

Case Study on Project Management at a Mineral Sand Organization

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Abstract--A study on project management maturity has been conducted in the mining sector, specifically a mineral sand organization, in order to compare this company's project management maturity with other industries in South Africa. The study further identifies gaps in the company's project maturity and makes recommendations to address these.

The 5-level project management maturity model has been applied and an average measurement of 2.92 out of 5.0 was obtained. On the project management maturity scale this is close to level 3 or the Defined stage. The results obtained for this company compared very well with previous project management maturity results for South African industries, although not in the same sector. Due to the nature of the mining industry, the Risk knowledge area scored remarkably higher for this company than what was found for other South African industries. Various suggestions are provided to overcome the identified gaps and enhance the project management maturity of the company in this case study.

I. INTRODUCTION

This paper reports on a study conducted in the mining industry to establish the project management maturity (PMM) of specifically a mineral sand organization. Only a few studies on PMM have been conducted on South African industries during the past decade, and none on a mining industry. Sonnekus and Labuschagne [1] reported on PMM versus project success in the South African Information Technology (IT) industry, and Ntshosho [2] on measuring PMM in an Eskom (electricity provider) project. A study was conducted by Labuschagne, Marnewick and Jakovljevic [3] on how the success of South African IT projects related to the PMM of organizations. Pretorius, Steyn and Jordaan [4] reported on whether PMM maturity has an influence on the perceived project success in engineering and construction projects in South Africa and some other parts of Africa. This study aims to contribute to the knowledge of PMM of South African industries by providing results of PMM studies conducted on a mineral sands organization. The objective of this study is to measure project management maturity at a mining company, in order to:

- compare the maturity with other industries in South Africa,
- identify gaps in project maturity at the company being studied, and
- make recommendations to address identified gaps.

II. LITERATURE SURVEY

Project Management Maturity Models (PMMMs) can be used to establish the current position of an organization in order to improve its project success rate to reach a future

desired state [5]. Project management maturity is defined by Crawford [6] as the enlightened progress or development of an enterprise-wide project management approach, methodology, strategy and decision-making process. The Project Management Institute (PMI) [7] defines project management maturity as the extent to which an organization practices organizational project management, whereas the Organizational Project Management Maturity Model (OPM3) defines maturity as the existence of best practices which is an optimal way adopted by industry to achieve a stated goal or objective.

More than 30 project management maturity models were developed since the mid 1990s [8]. However, most PMMMs originated from the initial capability maturity model for software which was released in 1991 by the Software Engineering Institute of Carnegie Mellon University [9]. This model is also known as the Capability Maturity Model (CMM). In 1998, the Project Management Institute (PMI) developed an Organizational Project Management Maturity Model (OPM3) [11]. OPM3 has three interlocking elements, e.g. (i) knowledge about OPM best practices; (ii) to assess an organization's current capabilities and identify areas to improve; and (iii) to use the assessment to develop a roadmap needed to improve performance. From the first edition of OPM3 in 2003, alignment has been ensured with the Project Management Body of Knowledge (PMBOK) Guide. The PMBOK Guide® [7] acknowledges nine knowledge areas which are typical of almost all projects. These knowledge areas are divided into two main categories, each including four areas, which are tied together by project integration management, Figure 1. The latest 2013 PMBOK Guide®, 5th edition, also includes Project Stakeholder Management as a 10th area [11].

In this study the 5-level PMMM was used in order to compare the results with other studies been done in South Africa, which applied the 5-level PMMM. This maturity model is a combination of several existing models, including Dinsmore and Cabanis-Brewin [12], Kerzner [13], Crawford [14], Micro-Frame Technologies Inc. and Project Management Technologies, Inc. [15]. These models are based on a 5-level ranking for maturity. Level 1, often known as the 'initial' or 'ad-hoc' stage, refers to a state where no established project management practices exist and processes are disorganised. Level 5 is the "sustained" or "optimized" stage indicating that the organization is fully matured and the organization applies feedback to continually improve processes. However, according to Andersen and Jessen [16] a fully matured organization will never exist in the real world as development is always required. A schematic presentation of the 5-level model is shown in Figure 2.

