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Establishing the project management maturity model and performance of GDID Maintenance teams in academic hospitals

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Establishing the project management maturity model and performance of GDID Maintenance teams in academic hospitals

Thebe Kepadisa

A research report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Business Administration

Johannesburg, 2017

ABSTRACT

This study seeks to establish the PMM level of the GDID maintenance teams based at the 5 academic hospitals around Gauteng province. Then the study will also investigate the association of PMM level to project performance and business performance of the GDID maintenance teams.

While GDoH's primary goal is to render health care services to the community, GDID's directive is to ensure that the health facilities are maintained properly and in a functional state. Therefore, GDID maintenance teams execute mandates that are turned into projects to maintain and improve the functionality of the health facilities.

A survey was conducted on 70 GDID employees carrying out project implementation based in 5 Academic hospitals, namely CHBAH, CMJAH, DGMAH, SBAH and TMRH. About 53 employees returned the survey questionnaires and 50 of the answered questionnaires were usable. Data was ran on SAS and results were analysed.

The PMM level for CHBAH, CMJAH and SBAH is 3, for DGMAH is 2 and for TMRH is 4. The radar chart showed the 4 academic hospitals to resemble octagon on the PMM knowledge management area except for DGMAH. The study revealed that high levels of PMM are not associated with project performance for all academic hospitals, the study further revealed high levels of PMM are also not associated with business performance except for DGMAH where high levels of PMM will improve business performance. These results will help and equip project managers with insight to know which knowledge management areas of PMM will they need to improve on.

DECLARATION

I, Thebe Kepadisa, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other university.

_____

Thebe Kepadisa

Signed at ……

On the …… day of ……. 2017

DEDICATION

To my father, Tshipisetso Wilfred Kepadisa and my mother Boitumelo Violet Kepadisa

Thank you for the early childhood you gave me, your teachings will always be around my neck and I am forever grateful for all the means you made for me to make it through in this life.

ACKNOWLEDGEMENTS

Glory to God in the Highest

By virtue that I typed this sentence, I am glad that You have given me the ability to study MBA and to come to the pinnacle of completing it. This is through Your grace that is more than enough for us. Amen

To Professor Anthony Stacey

Your selflessness

Your availability

Your labour

Speaks loud and clear

You really want us to be make it through MBA, by taking from your own time to create time for us so that we may be successful in completing our research. In short: “Thank you for the Research Bootcamp, it has catapulted me”

To Mr Mike Mundy

Thank you for your welcoming and embracing spirit,

Your encouragement has brought me this far and thank you for the guidance throughout the research period, I appreciate it

To my wife, thank you for standing by me and being there for our kids in my absence.

Thanks to Prof. Dichaba for editing the research report.

Dr Senosi, thank you for running the data for me on SAS to get the results.

Thanks to my family and friends for understanding when I could not be there for events and functions due to my engagement with this course.

Lastly, to my Manager, Mr Khanchane Leteba and colleagues, thank you for your support and participating in the survey which was pivotal to my research

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1 CHAPTER1: INTRODUCTION

1.1 Purpose of the study

The academic hospitals in Gauteng play an integral part in province's health ecosystem. They provide a numerous health services to communities per year. The Gauteng Province has adopted a strategy to eliminate the maintenance function of academic hospitals and state hospitals from the Gauteng Department of Health (GDoH) so they may focus on their core function which is to deliver health service to the millions of citizens Gauteng Province and even over and above the Province's Citizens. This makes sense as it will off-load the burden of infrastructure maintenance from the GDoH. The government department responsible for the function of maintenance in Gauteng's academic hospitals is called the Gauteng Department of Infrastructure Development (GDID).

The GDID's directive in state hospitals is to provide maintenance support as indicated in its mission (GDID 2016). Annually, mandates are translated into projects which are executed over a period of time. While GDID's task is clear, the scale of these hospitals makes the maintenance management thereof complex. Some of the institutions' infrastructure is old making it difficult to do normal in-house maintenance which now compels the GDID Maintenance team in an academic hospital to do projects in order to refurbish the buildings and equipment so as to cover the greater scope of work.

Chris Hani Baragwanath Academic Hospital (CHBAH), for instance, being the largest hospital in the southern hemisphere (CHBAH 2016), makes it even more complex to carry out these projects if there is no project management that helps with the successful project implementation.

1.1.1 *The objective of the study*

Thus, the objective of the study is to establish the current project management maturity model of the GDID Maintenance team based at academic hospitals in Gauteng province. Also, to evaluate if improving the project management maturity level (PMM)

will improve the GDID's team performance in the executing the projects in academic hospitals in Gauteng.

1.2 Context of the study

1.2.1 *Definition of academic hospital*

(Kassner 1987) defines academic hospital as

> "a state run hospital which is attached to university medical school in which there are accredited programmes for medical undergraduate and postgraduate training and in which postgraduate interns and registrars are employed in order to receive their clinical training."

(GDoH 2016) summarises the purpose of a central hospital which is also referred to as an academic hospital by Sebopa 2016

> "To provide a highly specialized health care services, a platform for the training of health workers, a place of research, and to serve as specialist referral centres for regional hospitals and neighbouring provinces."

(Kassner 1987) continues to elaborate the essential services that are rendered by an academic hospital. The difference between the academic hospital and other tertiary hospitals is that its patients are sicker with intricate diseases that require advanced health care (Kassner 1987).

1.2.1 *Health Facilities around Gauteng Province*

There are a total of 33 public hospitals in Gauteng Province, 7 are primary hospitals, 11 are regional hospitals and 18 are district hospital (GDoH 2016)

There used to be 4 academic hospitals in Gauteng, now Thelle Mogoerane Regional Hospital has been added as the fifth academic hospital. Table 1-1 depicts a high-level information that outlines the number of beds of the 5 academic hospitals.

Table 1-1 Academic Hospitals around Gauteng

No.	**Primary**	**Abbreviation**	**Origin**	**No of beds**	
1	Chris Hani Baragwanath Academic Hospital	CHBAH	1941	3200	Soweto, neighbouring state
2	Charlotte Maxeke Johannesburg Academic Hospital	CMJAH	1968 - 1978	1088	Johannesburg area
3	Dr. George Mukhari Academic Hospital	DGMAH	1972	1652	North of Tshwane, Limpopo, Northwest Province
4	Steve Biko Academic Hospital	SBAH	1927-1932	832	Pretoria central area
5	Thelle Mogoerane Regional Hospital	TMRH	2014	821	Eastrand

The 5 academic hospitals are spread around Gauteng, 2 in Tshwane namely DGMAH and SBAH and 3 in Johannesburg that is CHBAH, CMJAH and TMRH, please see the distribution map on figure 1-1.



Figure 1-1 Gauteng map depicting the 5 Academic Hospitals

Academic hospitals boast of several health care departments

- Accidents and emergency
- Maternity
- Radiology
- Burns unit
- Eye hospital
- Theatres
- Intensive care units
- Mortuary

For the above-mentioned areas to function well they need support in terms of the following,

- Water supply
- Electricity

- Steam generation and supply
- Heating, Ventilation and Air Conditioning
- Compressed air
- Oxygen
- Functional buildings

For every Infrastructure facility to function properly it needs to have a maintenance team to do onsite planning for proper maintenance execution and also attending to any maintenance breakdown or malfunctions that arise. Project management has been seen as the leverage to speed up implementation mandates and work requests that emanate from infrastructure challenges that cannot be executed by an in-house maintenance works group but rather the Maintenance Inspectorate group in academic hospital.

1.2.2 *GDID Maintenance team*

Gauteng Department Infrastructure Development (GDID) was established in the year 2009 following the split of the Gauteng Department of Public Transport, Roads and Works into two separate departments. GDID is responsible for the construction, maintenance and management of public facilities and buildings such as hospitals and community health centres across the province. (GDID, 2016). GDID has the Maintenance team onsite manning the maintenance of hospital equipment and carrying out the necessary project work to keep the academic Hospitals functional.

GDID deploys Chief Engineer at an academic and he is in charge of Inspectorate and the Works Group teams as shown in figure 1-2. Inspectorate teams do projects in the hospital and are led by Control Works Inspector (CWI). Works Groups do day to day Maintenance and are led by Chief Artisans, the work that works group is not able to do is referred it to the inspectorate team to do as a project.

CWI as first line of reporting on projects falling under three different categories, Building, Electrical and Mechanical. The CWI has inspectors in their respective fields

reporting to them, this is the inspectorate team that executes projects under Maintenance.

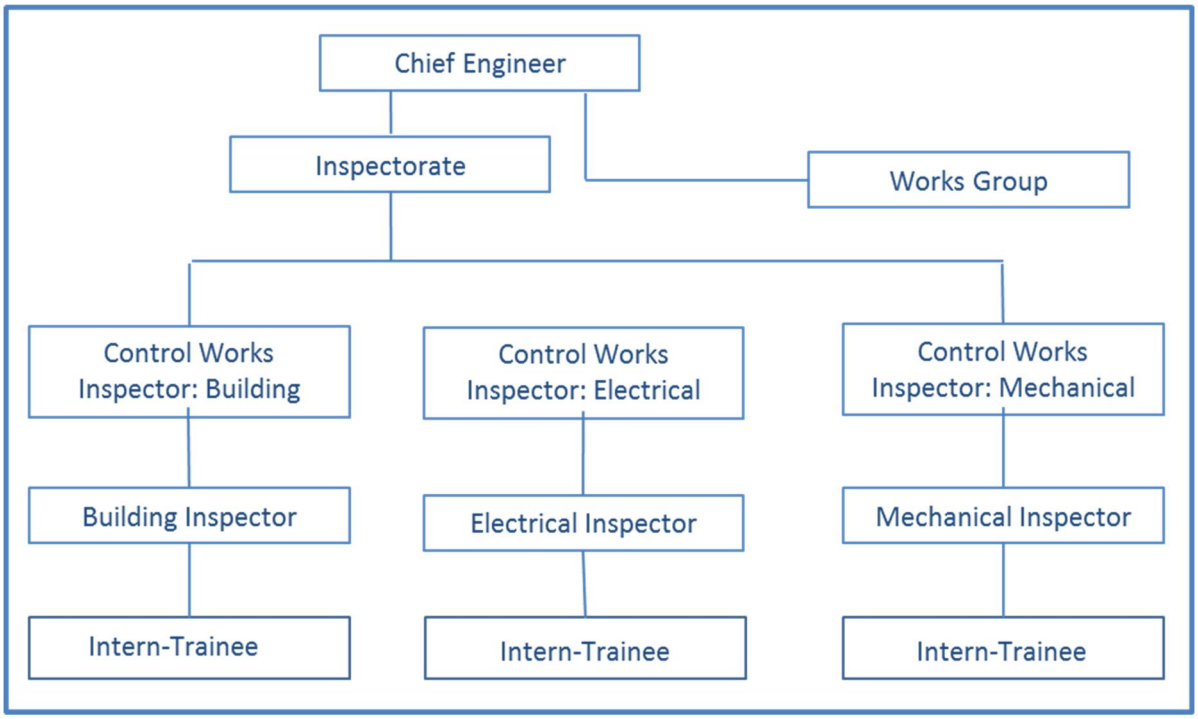


Figure 1-2 GDID Maintenance team based at Gauteng's Academic Hospital

1.3 Problem statement

Academic hospitals are in the public eye and draw attention good or bad for their respective management. Projects need to be completed on time to bring forward the new technologies to combat the new developing diseases and also to minimise new infections by implementing engineering controls through successful project implementation.

GDID is the implementing agent for the GDoH, to enable the hospital to carry out it core function which is to provide health services to the community. Therefore, GDID Maintenance drives all the infrastructure related issues for the hospital to maintain and improve service delivery to the society. Some of the hospital are old and do not require maintenance to be fixed, but require a project to be carried out to resolve the persisting infrastructure challenge. Hence the project management is used as a vehicle to improve the maintenance of equipment and infrastructure holistically.

In 2015, The GDID was allocated R2.05 Billion budget *(Vote 2015)*, whereby a Maintenance team based in academic hospital would easily spend close to R100 Million on its maintenance budget. The value of the projects vary from R50 000 to R5 Million.

GDID maintenance team in academic hospital do projects like the following

- Building extensions of wards and theatres
- Building renovations
- Installation of Heating Ventilation and Air-conditioning system (HVAC)
- Boiler steam supply
- Storm water reticulation
- Upgrade of electrical reticulation
- Uninterruptible Power Supply (UPS) installation
- Access control
- etc

1.3.1 *Main problem*

The main problem is that projects are not completed on time, within budget and covering the required specification.

1.3.2 *Sub problem*

1. Will implementing the Project management maturity model help improve the GDID's team performance at academic hospitals in Gauteng?

1.4 Significance of the study

The study fills a gap in that it will create awareness of the success of projects implementation carried out by the GDID Maintenance team based in an academic hospital. Good project management methodologies allow work to be accomplished in less time, at lower cost, with fewer resources, and without any sacrifice in quality. (Kerzner, 2002)

The study will provide guidance to Inspectors, Control Works Inspectors Chief Engineer, project owners and projects sponsors about the project management level of maturity for projects for GDID Maintenance teams based in academic hospitals around Gauteng. They will know how to maximise the resources, alleviate scope overlap and benefit from other studies conducted by the project.

1.5 Delimitations of the study

The study focuses on the maintenance projects done by the GDID employees based at an academic hospital. The Capital projects done by GDID employees based at Head Office are excluded since they do not report to Maintenance Chief Directorate and follow different processes. The projects conducted by the Department of health through the Donors who do projects for Academic hospital are also excluded in the study are, reason being that they are minimal and do not follow the GDID project management flow.

1.6 Definition of terms

CHBAH – Chris Hani Baragwanath Academic Hospital

Chief Engineer – The Engineer who carries overall responsible for proper execution of Project and Maintenance activities in an academic hospital,

CMJAH – Charlotte Maxeke Johannesburg Academic Hospital

Control Works Inspector (CWI) – The personnel who manages the inspectors in the respective field

DGMAH – Dr George Mukhari Academic Hospital

GDID – Gauteng Department of Infrastructure Development

GDoH - Gauteng Department of Health

Inspector – Personnel who undertakes project implementation in GDID Maintenance team

Maintenance Projects – Project conducted by the GDID Maintenance team based on site location of an academic hospital

PMM – Project Management Maturity

PP – Project Performance

SBAH – Steve Biko Academic Hospital

TMRH – Thelle Mogoerane Regional Hospital

1.7 Assumptions

The following assumptions have been made regarding the study:

a. The sample will have the required information, and be willing to share it

b. If a respondent does not wish to disclose certain information, they will not divulge the information on the survey questionnaire although participants are encouraged to answer all questions.

c. The objective of the study and its outcome are purely meant for academic purpose, and there is no intention direct or otherwise, to make use of the outcome in whatever form, as a tool for political application, or for undermining the leadership, and management of the organisations referred to in the study.

2 CHAPTER 2: LITERATURE REVIEW

2.1 Introduction and Background

Chapter two looks at the interrelated topics from project management to the benefits of the PMMM. This chapter outlines that the execution of projects in an organisation must be determined by the Organisational Strategy and objectives which are drawn from its vision and mission. The different project strategies for 4 different project environments, namely, obedient servant, independent innovator, flexible mediator and strong leader are discussed. These environments dictate different processes and procedures that need to be followed for projects to succeed. This chapter also provides a literature about the Project Management Maturity Model (PMMM) and its applicability to project performance at academic hospitals.

2.1.1 *Project management definition*

PMBOK (2004:5) defines a project as 'a temporary endeavour undertaken to create a unique product, service, or result'. Projects aim to be as effective as possible, completing within time, cost, and scope and according to the expected quality (Burke, 2006: 8). Therefore, Hudson (1996) describes project management as a general-purpose management tool that can bring projects to successful completion and to the satisfaction of the project stakeholders, given the traditional constraints, of defined scope, desired quality, budgeted cost, and a schedule deadline". Project Management Institute (2004:8) defines project management as 'the application of knowledge, skills, tools and techniques to project activities to meet project requirements.' Projects are typically part of an organisation (PMBOK, 2004: 27).

2.1.2 *Challenges experienced with lack of proper project management*

Rwelamila and Asalan attest that the common causes of project failure in the South African Public Sector, which are also reported by the UK office of Government Commerce in the article titled "Understanding of project management good practice by construction project managers" (Rwelamila 2010)

They identified the challenges as:

- Absence of strong vivid connection between the project and the organisation's key strategic priorities including established key performance areas and indicators.
- No senior management involvement or ownership
- No real stakeholder participation
- Lack of expertise and tried and tested approach to project and risk management
- Not being abreast with new technologies
- lack of understanding of, and contact with the supply industry at senior levels in the organization;
- No proper integration between project team and the customer
- Evaluation of proposals driven by initial price rather than long term value for money.

(Couture 2003) on the chapter of "Path to maturity" supports (Rwelamila 2010) argument by highlighting the symptoms of poor project management as follows:

- Project overruns
- Schedule delays
- Inefficient resource utilisation
- Misleading and confusing project status
- Misaligned project portfolio

It is worth noting that projects are part of the organization and the desired result of any project is to better or improve the current existing result on the organisation's performance in project implementation. For a project to be successful, it must be tied to the business strategy of an organisation. The next section looks at the links between a strategy and a project.

2.1.1 *Strategy and Project*

(Sopko 2015) depicts the linkage between strategy and execution and the interrelationship between portfolios, programs, projects and operations on table 2-1. According to (Sopko 2015) the business strategy must inform the projects that need to be approved and undertaken to take the company forward.

Table 2-1 Relationship between strategy and projects



For GDID Maintenance team to carry out successful projects implementation for the academic hospitals, they need to align their objectives and strategy which is informed by their mission and vision.

Vision: “To be a leading sustainable infrastructure provider and facilitator that positions Gauteng as a Globally Competitive City Region with inclusive economic growth and decent work for all’. (GDID, 2014)

And the mission brings the point home where it addresses the following as highlighted:

“To contribute towards the radical transformation, modernisation and re-industrialisation of Gauteng by **accelerating integrated service delivery**, **maintenance and management of public infrastructure and deploying build environment professionals** while encouraging the active participation of an empowered citizenry”. (GDID, 2014)

To increase the chances of realising the mission as outlined in the bold letters, proper project management that is aligned with best practices will need to be adhered to.

2.1.1 *Project Strategy and project environment*

Artto and colleagues defines project strategy in their journal titled “What is project strategy” in this manner:

> “Project strategy is a **direction** in a project that **contributes** to success of the project in its **environment**.” (Artto, Kujala et al. 2008)

The above definition emphasizes that the direction that project takes will be based on the environment, therefore different project strategies will be required based on their environment to be successful. *(Artto, Kujala et al. 2008)*

Artto and colleagues found four different environments that are articulated in the picture below, they went on to express that most of the projects are found in the first quadrant, that is, Obedient Servant where the project owner or project sponsor makes requests and the project manager as the obedient servant implements the project as commanded. (Artto, Kujala et al. 2008)

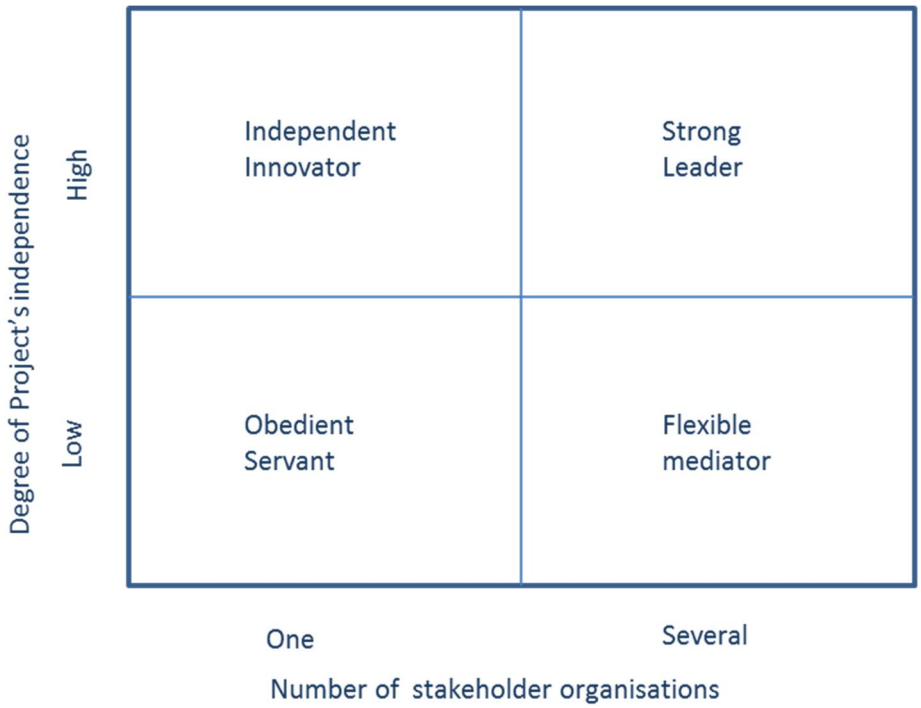


Figure 2-1 Different projects environments (Artto, Kujala et al. 2008)

Most of the projects that are carried out at academic hospitals are in the first quadrant where the project owner or the accounting officer, or the CEO of the hospital through structures reporting to him makes requests of projects and the GDID Maintenance team onsite implements the projects. Other three quadrants will not be considered since they are not carried out by the GDID Maintenance team based in an academic hospital.

2.2 Origin of Project Management Maturity

Project management maturity (PMM) describes how a project organization is able to successfully deliver its project performance (i.e. within time, budget, and specifications) in a consistent manner. The concept started with the Total Quality Movement, where the use of statistical process control (SPC) enabled to demonstrate that improved technical process maturity led to the reduction of special causes (non-normal) variations.

Maturity models have their origin in the field of total quality management (TQM). They drive strategically linked continuous improvement and so require a thorough understanding of an organization's current position and where it aims to be in the future (Brookes and Clark, 2009). In his thesis, (Mateen 2015) titled "Measuring the Project

Management Maturity" he describes the origins of the project maturity models in the attached in table 2. (Mateen 2015) shows that EFQM, PMI's PMBOK and SEI's CMM gave birth to today's Maturity models that is MINCE, Kerzner, OPM3 and OGC's P3M3. Here figure 2-2 (Mateen 2015) show how the 5 Project Management Maturity Models are related or not related, Kerzner and OPM3 originate from PMBoK.

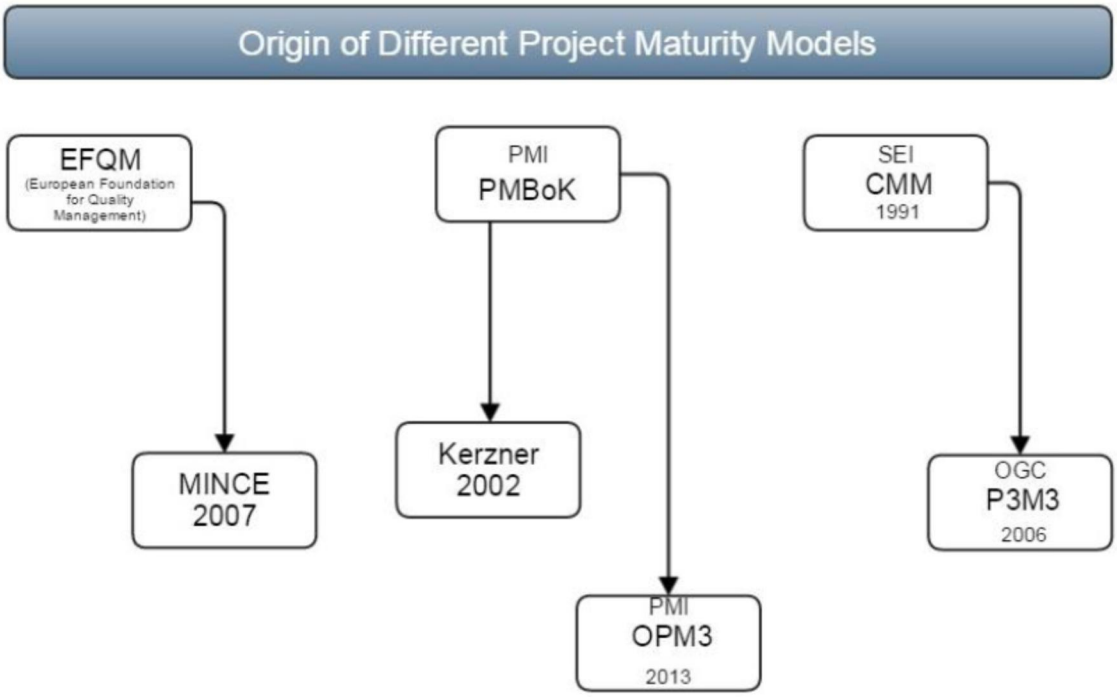


Figure 2-2 Origins of Project Management Maturity Models

2.2.1 Types of Maturity Models

According to Cooke-Davies in Hillson, 2003: 299) there are over thirty project management maturity models in the market. (Nenni 2014) identified 5 types of maturity models as follows in their document titled "How to increase the value of Project Management Maturity Model as a Business-oriented Framework".

1. Organizational Project Management Maturity Model (OPM3).
2. Capability Maturity Model Integration (CMMI-DEV).
3. Kerzner Project Management Maturity Model (PMMM).

4. Project, Program, Portfolio Management Maturity Model (P3M3).

5. Maturity Increments IN Controlled Environments (MINCE2).

Management Movement gave birth to the model of process maturity. This is where techniques of Statistical Process Control (SPC) exhibited that improving the maturity of any technical process will result into two effects:

"(i) a reduction in the variability inherent in the process,

(ii) and an improvement in the mean performance of the process"

Cooke-Davies and Arzymanow inform us that between 1986 and 1993, Software Engineering Institute of Carnegie-Mellon developed the extensively embraced "Capability Maturity Model" which is the mother of the Organsational Maturity Model.

In his book, "Strategic planning for project management using a project management maturity model", Harold Kerzner gives background of where the PMMM emanated. He mentions that simply following project management alone does not guarantee perfection but it may be a case of practice makes permanent. Permanence in repetitive flaws that is costly to the organisation.