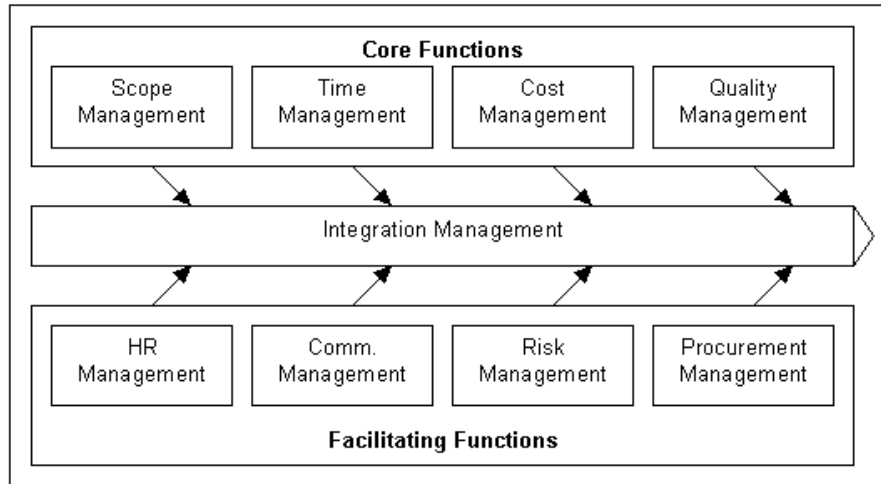


Figure 1: Nine knowledge areas of the PMBOK Guide® [7].

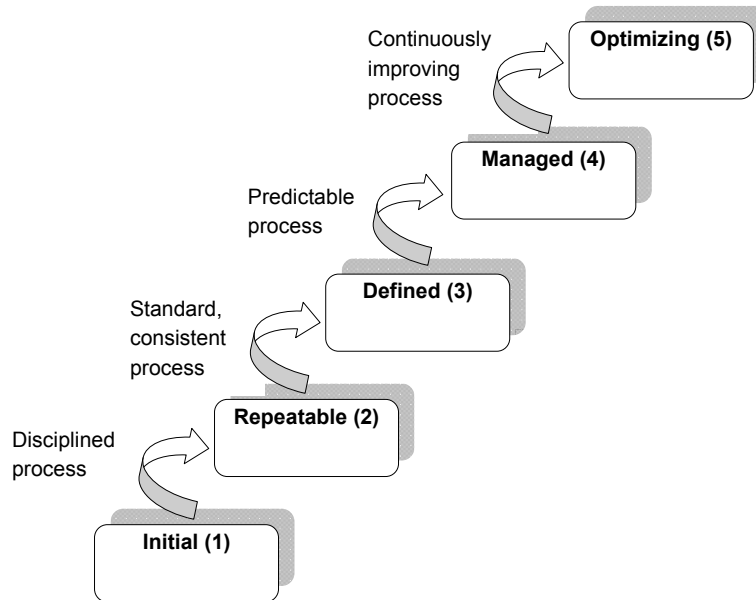


Figure 2: Project management maturity model [9].

PMM models (PMMMs) can be a tool to improve many areas within a business as indicated by Pennypacker et al. [17], which found that organizations with higher maturity levels, showed better performance in all observed areas. Studies conducted by Ashrafi and Hartman [18] also indicated that a link exists between high performing organizations and increased maturity.

III. RESEARCH METHODOLOGY

The purpose of this research is to generate new knowledge on the level of project management maturity at a mining industry. To achieve this purpose, a research questionnaire was generated. The research questionnaire comprised a total of eleven questions which were sent out electronically. The first two questions were directed to the respondents in order

to establish their work experience and exposure to project management at this company. The following questions were focused on each of the nine project management knowledge areas, namely (i) Integration; (ii) Scope; (iii) Time; (iv) Cost; (v) Quality; (vi) Human Resources (vii) Communication; (viii) Risk; (ix) Procurement. A brief description of each of the nine project management knowledge areas were provided in the questionnaire before posing the question.