He gave examples of telecommunication companies which were satisfied with their prosperity decades ago and neglected the introduction of PMMM. Kerzner went on to state that what Nortel and Ericsson achieved in 6 years what some telecommunication companies could not achieve in 20 years of trying without implementing PMMM. He sees PMMM as a catalyst to keep the organisation that implements it to survive unprecedented turbulence. (Kerzner, 2002)

2.2 The relationship between PMM and performance

Project management maturity is an important element of strategic planning, as it provides a methodology and a road map to determine and compress the gaps in resources and quality (Kerzner, 2005). In order to improve the overall organizational performance, it is important to reach a maturity level in project management and PMMM offers a progressive maturity. (Demir & Kocabas 2010)

2.3 5 Levels of Project Management Maturity Model

The levels of PMMM indicate how project managers can arrange key process areas hierarchically to provide transition states to help organisations to achieve realistic goals. Kerzner, Tahri and Drissi-Kaitouni and other PMMM advocaters attest that there are 5 levels. And they are named as from level 1 to 5 as illustrated in figure 2-3 describing the inter-linkages between the levels (Kerzner 2002)

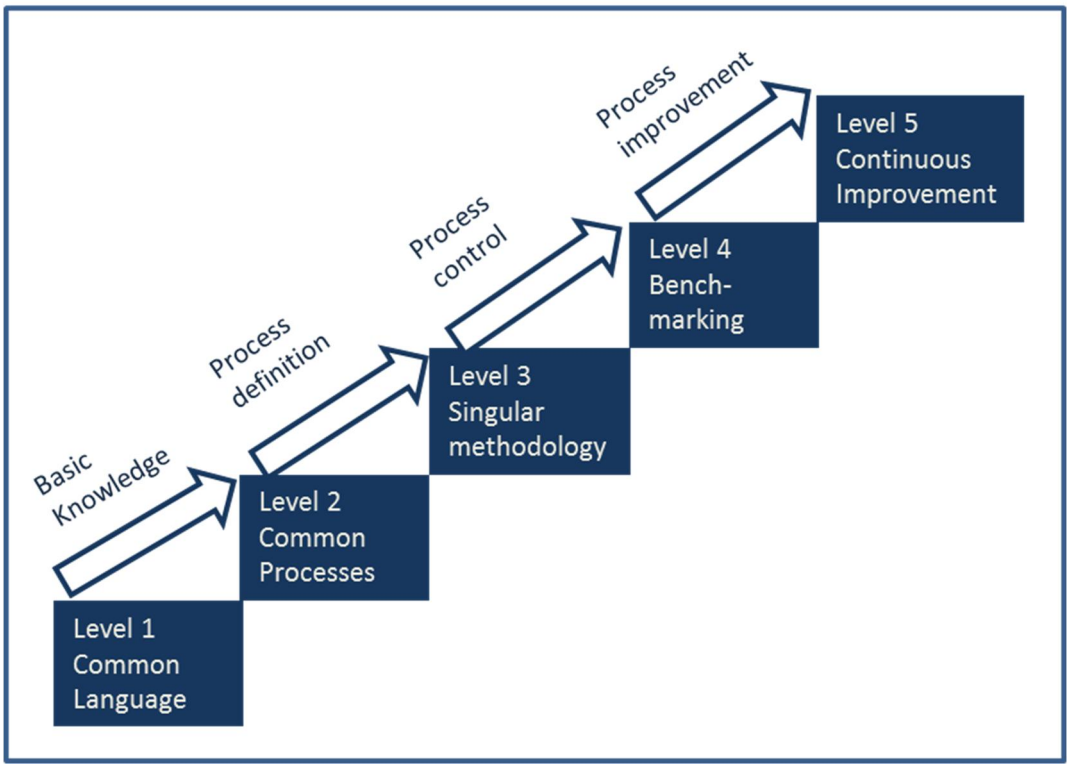


Figure 2-3 Project Management Maturity Model (Kerzner 2002)

The levels are described according to Kerzner's description

- Level 1— talks to common language, whereby the importance of project management is recognized by the organization and the necessity for an adequate understanding of the fundamental knowledge on project management and the complementary terminology.

- Level 2— addresses common processes which will ensure project success repeatability. It also ties with the recognition of the application and support of the project management principles to other methodologies employed by the company.
- Level 3—Singular methodology: In this level, the organization recognizes the synergistic effect of combining all corporate methodologies into a singular methodology, the centre of which is project management. The synergistic effects also make process control easier with a single methodology than with multiple methodologies.
- Level 4—Benchmarking: This level encompasses the recognition that improvement process is essential to maintain a competitive advantage. Benchmarking must be performed on an unceasing basis. The organisation must select whom their benchmark criteria against which company.
- Level 5— in continuous improvement: The organisation assesses the information captured through benchmarking stage, and must then takes a decision whether or not this information will improve Level 3.

Five levels of maturity are used as descriptors of the Capability Maturity Model

2.3.1 *Why PMMM*

The project management maturity model is used to assess and criticize the organization project management system to improving it. In theory, it should be likely to assess how “mature” a project-based company is by observing the blend of which characteristics of project performance or project management practice it measures, and what are the results shown by measurement thereof (Cooke-Davies, 2004).

In essence, maturity means fully developed, or perfected (Cooke-Davies, 2004). Maturity Levels mean a collective capabilities which progressively show greater orders of uniformity, visibility, and control within the company (J.Schlichter,1999) cited by (Cooke-Davies, 2004).

2.3.2 *Frameworks of PMMM evaluations used in different case studies*

We will discuss 3 frameworks or assessment tools of how the Project management maturity model is evaluated, namely by

i) Tahri and Drissi-Kaitouni

ii) Yazici

iii) Kerzner

a. *Tahri and Drissi-Kaitouni Framework*

In Table 2-2 (Tahri and Drissi-Kaitouni 2015) came up with framework for assessing the maturity model that comprises of 5 rows of dimensions named D1 to D5 and 5 columns characterising the maturity level from N1 to N5.

The row and the column produce the matrix that can be reference using the following code Cijk where i = Dimension i, j = level of maturity j and k = the number of the feature

Table 2-2 Tahri and Drissi-Kaitouni PMM evaluation framework

	N1 = Reactive	N2 = Disciplined	N3 = Adjusted	N4 = Effective	N5 = Optimized
D1= Methodology	C111 :	C121 :	C131 :	C141 :	C151 :
		C122 :	C132 :	C142 :	C152 :
		C123 :	C133 :	C143 :	C153 :
		C124 :	C134 :	C144 :	C154 :
				C145 :	C155 :
D2= IT Resources	C211 :	C221 :	C231 :	C241 :	C251 :
			C232 :	C242 :	C252 :
			C233 :		
D3= Managerial skills	C311 :	C321 :	C331 :	C341 :	C351 :
	C312 :	C322 :	C332 :	C342 :	C352 :
		C323 :	C333 :	C343 :	C353 :
			C334 :		
D4= Relationship	C411 :	C421 :	C431 :	C441 :	C451 :
D5= Communication	C511 :	C521 :	C531 :	C541 :	C551 :

The value of Cijk is 1 or 0; which respectively means the presence or absence of the element.

The changeover to the subsequent level (L+1) is based on the gratification of all requirements of the present level.

a. *Yazici's assessment method*

(Yazici 2009) start by finding out the demographics of his respondents, from there he presents the PMMM survey and then the performance measures as identified in Appendix B.

(Yazici 2009) first endeavor to find out the demographics of his respondents in Part 1 and goes on to learn organizational culture of respondents through a 24 item questionnaire in Part 2. He then looks into the 8 knowledgement areas of Project management according to PMBoK in Part 3 using 46 questions on likert scale. Part 4 he interrogates project performance from "not at all" to "to a great extent" where a score of 100 will be divided among the 4 areas based on the respondents feedback.

b. *Kerzner's assessment method*

(Kerzner 2002) in his book titled Strategic Planning for Project Management using PMMM, chapter 5 to 9, he defines the level 1 to 5 respectively, giving questions to rate the levels and also providing the correct answers. He uses the different assessment instruments for different levels

Level 1: 80 multiple choice questions covering PMBOK and the basic principles of project management

Level 2: 20 questions reviewed on a scale of -3 to +3 which depicts strongly disagree to strongly agree to assess life cycle phases

Level 3: 42 multiple choice questions to assess hexagon of excellence

Level 4: 25 questions reviewed on a scale of -3 to +3 which depicts strongly disagree to strongly agree to assess qualitative and quantitative benchmarking

Level 5: 16 Questions reviewed on a scale of -3 to +3 which depicts strongly disagree to strongly agree to assess improvement over 12 months

2.3.3 *PMMM industry performance*

Sopko 2015, conducted a study where he identified the status of the maturity levels for different industries as depicted on the figure 2-4 below

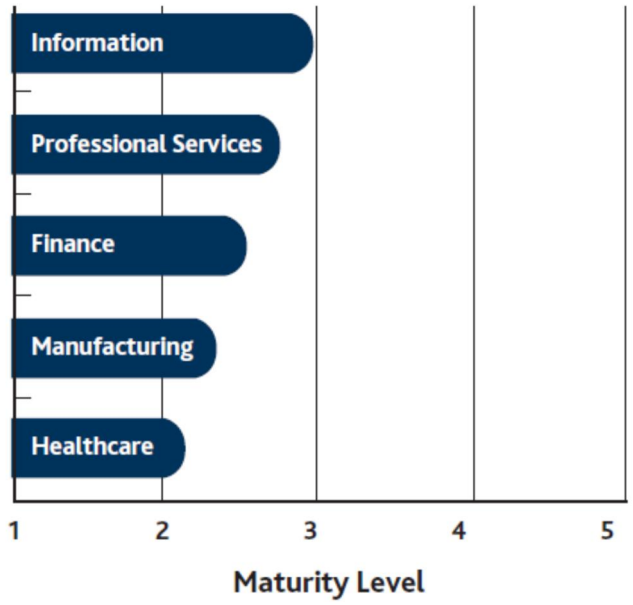


Figure 2-4 Different Industry performance (Sopko 2015)

Information Technology companies are leading the pack since they are the trailblazers of the model, followed on by professional services and Finance institutions. (Sopko 2015) reckons that Healthcare is the least just above the second maturity level and followed up by manufacturing companies.

2.3.4 *Criticism of Project Management Maturity models*

As any other model or program, PMMM has its own critics, Crawford (2006) emphasizes that the model can be wrongly applied as the remedy to all problems. (Andersen and Jensen 2003) also attest to likelihoods of mistakes being committed in the sense that maturity assessment appears to be bias rather than objective. Therefore it is best practice to apply the tried and tested assessment tool to achieve reliable and precise outcome. (Crawford, 2006).

In short, a literature review by Jugdev and Thomas (2002) cited from (Backlund, Chronéer et al. 2014) condense some major criticism of PMMMs:

- The models are rigid where an easy user-friendly model is required for transformation and improvements implementation
- The models are more for problem identification and awareness rather than solution based
- The models do not account for the rapid pace of change with which firms adopt new technology and change processes, practices, management systems, or policies;
- The model's five maturity levels do not offer enough deep level of details to measure progress overtime;
- The models are overly disciplinary, impractical, and overwhelming as methodologies;
- The models focus on the work processes and some ignore the human resource or organizational aspects.
- The models have some limitations from a theoretical perspective as they are based on software maturity models that lack a theoretical basis.

2.3.5 *Benefits of the Project Management Maturity Model*

As it is evident from figure 2-5, the initial level graph is flatter than level 5's, it means level 1, and there is increased non-conformance costs (NCC). Like (Sopko 2015)) puts it, the projects that miss their scheduled objectives, are generally expensive, delay and are inferior in quality and also the risk is too high. On the contrary, at level 5, the opposite is true; the graph is narrower, meaning that the projects are on time, within budget and of good quality with less risk.

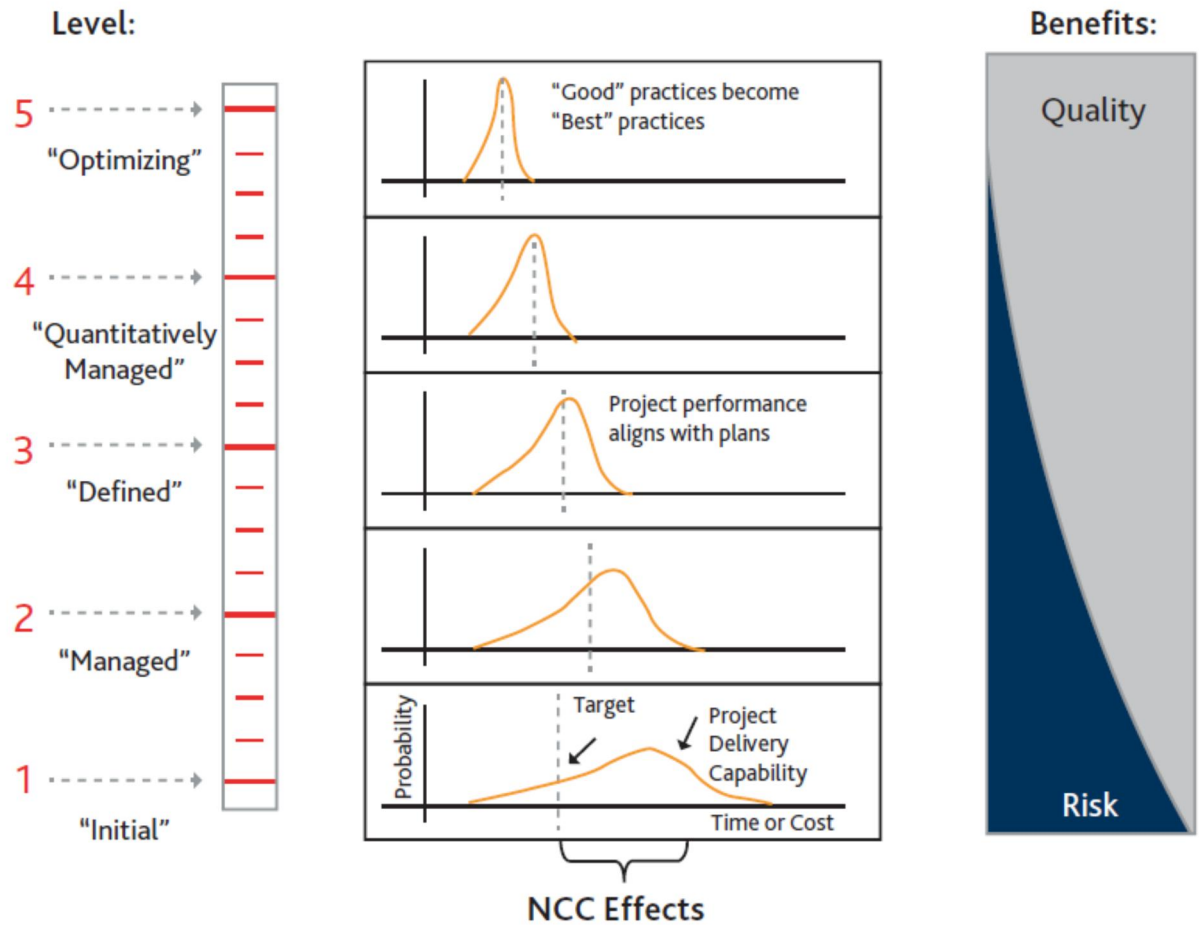


Figure 2-5 PMMM levels vs NCC (Sopko 2015)

2.3.1 *Qualities of Project management maturity*

Silvius and Schipper (2012) summarized the qualities of the maturity model as follows:

- It translates the abstract and interpretive concepts of sustainable development into practically applicable prescriptive actions.
- It assesses concrete projects as unit of study, thereby specifying overall corporate strategies.
- It allows organizations to set their own standards and ambitions in accordance with company values.
- It allows organizations to monitor and report their development.
- It is not normative as to whose responsibility (project sponsor, project manager, etc.) the actions are, but allows discussion and agreement about this.

2.4 Performance Assessment

In this section, 4 items relating to project performance construct, 3 items relating to internal business performance construct, and 3 items relating to the external business performance constructs where studied.