The actual maturity level for the company was determined by combining the averages for each maturity level value. The actual maturity level was determined by the average of the maturity value of the nine knowledge areas. Further, the average of a specific knowledge area is determined by the processes within that knowledge area.

The questionnaire was distributed to 300 people within the company who had been involved in projects. From this

sample, a total of 97 responses was received. The desired samples size was calculated to be 47 respondents for a confidence limit of 95% and a standard deviation of 10%. Better than expected response was thus obtained in this study.

IV. RESULTS AND DISCUSSION

The questionnaire was administered to survey participants involved in projects, within all eight departments of the company, to obtain as representative sample as possible. Knowledge of project management was found to be sufficient in this sample with more than 70% of respondents having over five years' working experience, which includes 35% with more than 10 years' experience, see Figure 3. Factors that were unfortunately not explored, include the respondents' years of work experience prior to joining this company, as well as their age. It is thus possible that even the respondents who were not long with the present company, had years of experience in the field.

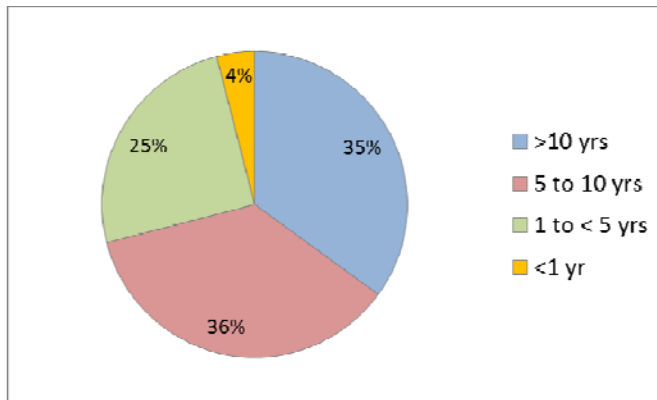


Figure 3: Respondents' years of experience at the company.

A. Project Management Maturity

Figure 4 reveals that a minority (3.1%) of respondents indicated that the company was in the initial stage (level 1), while 35.1% rated it at level 2 (repeatable), 38.1% at level 3 (defined), 18.6% at level 4 (managed), and 5.1% rated the knowledge areas at level 5 (optimizing/maturity).

Figure 5 and Table 1 show the results of the individual knowledge areas as scored from lowest to highest. The project human resource management is the lowest rated knowledge area followed by project scope and communications management. At the upper end of the scale is the project integration and project procurement management. The average of the nine project management knowledge areas as found from the survey conducted, was 2.92 out of a possible 5. On the project management maturity scale this is almost at level 3, which is known as the Defined stage. At this level organizational standards exist and the project management process is institutionalized, although not very well managed.

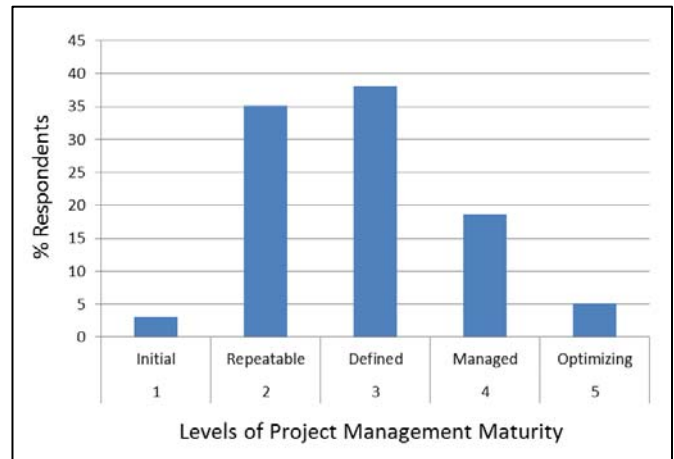


Figure 4: The percentage respondents per knowledge area level.