2.4.1 *Project Performance*

Yazici (2006) in her other research paper titled “Role of organisational culture in project success” outlines that project performance rests on two legs i.e. Project efficiency and project effectiveness.

Dvir etal (2006) emphasize in their research that Project efficiency is determined by completing the project

- within specified duration
- within budget requirements

Dvir etal (2006) also attest that Project effectiveness is determined by

- meeting expectation
- well satisfied team members

These above-mentioned 4 aspects are the first 4 questions in the Project performance measure questionnaire.

2.4.2 *Internal and External Business performance*

Nahm et al (2004) categorises the team business performance in to two, internal and external performance

a. ***Internal team performance***

Further, the perceived inspectorate team internal performance is also measured by

- the savings benefits of the project
- the improved service

- overall performance improved from last year

b. *External team performance*

Furthermore, the external team performance is

- The team's preference to the client
- The team's trust improvement to the client
- The team's performance improvement compared to the best world-wide competition

From this detailed discussion, two hypotheses are brought forward

H1: Project performance is associated with high levels of project maturity

H2: Internal and external business performance are associated with high levels Project maturity

2.5 Conclusion of Literature Review

In conclusion of the literature review, we considered the interrelated topics that were discussed from project management to the benefits of the PMMM. Execution of projects in an organisation must be determined by the Organisational Strategy and objectives which are drawn from its vision and mission. When the leaders of the organisation fail to align the project execution and its strategy failure will be imminent.

Different project strategies for 4 different project environments, namely, obedient servant, independent innovator, flexible mediator and strong leader were discussed. These environments dictate different processes and procedures that need to be followed for projects to succeed.

Central to this chapter is PMMM, where I discuss the levels of maturity from 1 to 5, and give reasons why it is important for the organisation to consider PMMM. Different kinds of Maturity models were discussed with the reason why they are used and how they came about. Mateen also gave clear indication of how the PMMMs were developed and also how they are related. It was mentioned about the frameworks to evaluate PMMM, the Tahri and Drissi-Kaitouni, Yazici and Kerzner assessment methods were discussed. Yazici was selected to be the user-friendly assessment tool that will also encourage participant's feedback.

Sopko identified the maturity levels of 5 different industries and the highest was IT just above level 3 and Healthcare was just above level 2. (Backlund, Chronéer et al. 2014) cited Jugdev and Thomas gave reasons criticising the use of PMMM. Crawford added saying that PMMM is used to solve business problems that it cannot resolve. At the end of the literature review, Sopko gives the benefits of implementing PMMM emphasising that they reduce risk, implementation time and give high quality projects.

Discussion is also held where project performance and business performance clearly outlined by Dvir etal and Nahm etal. Project performance is categorized in project efficiency and effectiveness, while business performance is split into internal and external performance

Hypotheses

- H1: Project performance is associated with high levels of project maturity
- H2: Internal and external business performances are associated with high levels Project maturity

3 CHAPTER 3: RESEARCH METHODOLOGY

This section will describe the methods chosen to conduct this research. The methodology of the study will cover the following issues: the approach and the design of the study, population and sample, the data collection instruments and the reasons for using them, data collection and analysis and lastly the validity and reliability.

3.1 Research methodology

To address the critical questions of this study, this research will use a quantitative research approach. This study will employ survey research in collecting data. A survey research design is one in which group of people or items are studied by collecting and analysing data from only few or items considered being representative of the entire group with the intention of using the data to justify current conditions of the studied phenomenon. A survey will be carried out in a form of questionnaire to the teams of respondents who are interacting with project management in academic hospitals.

3.2 Population and sample

3.2.1 *Population*

The population will comprise of the Gauteng Department of Infrastructure Development (GDID) Maintenance teams at the four academic hospitals in Gauteng, see table 3-1.

Table 3-1 Academic Hospitals which will be sampled

No.	**Primary**
1	Charlotte Maxeke Academic Hospital
2	Chris Hani Baragwanath Academic Hospital
3	The Steve Biko Academic Hospital
4	George Mukhari Academic Hospital

5	Thelle Mogoerane Regional Hospital

The respondents in both teams are currently employed by the respective departments and reporting for duty at academic hospitals.

3.2.2 *Sample and sampling method*

This study will use purposive sampling to identify of GDID teams and) based at the academic hospital in Gauteng. In this study, the research sample included the following:

Table 3-2 Description of respondents

Description of respondent type	**Number to be sampled**
Chief Engineers	5
Control works inspectors	12
Inspectors	20
Inspectorate Interns	33
Total	70

3.3 The research instrument

According to Sechrest (2015), measuring variables can be a complex process. Selecting a valid and reliable assessment instrument is the foundation of a sound research design. Concurring, Leedy and Ormrod (2013) affirmed measurement

instruments provide the foundation upon the entire study efforts rests. In addition, the most important concern in research is to ensure reliability and validity.

Validity is concerned with the extent to which an instrument measures what it is intended to measure. Spiliotopoulou (2009) and Panayides (2013) maintain that Cronbach's alpha is the most widely applied index of internal consistency reliability. Alpha was developed by Lee Cronbach in 1951 to provide a measure of the internal consistency of a test or scale; it is expressed as a number between 0 and 1 (Tavakol, 2011). Schmitt, 1996) and Sijtsma (2009) see internal consistency as the extent to which all the items in a test measure the same concept or construct and hence it is connected to the inter-relatedness of the items within the test. It is worth noting that the number of test items, item relatedness and dimensionality affect the value of alpha. In this study internal consistency was determined before a test can be employed for this research purpose to ensure validity.

According to Tavakol (2011) reliability estimates show the amount of measurement error in a test. Put simply, this interpretation of reliability is the correlation of test with itself. If the items in a test are correlated to each other, the value of alpha is increased. However, a high coefficient alpha does not always mean a high degree of internal consistency. This is because alpha is also affected by the length of the test. If the test length is too short, the value of alpha is reduced. Thus, to increase alpha, more related items testing the same concept should be added to the test. It is also important to note that alpha is a property of the scores on a test from a specific sample of t-tests. Therefore investigators should not rely on published alpha estimates and should measure alpha each time the test is administered.

Reliability refers to the consistency of a measure of concept, the important factors here are stability, internal reliability and inter-observer consistency as defined by Bryman 2012 on "Social research methods". In order to increase reliability, the researcher will explain the survey to respondents and ensure that they understand what they need to answer in all the 5 academic hospitals. Cronbach alpha and Composite reliability were calculated to present an index of internal reliability consistency for scales.

The research project comprised of project management maturity model analysed on 8 knowledge management areas, project performance will be analysed on 4 areas,

internal and external business performances will be analysed on 4 areas. The diagram on figure 3-1 shows the research model that will be followed to establish the relationship of project management maturity model to perceived project performance, perceived internal business performance and perceived external business performance.

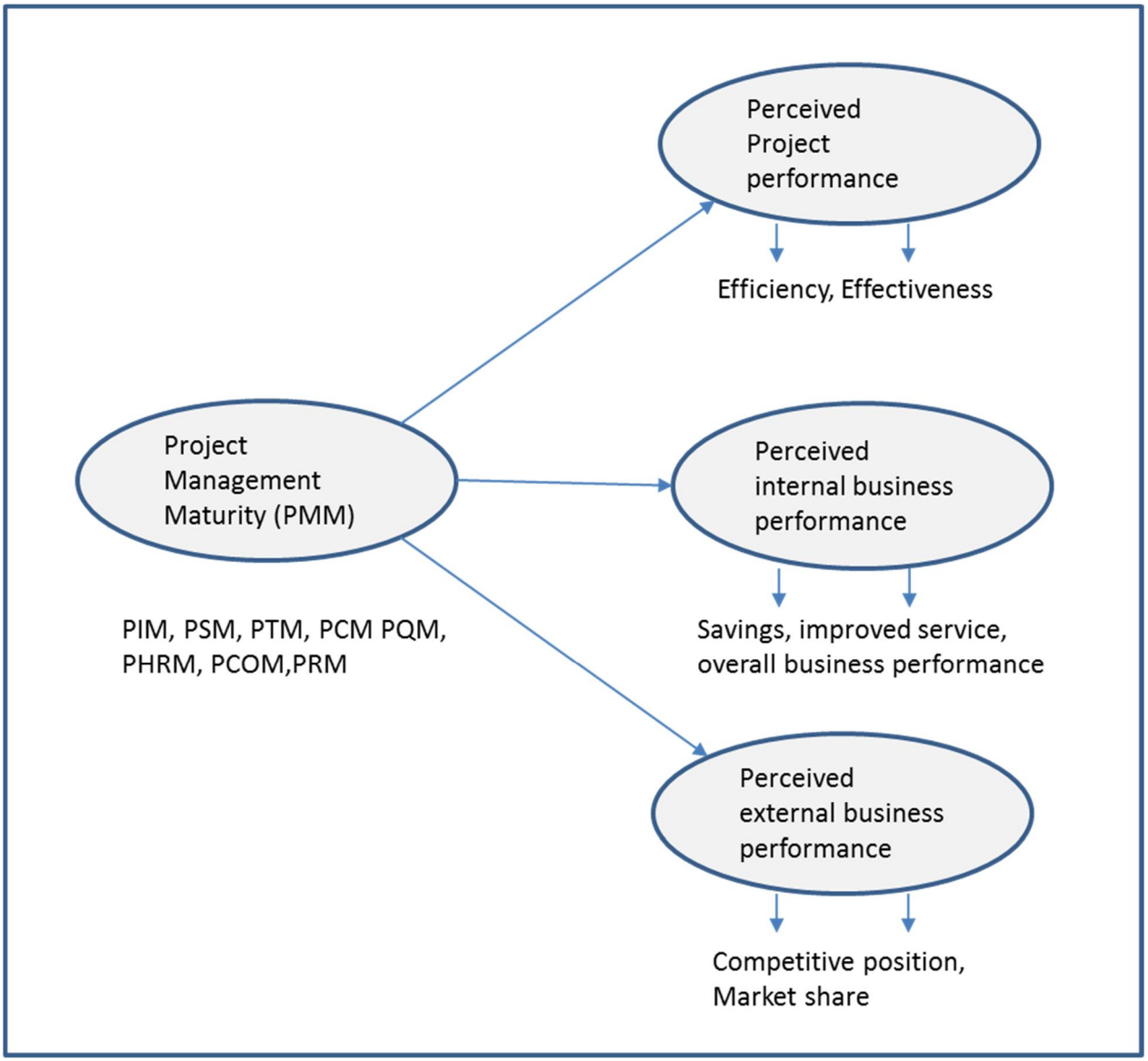


Figure 3-1 Research model

3.4 Design of the study

The objective of this study was to quantify the data collected and generalise the findings from the sample to the population of concern. To address the critical questions of this study, this study employed a quantitative research strategy, in line with the aim to test objective theories by investigating relation amongst the predictor and predicated variables. One of the objectives of quantitative research is to develop and employ mathematical models, theories and computation. As a result, Creswell (2014:4) defined quantitative research as “an approach for testing objective theories by examining relationship among variables”. In addition, these variables are measured through instruments in order for the computed data to be analysed using statistical techniques (Creswell, 2014).

The research design is important when collecting data and answering research questions. Cross-sectional design was employed as the research design in this study. Cross-sectional design means data collected at a specific point in time to make inferences about a population of interest required at a specific point in time (Leedy & Ormond, 2014). Cross-sectional design is used to investigate relationships between variables.

3.5 Research method

Research method concerns the way data is collected, analysed, and interpreted as proposed by researchers for their different studies (Creswell, 2014).

One of the most important steps in this study was to identify the unit of analysis, the organisation from which data was collected. Unit of analysis can be defined as the major entity that is being analysed, focusing on 'what' or 'who' is being studied (Trochim, 2006). The organisations used in this study were comprised of the Gauteng Department of Infrastructure Development (GDID) Inspectorate.

Subsequent, to the researcher identifying the organisations from which the data was collected for this study, written permission was sought from the management of GDID and all employees were provided with informed consent form explaining the aims and objectives of this study. Employees were also informed that participation was

voluntarily and participants may withdraw from the research project at any time without giving any reason and without their rights being affected in any way. A purposive sampling was applied to the targeted population and a sample of 70 was selected out of the entire population. Participants comprised of chief engineers, control works inspectors, inspectors and inspectors' interns.

Self-administered questionnaire was emailed to the chief engineers to be issued to their subordinates and complete. The researcher briefed chief engineer on the questionnaire telephonically thereafter made a visit to SBAH to take the entire team through the questionnaire. The researcher explained the questionnaire to the respondents and encouraged them to answer all the questions. Participants who do not have access to the computer were given printed questionnaires.

The data collected was captured into a Microsoft (MS) Excel spreadsheet. Once, the data capturing process was completed; the research combined all data files of all the participants and prepared it to be analysed using SPSS and SAS.

3.6 Data analysis and interpretation

From Leedy and Ormond's (2014:161) perspective "data analysis and data interpretation are different, with numerical data being mathematically and statistically analysed, followed by interpretations of those manipulations and analyses in order to address the original research questions and hypotheses".

The analyses followed in this study are based on Yazici (2009) where the following were performed in SPSS:

- Descriptive analysis using frequency distributions of the demographic data

"Descriptive statistics is the description and summarisation of the data obtained for a unit of analysis" (Welman & Kruger, 2001:208). Data is presented in the form of frequency tables, pie charts and bar diagrams to profile the respondents in terms of predictor and predicted variables.

The data describing the demographics of the participants was produced. This was done in the form of means for continues variables such as age, positions and years of services. The purpose of producing the demographics data first was for the researcher to be familiar with the participants who took part in the study.

Subsequently to producing the demographics data, the study calculated the means and standard deviations for all variables, which were PMM, perceived project performance, perceived internal business performance and perceived external business performance. Bryman (2012) describes mean as the normal average, the sum of a distribution of values divided by the number of values and standard deviation is a measure of dispersal around the mean. Calculating the means and standard deviations of the three variables was done to gain an understanding of the participants on the different variables.

- Validity assessment using Cronbach alpha and Composite Reliability to establish the validity of the scale used

The researcher generated reliability information by means of calculating the Cronbach alpha and Composite Reliability.

Cronbach alpha is considered to be a measure to gauge reliability. Cronbach alpha was developed to measure internal consistency, in order words determining how tightly related a set of items are as a group (Gliem & Gliem, 2003). Cronbach alpha usually runs between .80 and .90. Therefore, the values of Cronbach alpha surpass the value of .70 that is usually used as the norm. In addition, in practically all cases, the alpha should meet the more rigid value of .80 that is nowadays deemed a generally accepted standard (Schaufeli, Bakker & Salanova, 2006).

Composite reliability is an inter-correlation among items in a group indicating the extent to which the group can be seen as measuring a single latent variable. The composite reliability for project management maturity model will be easier to calculate using the 8 knowledge areas. Factor analysis is conducted where the rotated component matrix is established to obtain Lambda (λ). From Yazici's study it is already

known what comprises the project performance, the internal business and the external business performance.

The team performance, internal business and external business performance where evaluated over 100 scores among four alternatives (A, B, C, D) depending on the extent to which each alternative represents better the overall body of projects. As the assessment, may vary among projects, higher number of scores were given to the alternative that most represents the majority of the projects

$$CR = \frac{(\sum_{i=1}^{n} \lambda_i)^2}{(\sum_{i=1}^{n} \lambda_i)^2 + (\sum_{i=1}^{n} \delta_i)}$$

Composite Reliability Formula

Where λ=Standardized Factor Loading; n=number of items; δ= error variance

- Inferential analysis using the Partial Least Square regression to establish the drivers of project performance based on Yazisi (2009)
    - PMM and Project Performance,
    - PMM and Internal business performance
    - PMM and External business performance

3.7 Limitations of the study

There are various limitations to the study at hand, and the following limitations had to be considered when analysing the research report. The limitations are as follows:

- Only the projects that are carried out by the maintenance team onsite will be considered for the study
- Capital projects carried out by the GDID Capital works projects team will not be considered for the study, since they follow different tender processes.
- Projects carried out by the Public Private Partnerships will not be considered for the study because they do not follow the GDID project flow and are carried out by external consultants

- Donor projects will also not form part of the study.

3.8 Analysis of the demographics

Analysis of demographics will cover spread of the respondents according to their academic hospitals and distinguish them by the position they hold currently. Then their years of service will be depicted with their age, and finally the number of subordinates that they manage.

Seventy surveys were sent to the inspectorate teams from South Africa's 5 academic hospitals in Gauteng province. These are teams deemed relevant participants because they are responsible for project management in academic hospitals. Of the 70 surveys sent to the inspectorate teams, 53 were returned and only 50 useable. The other 3 of the 53 were deemed unable as they were partially competed. The response rate of the usable survey of 50 out 70 sent was therefore 71%.

3.8.1 *Respondent distribution according to Academic hospital*

Fifty responses were collected from the manually conducted survey questionnaire. The demographics shows that 44 percentage of respondents came from the CHBAH team, followed by SBAH at 20% and CMJAH at 16% on figure 4.1.

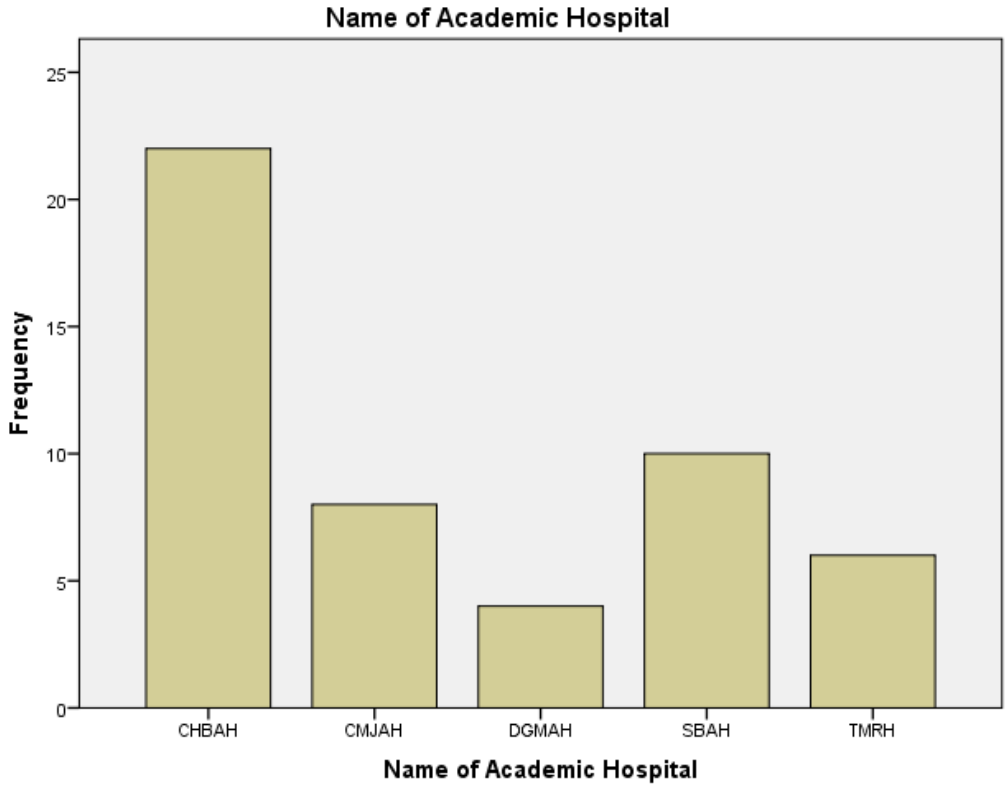


Figure 3-2 Academic hospital respondents

3.8.2 *Positions held by respondents*

According to the barchart below in figure 4.2, the interns responded the most, under CHBAH about 60% of their respondents are interns, and then followed by CMJAH and SBAH with 25% and 20% of their respondents respectively

This suggests that the highest position in the delivery and management of maintenance projects is that of a chief engineer. All five chief engineers from the academic hospital responded.

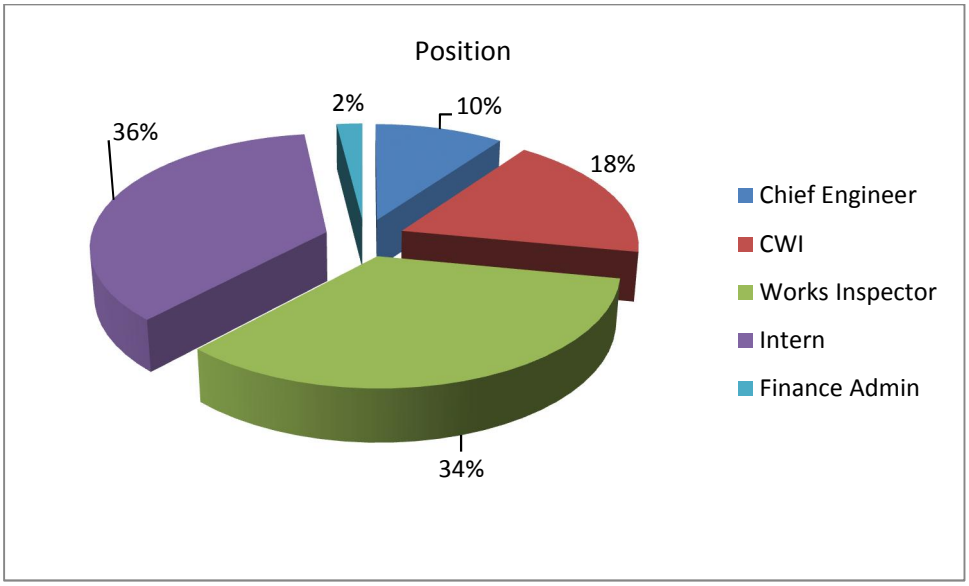


Figure 3-3 Positions of respondents

3.8.3 *Years of service*

The years of service, are years spent by the candidate on Gauteng department of infrastructure not taking into account the experience gained from the previous employers.

From the pie chart below on figure 3-4 it shows that, the 62 per cent of the respondents have are within 1-3 years' experience. Actually, the chief engineers who are the Managers of the Maintenance sections are newly hired and are all having almost 2 years' experience in the Department. CHBAH and SBAH have 72% and 70% of their respondents respectively working for GDID for less than 3 years in their current positions

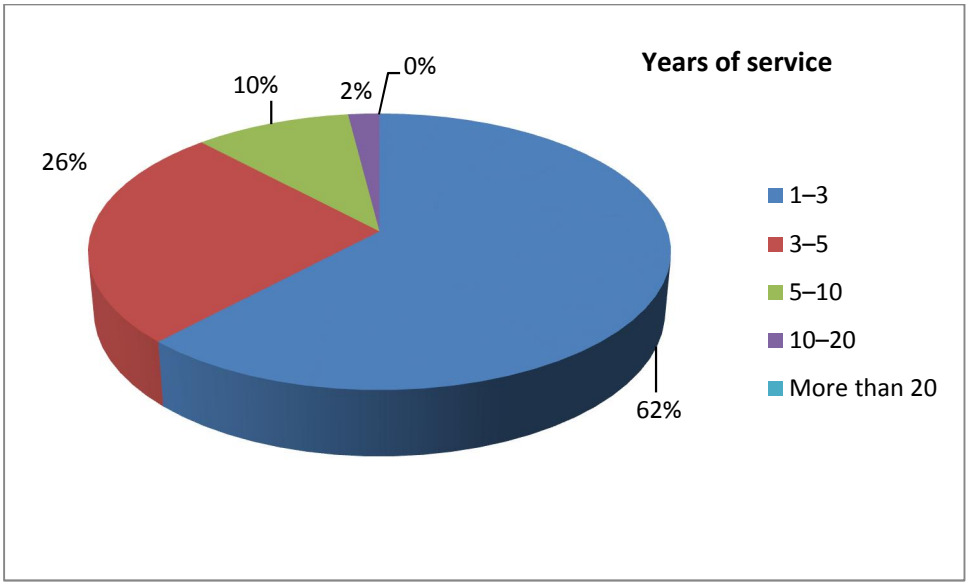


Figure 3-4 Years of service

Then 26% of the respondents are inspectors with 3-5 years' experience at GDID. The department appoint the Inspectors from interns, which roughly means that about 50% of the interns get absorbed after their 3 years with the department.

3.8.4 *Age of the respondents*

Over 70% of responders are 35 years old or younger, with only 3 of the 50 respondents being 45 years or more.

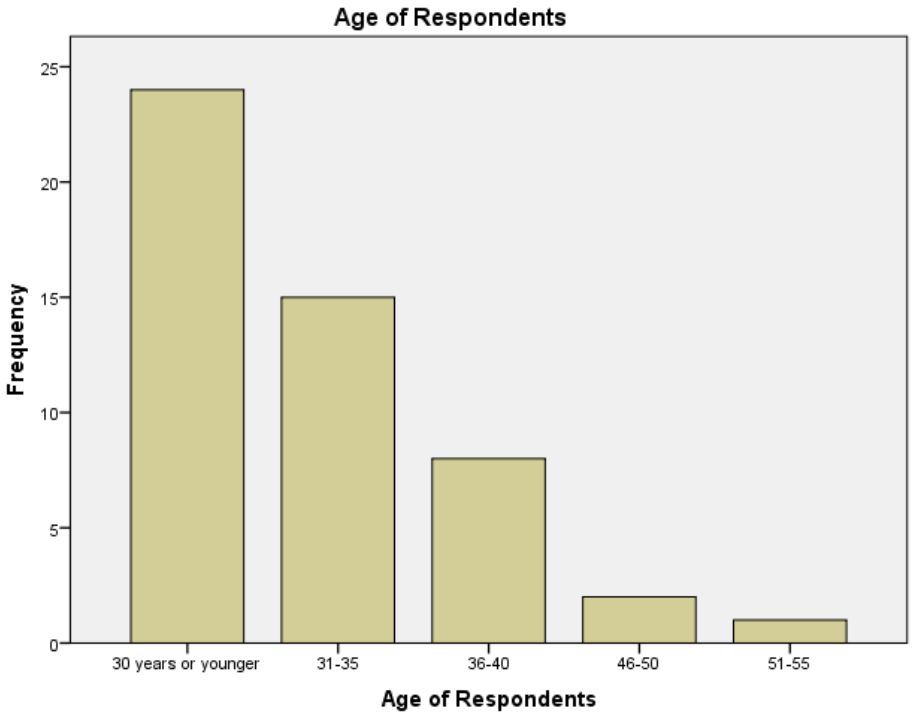


Figure 3-5 Age of respondents

The predominately younger workforce of the inspectorates teams that are responsible for the delivery of projects in academic hospitals is consistent with the DID' resourcing strategy of hiring interns and grooming them from within. DID is the academic hospital's maintenance project partner for the health department. The 30 years and younger are mainly interns and some inspectors.

3.8.5 *Number of Subordinates*

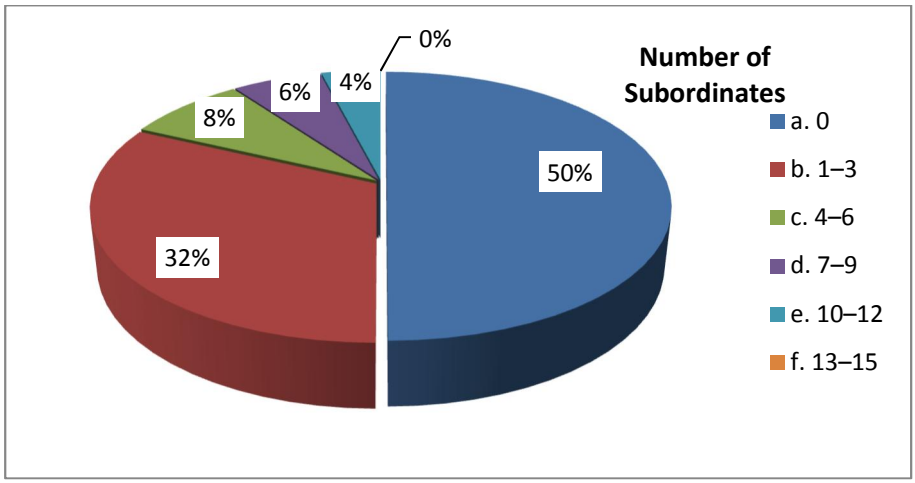


Figure 3-6 Number of subordinates

4 CHAPTER 4: PRESENTATION OF RESULTS

4.1 Introduction

In this chapter, the results of the analysis of data captured through questionnaires is presented followed by the summary of findings. The data collections and analysis were driven by the two study objectives of understanding whether project maturity level in academic hospitals improves the performance of projects embarked on by these hospitals.

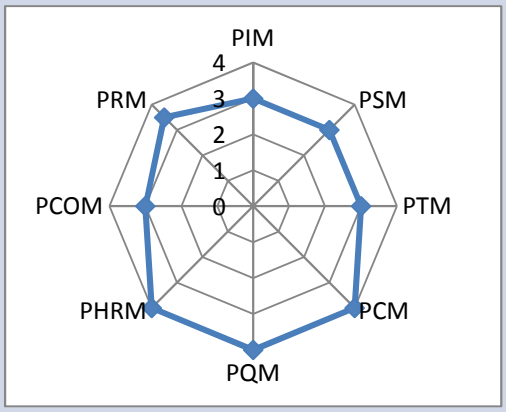
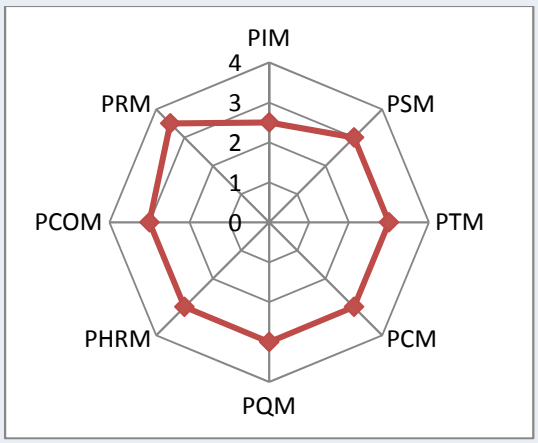
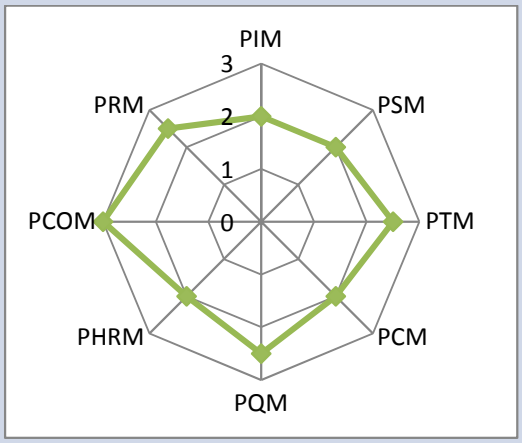
- PMM Results for Academic Hospitals in Gauteng
- Results pertaining to Hypothesis 1 and 2
    - Validity assessment using Cronbach alpha to establish the validity of the scale used
    - Inferential analysis using the Partial Least Squares regression to establish the relationship between
        - PMM and Project Performance,
        - PMM and Internal & External business performance

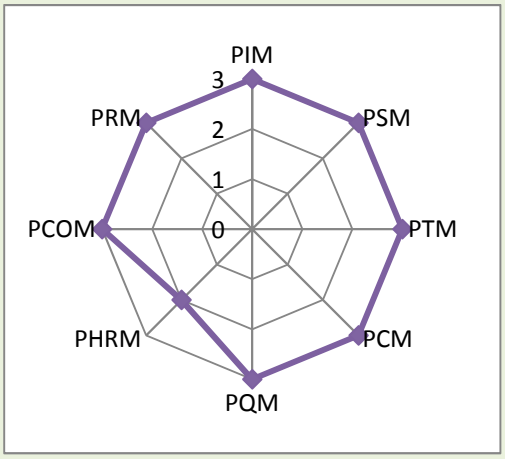
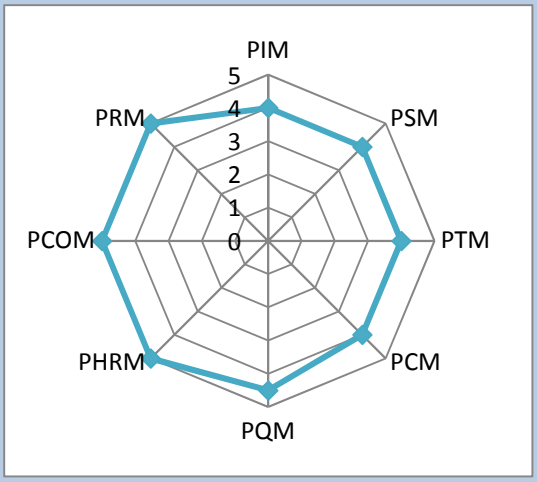
4.2 PMMM Results for Academic Hospitals in Gauteng

In the section 2 of the survey instrument (see appendix 1) the respondents were asked to assess the importance of the 8 items that apply to project maturity construct.

The project management maturity model (PMMM) questionnaire was based on eight knowledge management areas of project management. Respondent were requested to assess their respective academic hospitals' PMM level for each knowledge area and sub-areas based on the Likert scale of 1 to 5 and the results are shown on the radar chart in table 4-1.

Table 4-1 PMM results on Radar Chart

Hospital	PMM	Results explained
CHBAH		-PMM is 3 -Project cost, quality and human resource are scored at 4,
CMJAH		-PMM is 3 -Most knowledge areas are at level 3 except for PIM and PRM -Resembles octagon
DGMAH		-PMM is at 2.4 -Only Project communications reached level 3 -The knowledge management does not resemble octagon shape but it rectangular instead.

SBAH		-PMM is 3 -All knowledge management areas are score at 3 except the Project Human Resource management which is at 2.
TMRH		-PMM is 4 -Nearly more than 50% of the knowledge area is on level 4. -TMRH have reached the optimal level on Risk management, communication and Human resource management

Shown in table 4-2 in is the mean of the 8 knowledge management area of PMM with their respective standard deviation.

Table 4-2 PMM Mean and Standard deviation

Item Statistics		
	Mean	Std. Deviation
Project Integration Management	2.76	0.894
Project Scope Management	3.04	0.880
Project Time Management	3.08	0.900
Project Cost Management	3.40	0.857
Project Quality Management	3.64	0.921
Project Human Resource Management	3.40	1.050
Project Communications Management	3.36	0.802
Project Risk Management	3.52	0.839

The project maturity for all the 5 hospitals is 3

4.3 Results pertaining to Hypothesis 1 and Hypothesis 2

4.3.1 *Cronbach alpha and Composite reliability*

Cronbach alpha was confirmed in both SPSS and SAS and the values are placed on table 10. In order to get composite reliability values which are also displayed in table 10 factor analysis was undertaken and results are depicted on table 4-3.

Table 4-3 Factor analysis results

	λ	λ^2	$1-\lambda^2$
Duration	0.821	0.674	0.326
Budget	0.682	0.466	0.534
Team work	0.853	0.727	0.273
Expectation	0.788	0.621	0.379

$$CR = \frac{(\sum \lambda)^2}{(\sum \lambda)^2 + (\sum (1 - \lambda^2))}$$

CR = 0.867

Following the similar calculation the table below is populated with results

Depicted in table 4-4 are the results construct with their respective Cronbach alpha and composite reliability.

Table 4-4 Cronbach Alpha and Composite Reliability

Constructs	Cronbach Alpha	Composite reliability
PMM (PIM, PSM, PTM, PCM, PQM, PHRM, PCOM, PRM, KMAVG)	0.918	0.934
Project performance	0.577	0.867
Internal business performance	0.440	0.765
External business performance	0.374	0.773

4.3.2 *Project Management Maturity vs Project Performance*

Depicted below on figure 4-1 is the correlation plots from SAS showing the relation between PMM and PP for both individual and overall GDID teams based at academic hospitals

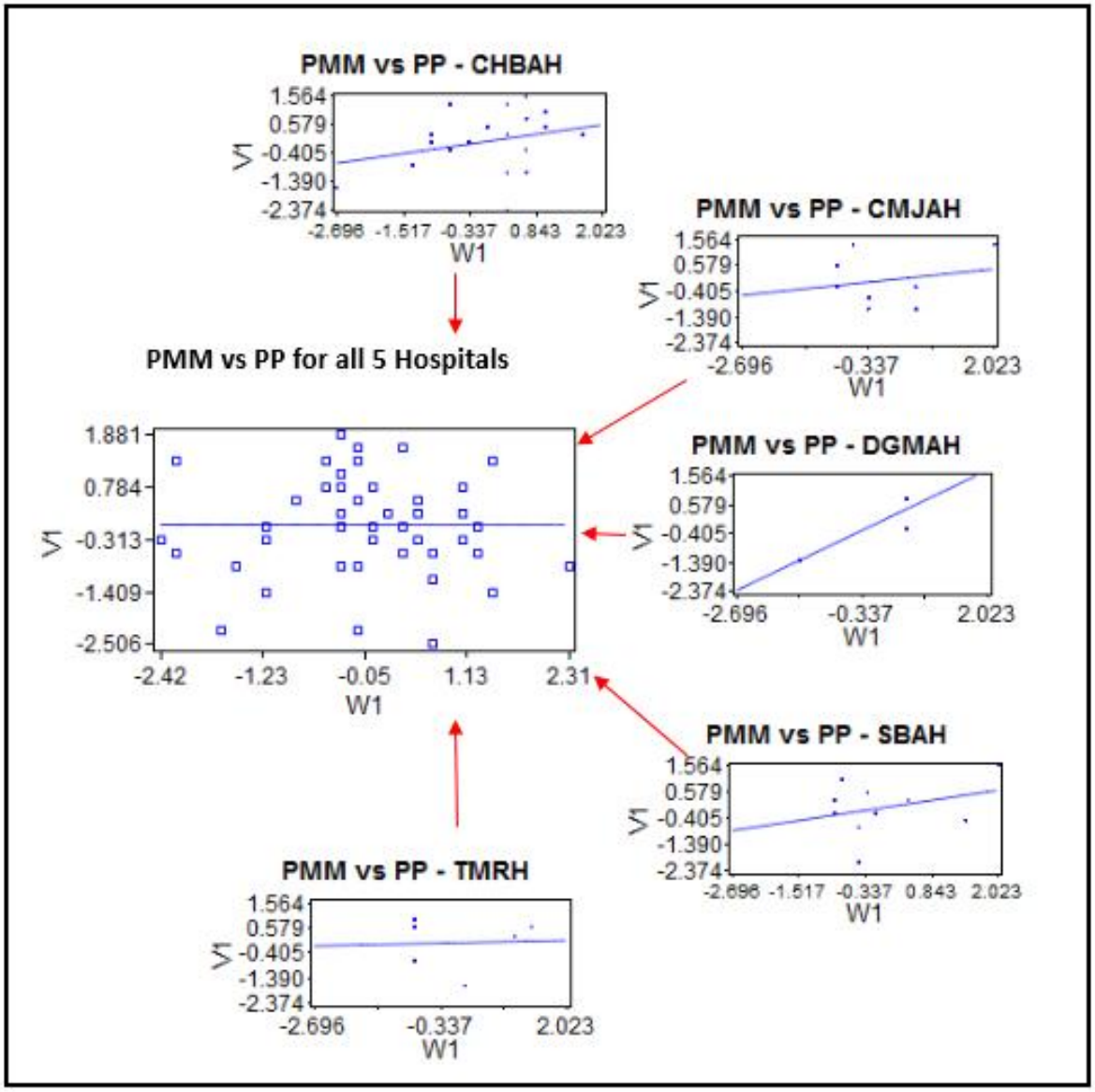


Figure 4-1 Correlation of PMM vs PP

4.3.3 *Project Management Maturity vs Project Performance*

Depicted below on figure 4-2 is the correlation plots from SAS showing the relation between PMM and BP for both individual and overall GDID teams based at academic hospitals

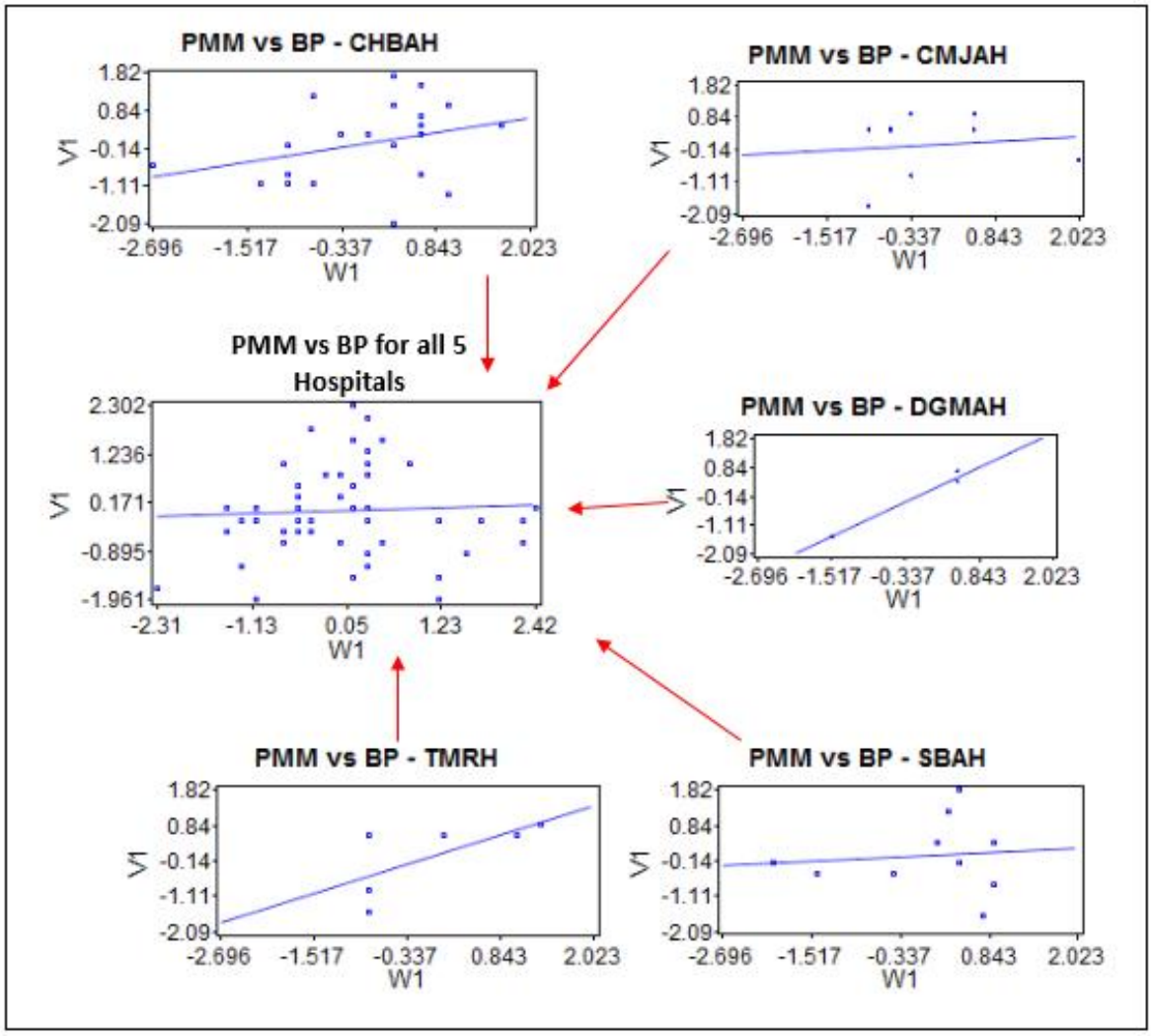


Figure 4-2 Correlation of PMM vs BP

4.3.4 *Partial Least Squared Method*

The results for Partial Least Squares method were obtained from SAS as shown on Table 4-5, since the SPSS program needed another extension file to be loaded and could not show the results.

Table 4-5 Hypotheses testing for PMM and Performance

Hypotheses	Path coefficient	t-value	P value
PMM-Project Performance	-0,00	-0.01	0,99
PMM-Internal business performance	-.0.03	-0.20	0.85
PMM-External business performance	0.1	0.80	0.43
R^2 for Project performance	0.00		0
R^2 for Internal business performance	0.00		
R^2 for external business performance	0.01		
R^2 for PMM	0.80		

The statistical results

T(48) =-0.01, p = 0.99 > 0.05 insignificant

The GDID Maintenance team scored M -1.76, SD = 1.15, N=50 on the relationship between PMM and project performance

The t-test provides the evidence to reject the null hypothesis

T(48) =-0.20, p = 0.85 > 0.05 insignificant

The GDID Maintenance team scored M = -1.74, SD = 1.03, N=50 on the relationship between PMM and internal business performance

The t-test provides the evidence to reject the null hypothesis

T(48) =-0.80, p = 0.43 > 0.05 insignificant

The GDID Maintenance team scored M = -1.99, SD =1.06 , N=50 on the relationship between PMM and external business performance

4.3.5 *Conclusion*

The hypothesis testing result for all the 5 academic hospitals is shown on table 4-6 which does not support H1 and H2.

Table 4-6 Hypothesis testing results for all 5 hospitals

Hypothesis	Test results	p-value
H1: Project performance is associated with high levels of project maturity	Not Supported	0.99
H2: Internal and external business performances are not associated with high levels Project maturity	Not Supported	0.71

The hypothesis testing results for individual academic hospitals are shown on Table 4-7 which shows that all H1 and H2 are not supported except H2 for DGMAH which is supported.

Table 4-7 Hypothesis testing results for individual hospitals

	Hypothesis	Test results	p-value
CHBAH	H1: Project performance is associated with high levels of project maturity	Not Supported	0.20
	H2: Internal and external business performances are associated with high levels Project maturity	Not Supported	0.14
CMJAH	H1: Project performance is associated with high levels of project maturity	Not Supported	0.61
	H2: Internal and external business performances are associated with high levels Project maturity	Not Supported	0.78
DGMAH	H1: Project performance is associated with high levels of project maturity	Not Supported	0.13
	H2: Internal and external business performances are associated with high levels Project maturity	Supported	0.01
SBAH	H1: Project performance is associated with high levels of project maturity	Not Supported	0.37
	H2: Internal and external business performances are associated with high levels Project maturity	Not Supported	0.78
TMRH	H1: Project performance is associated with high levels of project maturity	Not Supported	0.93
	H2: Internal and external business performances are associated with high levels Project maturity	Not Supported	0.13

4.4 Summary of Results

The PMM level for the academic hospital in Gauteng is at 3, where DGMAH is at level 2, and at level 3 is CHBAH, CMJAH and SBAH, and TMRH is at level 4.

The PMM level of the academic hospital is not influenced by the project performance measure, and further the PMM Level is not affected by the business

performance, except for DGMAH where the business performance is influenced by PMM level

5 CHAPTER 5: DISCUSSION OF RESULTS

5.1 Introduction

In this chapter, the results of the data analysis will be discussed based on PMM results, further the hypothesis testing for PMM vs project performance and hypothesis testing for PMM vs Business performance will be discussed.

5.2 Project management maturity model

In this chapter, the study reveals significant findings about the relationship of PMM and performance of the project team in academic hospitals. The Mean score was calculated for each knowledge management area and for the knowledge Area maturity. From the responses collected from 50 inspectorate professionals, the total maturity of 3.00 was achieved.

The table 8 shows the results of the mean, the columns show the knowledge management areas whereas the rows are the 5 academic hospitals. Column 2 shows the individual PIM and the total PIM for all the academic hospital.

The mean score of each knowledge management area is 3 except for Project Human Resource Management (PHRM) which is 2.25 and PCOM which is 3.25. From the table it is evident that CMJAH, DGMAH and SBAH scored low on PHRM at 2.25.

In the 5 academic hospitals, an average of PMM level 3 is obtained, DGMAH scoring 2.4 and TMRH scoring 4, whereas CHBAH, CMJAH and SBAH are all at PMM level 3. There is still a room for the academic hospitals that scored low to improve on their PMM level by benchmarking and learning from TMRH that scored the highest. Actually, for Infrastructure Department the PMM level of greater than 3 is high referring to Sopko's graph in figure 2.3 in the literature review where his study shows professional services to be around PMM level of 2.5.

The amalgamated PMM of the 5 hospitals on the radar chart in figure 5-1 shows that TMRH encompasses all the other 4 academic hospital in terms of the knowledge

management areas of PMM. CHBAH covers the second largest area followed by CMJAH and SBAH which have attained the almost octagon shape for PMM level 3.

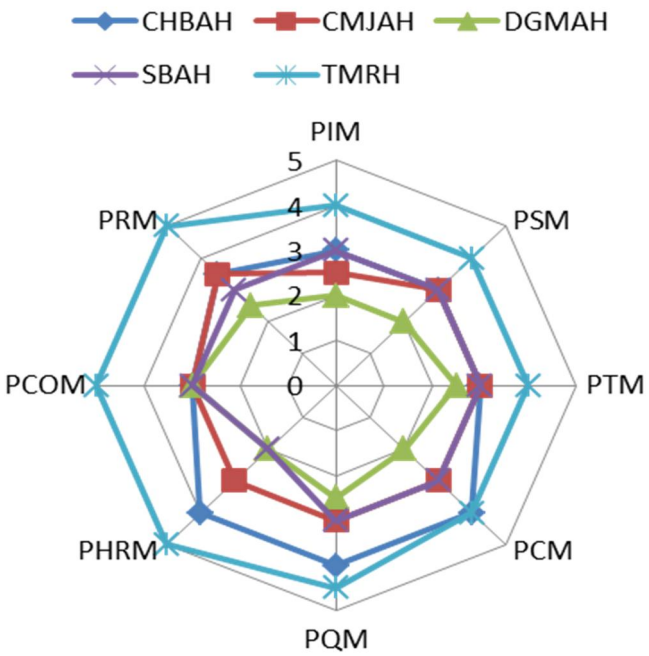


Figure 5-1 ***Amalgamated PMM on radar chart***

Figure 5-2 is the representation of knowledge management areas of PMM for all 5 academic hospitals. It shows that the DID teams based at the hospitals are achieving a balanced octagon shape of knowledge management areas

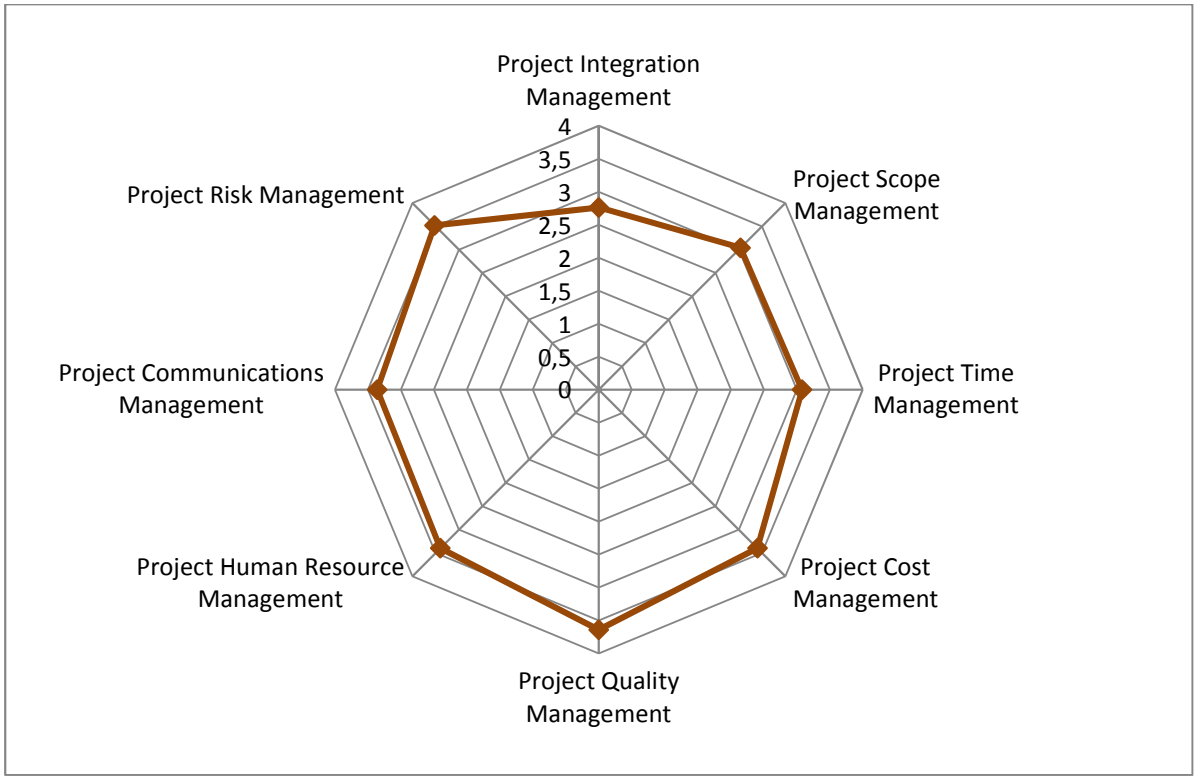


Figure 5-2 ***All 5 Academic Hospital PMM radar Chart***

The DID Inspectorate team scored low in Project integration management and project scope management. Benchmarking needs to be done on plan development and execution, change control, information system and project office to improve project integration management.

The project scope management will be improved by benchmarking on identifying the deliverables correctly and doing proper scope definition. Also by clearly itemising the tasks that need to be carried out and to have any scope changes documented correctly.

The average score level 3 means the project team is governed by a refined and integrated project management process that is consistently applied on each project. Further that all project management processes are standard and repeatable for all projects. Management has established the processes and standards with formal documentation existing on all processes and standards.

The DID department is governed by Public Finance Management Act which enforces compliance with use of public funds. There are processes in place that ensures that every project that needs to be carried out has financial allocation in a financial year budget. That is the reason project cost management at maturity level of 4.

5.3 Discussion on Cronbach Alpha and Composite reliability

Cronbach alpha and Composite reliability (CR) are statistical methods used for testing each of the constructs' validity in research as depicted on table 10. Cronbach's alpha for PMM is stronger at 0,91. This indicates that the 8 items under PMM have a high inter-correlation and thus measuring the extent to which they all measure PMM construct consistently. The CR of the same construct is also high. The PMM instrument is reliable.

The second construct is PPM, a 4-item construct, showed relatively lower Cronbach alpha of 0,58. Deleting items under this construct diminishes the Cronbach alpha values further. The relatively lower alpha could be attributed to the number of items in the PMM construct. As highlighted in chapter 3, when the number of items is too few, the reliability of a construct usually undermined due top the violation of the assumption of homogeneity on the same scale. The CR is, however, at acceptable levels. The PMM instrument too is considered reliable for this study.

The third and forth constructs, both 3-item constructs, have the least Conbrach alpha values ranging between 0,440 and 0,374. An alternative approaches like Spearman-Brown prediction3 formula could be used as a measure of internal consistency. However, for this analysis, CR is considered. The CR for both Internal and External Business Performance ranges between 0,765 and 0,773.

5.4 Discussion of Hypothesis 1 and 2

Discussion around project management maturity against project performance and business performance.

5.4.1 *Project management maturity level against project performance*

Table 4-6 and 4-7 confirm that high level of PMM is not associated with project performance, this is similar to Yazici's finding in her study whereby PMM was found not to be associated with project performance. In this study GDID Maintenance team at academic hospital, PMM is found to be above level 3 which means that there is solid standardisation of document of managing project processes. In Yazici study, PMM level was at 2.6 which means there is a certain level of standardisation to project management process documents but there is still room for improvement.

The finding is contrary to Sopko's graphs that were shown in figure 2-5 which suggest that high levels of PMM will improve Project performance. It means high levels of PMM will not necessarily improve project efficiency and project effectiveness. This means that projects will be completed within specified duration and budget requirements. Also high levels of PMM will ensure that projects meet client's expectation and in return ensure that team members are well satisfied while they are at work doing project.

Figure 4-1 shows that the overall correlation plot of PMM vs PP for all the GDID teams based in academic hospitals is flat which means no relation at all. The individual academic hospitals show slight positive trend. DGMAH with low PMM level show a linear correlation better than CHBAH, CMJAH and SBAH, and TMRH's graph is almost flat.

5.4.2 *Project management maturity level against business performance*

Table 4-6 and Table 4-7 also confirm that High levels of PMM is not associated with business performance, this is not in-line with Yazici's finding where it is found that PMM influenced business performance. Table 4-7 shows that H2 for individual academic hospitals is not supported except for DGMAH which is supported and is in agreement with Yazici's find where PMM level influence business performance.

DGMAH's PMM level is 2, so increasing it will improve the business performance of the GDID Maintenance team based at the academic hospital.

Figure 4-2 shows a slight positive correlation for PMM vs BP for all 5 academic hospitals which means there is a relation even though the hypothesis was not supported for 80% of the hospitals. DGMAH and TMRH which scored low and high on PMM level respectively, have a steeper positive correlation to business performance than CHBAH, CMJAH and SBAH

5.5 Conclusion

The high PMM level is not associated with the project performance. The GDID teams based at academic hospital with low PMM level showed a positive correlation than the ones with high PMM level. The PMM level is not associated the project performance.

At intermediate PMM level, there is no association with business performance, but at low level of PMM there is a relationship, as shown by the DGMAH hypothesis that is supported. There is also a good correlation of PMM and BP at high PMM level as demonstrated by TMRH.

6 CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

In this chapter the focus will be to outline the conclusions of the study with regards to determining the PMM level and performance of the GDID Maintenance team based at the academic hospitals in Gauteng. Then recommendations will be provided for the stakeholders that were identified in chapter 1 under the significance of the study. Lastly, from all the thoughts and questions that developed throughout the research will emanate the suggestions for further research for those who will like to consider researching PMM further.

6.2 Conclusions of the study

GDID Maintenance Inspectorate teams from 5 academic hospitals have collectively achieved the Project Management Maturity score of above 3. Individual academic hospitals resembled their patterns on the radar chart, for the CHBAH, CMJAH and SBAH where almost similar to octagon and at PMM level 3, DGMAH is at level 2 while TMRH is at level 4. All the academic hospitals collectively showed a better octagon shape which means the teams are well balanced and can draw from their synergies and learn from their differences to improve their PMM level.

High levels of Project management maturity level are not associated with project efficiency. High levels of Project management maturity level are also not associated with business performances except for DGMAH which its project maturity level is associated with business performance.

6.3 Recommendations

Firstly, proper and thorough training of all GDID maintenance teams based at the academic hospitals on project management process flow needs to take place as soon as possible. This training will bring all the maintenance team to the same level of understanding in terms of process flow and the necessary documentation for each step of the project phase.

Chief Engineers and Control Works Inspectors of GDID teams based at all 5 academic hospitals in Gauteng need to have knowledge sharing meetings at least twice a year. This is where they will share and document lessons learnt from the projects that they carry out at their workplace and will then establish the knowledge management sharable drive.

CHBAH, CMJAH, DGMAH and SBAH will have to make their benchmark sessions with TMRH to learn from them which gaps do they need to close in order to improve their respective project management maturity level. It will also be highly recommended that the teams also benchmark with other Maintenance team in other Academic hospitals in other provinces in like Western Cape, Kwazulu Natal and Eastern Cape.

The demographics showed that in terms of experience in positions, 62% of employees are less than 3 years and majority being interns and further 26% is between 3-5 years of the employees are less than 5 years. This means that the maintenance team is fairly new to GDID and will need clear understanding of project management process flow and documentation. It will also be necessary to have information readily available to employees on a web-based directory.

6.4 Suggestions for further research

1. Questionnaire to be sent to all the maintenance teams based in academic hospital all over South Africa
2. Compare PMM of academic hospitals and private hospitals irrespective of their different project management processes.

3. Include a questionnaire for Hospital management in the study, to give perspective of the GDID maintenance team performance.
4. Compare the team performance of Academic hospitals who have high level of performance against those with low levels of performance
5. In the similar study include organisational culture just like Yazici carried it out in her article named “The Role of Project Management Maturity and Organizational Culture in Perceived Performance”

REFERENCES

Artto, K., et al. (2008). "What is project strategy?" International Journal of Project Management 26(1): 4-12.

Backlund, F., et al. (2014). "Project Management Maturity Models – A Critical Review." Procedia - Social and Behavioral Sciences 119: 837-846.

Bryman, A. (2012). *Social Research Methods* (4th ed.). New York: Oxford University Press.

Bryman, A. & Bell, E. (2011). *Business Research Methods* (3rd ed.). New York: Oxford University Press.

CHBAH (2016). "Chris Hani Baragwanath Academic Hospital." Retrieved from: www.socialresearchmethods.net (accessed on 14-05-2015).

Cooke Davies, T. J. a. A., A (2003). "PM-maturity in different industries." 471 - 478.

Couture, D. (2003). "Enterprise Project Management: The Path to Maturity."

Crawford, J. K. (2002). Project management maturity model. New York: Marcel Dekker, Inc.

Creswell, J.W. (2014). *Research Design: Qualitative, Quantitative and Mixed Methods Approaches* (4th ed.). UK: Sage Publications.

Demir, C. and Kocabaş, I (2010). "Project Management Maturity Model (PMMM) in educational organizations." Procedia - Social and Behavioral Sciences 9: 1641-1645.

Dvir,D.,Sadeh,A.,& Malch-Pines,A. (2006). Projects and project managers: The project success. Project Management Journal,37(5), 36–48.

GDID (2016). "Gauteng Department of Infrastructure Development." Retrieved from: http://www.did.gpg.gov.za/Pages/Frequently-Asked-Questions.aspx (accessed on 14-05-2017).

GDoH (2016). "Central Hospital Services." Retrieved from: http://www.health.gpg.gov.za/hospitals (accessed on 14-05-2017).

Gliem, J.A. & Gliem, R.R. (2003). *Calculating, interpreting, and reporting Cronbach's Alpha Reliability Coefficient for Likert-Type Scales.* Paper presented at the 2003 Midwest Research to Practice Conference in Adult, Continuing, and Community Education at Columbus, Ohio, Ohio State University, 2003.

Kassner, G. W. (1987). "The cost of an academic hospital Patient."

Kerzner, H. (2002). "Strategic Planning for Project Management Using a Project Management Maturity Model."

Leedy, P.D. & Ormrod, J.E. (2014). *Practical Research: Planning and Design* (10th ed.). UK: Pearson.

Mateen, M. (2015). "Measuring Project Management Maturity - A framework for better and efficient Projects delivery."

McDonald, J.H. (2014). *Handbook of Biological Statistics* (3rd ed.). Maryland: Sparky House Publishing.

Nahm,A.Y.,Vonderembse,M.A.,& Koufteros,X.A.(2004).The impact of organizational culture on time-based manufacturing and performance. Decision Sciences, 35, 579–607

Nenni, M. E. A., I; Boccardelli, P and Napolitano, I (2014). "How to Increase the Value of the Project Management Maturity Model as a Business-oriented Framework." International Journal of Engineering Business Management.

Panayides, P. (2013). Coefficient Alpha: Interpret with caution. Europe's Journal of Psychology, 9, 687-696.

Rwelamila, P. D. a. A., R (2010). "Understanding of Project Management good practices by construction project managers: The case of ABCD." 1189-1198.

Schaufeli, W., Bakker, A.B. & Salanova, M. (2006). The measurement of work engagement with a short questionnaire: A cross-national study. *Educational and Psychological Measurement, 66*(4), 701-716.

Schmitt, N. (1996). Uses and abuses of coefficient alpha. Psychological Assessment, 8(4), 350-353

Sechrest, L. (2005). Validity of Measures Is No Simple Matter. *Health Services Research, 40*(5p2), 1584-1604. doi: 10.1111/j.1475-6773.2005.00443.

Sijtsma (2009) Sijtsma, K. (2009), “On the Use, the Misuse, and the Very Limited Usefulness of Cronbach’s Alpha”, Psychometrika, Vol. 74 No. 1, pp. 107–120.

Silvius, A. G. J. and Schipper, R. (2012) "A Maturity Model for Integrating Sustainability in Projects and Project Management"

Spiliotopoulou, G. (2009), “Reliability reconsidered: Cronbach's alpha and paediatric

assessment in occupational therapy”, Australian Occupational Therapy Journal, Vol. 56 No. 3, pp. 150-155.

Sopko, J. (2015). "Organizational Project Management: Why build and improve."

Tahri, H. and O. Drissi-Kaitouni (2015). "New Design for Calculating Project Management Maturity (PMM)." Procedia - Social and Behavioral Sciences 181: 171-177.

Tavakol, M., Dennick, R. (2011). Making sense of Cronbach’s alpha. International Journal of Medical Education. 2:53-55.

Trochim, W.M.K. (2006). Unit of Analysis. Retrieved from: www.socialresearchmethods.net (accessed on 14-05-2015).

Welman, J. & Kruger, S. (2001). *Research Methodology.* Cape Town: Oxford University Press.

Yazici, H. J. (2009). "The role of project management maturity and organizational culture in perceived performance." Project Management Journal 40(3): 14-33.

APPENDIX A - QUESTIONNAIRE

The following questionnaire was is similar to the one used on Yazici's case study when she wanted to establish the Role of PMMM on the project performance and the organisational culture(Yazici 2009). Since we are no evaluating the organisational culture it was excluded from the conducted this study.

Demographics:

1. Name of Academic Hospital

_____

2. Years of service in the GDID/FMU:

a. 1–3
b. 3–5
c. 5–10
d. 10–20
e. More than 20

2. Current position:

_____

3. Sex:

a. Female
b. Male

4. Age

a. 30 years or younger
b. 31–35 years
c. 36–40 years
d. 41–45 years
e. 46–50 years
f. 51–55 years
g. 56 years or older

5. Number of subordinates reporting directly to you

a. 0
b. 1–3
c. 4–6
d. 7–9
e. 10–12
f. 13–15

g. 16–18
h. More than 19

Project Management Maturity Model Questionnaire

	Project Management Maturity levels				
	1	2	3	4	5
Project Integration Management					
Project Plan Development					
Project Plan Execution					
Change Control					
Project Information System					
Project Office					
Project Scope Management					
Requirements Definition (Business)					
Requirements Definition (Technical					
Deliverables Identification					
Scope Definition					
Work-Breakdown Structure					
Scope Change Control					
Project Time Management					
Activity Definition					
Activity Sequencing					
Schedule Development					
Schedule Control					
Schedule Integration					
Project Cost Management					
Resource Planning					
Cost Estimating					
Cost Budgeting					
Performance Measurement					
Cost Control					
Project Quality Management					
Quality Planning					
Quality Assurance					
Quality Control					
Management Oversight					
Project Human Resource Management					
Organizing Planning					
Staff Acquisition					
Team Development					

Professional Development					

	Project Management Maturity levels				
	1	2	3	4	5
Project Communications Management					
Planning					
Information Distribution					
Performance Reporting					
Issues Tracking and Management					
Project Communications Management					
Planning					
Information Distribution					
Performance Reporting					
Issues Tracking and Management					
Project Risk Management					
Risk Identification					
Risk Quantification					
Risk Response Development					
Risk Control					
Risk Documentation					

	Project Management Maturity levels				
	1	2	3	4	5
KNOWLEDGE AREA MATURITY LEVEL					
Project Integration Management					
Project Scope Management					
Project Time Management					
Project Cost Management					
Project Quality Management					
Project Human Resource Management					
Project Communications Management					
Project Risk Management					
Project Procurement Management					

Organizational Maturity level determined =

PROJECT PERFORMANCE MEASURES:

Distribute 100 scores among four alternatives (A, B, C, D) depending on the extent to which each alternative represents better the overall body of projects. As the assessment may vary among projects, give a higher number of scores to the alternative that most represents the majority of the projects.

1. Assess whether projects are completed within specified duration		
A	To a great extent (exceeds expectation)	
B	To a moderate extent (meets expectation)	
C	To a little extent (some expectations are met—with some overtime)	
B	Not at all (under expectation—overtime)	
	Total	100
2. Assess whether projects met budget requirements		
A	To a great extent (exceeds expectation)	
B	To a moderate extent (meets expectation)	
C	To a little extent (some expectations are met—with some over budget)	
D	Not at all (under expectation—completely over budget)	
	Total	100
3. Assess whether projects met expectations		
A	To a great extent (exceeds expectation)	
B	To a moderate extent (meets expectation)	
C	To a little extent (not all expectations are met)	
D	Not at all (under expectations—disappointed)	
	Total	100
4. Assess whether team members are satisfied to work together		
A	To a great extent—willing to work together for future projects	
B	To a moderate extent—somewhat satisfied with minor issues	
C	To a little extent—some conflicts and issues are present	
D	Not at all—conflicts are present; team members never want to work together	
	Total	100
5.Upon completion, evaluate the savings (R) benefits of projects to the organization		
A	To a great extent (exceeds expectation)	
B	To a moderate extent (meets expectation)	
C	To a little extent (some expectations are met)	
D	Not at all (under expectation)	
	Total	100
6. Evaluate whether projects resulted in improved service		
A	To a great extent	
B	To a moderate extent	
C	To a little extent	
D	Not at all or not applicable	

	Total	100

7. Evaluate whether projects helped the organization to increase preference to the client		
A	To a great extent	
B	To a moderate extent	
C	To a little extent	
D	Not at all or not applicable	
	Total	100
8. Evaluate whether projects helped the organization improve its trust to the client		
A	To a great extent	
B	To a moderate extent	
C	To a little extent	
D	Not at all or not applicable	
	Total	100
9. **Evaluate whether as a result of the projects, overall performance of your organizational unit is improved compared to last year at this time**		
A	A To a great extent	
B	B To a moderate extent	
C	C To a little extent	
D	D Not at all or not applicable	
	Total	100
10. Evaluate whether as a result of the projects, your unit's performance improved compared to your best worldwide competition?		
A	To a great extent	
B	To a moderate extent	
C	To a little extent	
D	Not at all or not applicable	
	Total	100