This company's score of 2.92 was found to be comparable with project management maturity scores obtained from previous studies conducted on other South African companies. For example, the energy utility company, Eskom, scored 3.03 out of 5 according to Ntshosho [2]. Sonnekus and Labuschagne [1] found project management maturity in the South African Information Technology industry to be 2.97 and Labuschagne et al. [3] obtained a score of 3.61 within the same industry in 2007. African engineering and construction companies average score was 2.88 as reported by Pretorius [19] and Pretorius et al. [4]. These maturity results are higher than results obtained in international studies by PriceWaterhouseCoopers (PWC) which revealed a score of 2.5 [20], as well as Grant and Pennypacker's survey of 126 organizations from various industries with a result of 2 out of 5 [21].

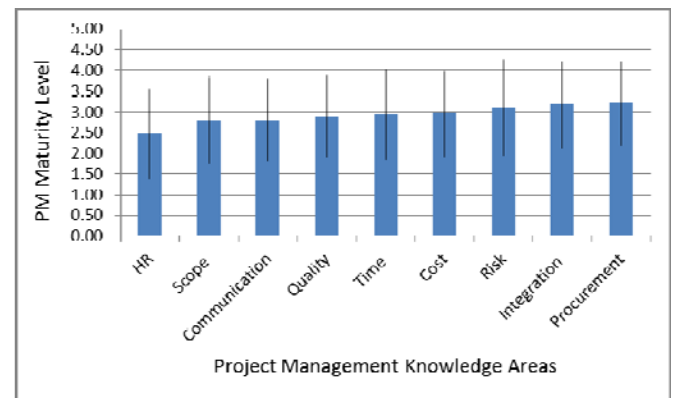


Figure 5: Project management maturity ranking per project management knowledge area.

TABLE I: PM MATURITY LEVEL RESULTS PER PMBOK GUIDE® KNOWLEDGE AREA.

PMBOK Guide® Knowledge Area	Mean	Standard Deviation
Integration	3.16	1.05
<i>Average for Core Functions</i>	<i>2.89</i>	<i>1.04</i>
Scope	2.79	1.05
Time	2.93	1.10
Cost	2.96	1.03
Quality	2.89	0.99
<i>Average for Facilitating Functions</i>	<i>2.89</i>	<i>1.06</i>
Human Resources	2.46	1.08
Communication	2.80	0.99
Risk	3.10	1.16
Procurement	3.21	1.01
<i>Average for All Functions</i>	<i>2.92</i>	<i>1.07</i>

Interesting to note was that the average for the Core – and Facilitating Functions were both 2.89 and less than the Integration function of 3.16, Table 1. Similar results were also obtained by Sonnekus & Labuschagne [1] where Integration (3.02) was slightly higher than the Core – (2.97) and Facilitating Functions (2.86).

B. Project Management Maturity per Project Management Knowledge Area

In this section the results of the lowest three, middle three and top three knowledge areas are compared. Figure 6 reveals very similar response behaviour for PM knowledge areas Human Resources (HR), Scope and Communication with more than 40% of the respondents selected maturity level 2. The tailing of the graph with higher levels vary slightly between the knowledge areas. The HR knowledge area scored the lowest at 2.46. The main objective of project human resource management is to identify the necessary skill sets needed for specific project activities, and assigning these individuals to the projects. Project human resource management also involves managing and ensuring high productivity of those resources and forecasting future resources needs. Although Project Scope and Communication also scored relatively low, the gap for improvement is considered not very demanding and can be overcome by involving stakeholders for example, in project planning, project charter preparation, scope-of-work statement, validation of the project scope, etc.

Figure 7 shows the graphs for knowledge areas Quality, Time and Cost which had very comparable average values of 2.89; 2.93 and 2.96, respectively. Further discussions revealed that end-users must be engaged to make quality an effective aspect of successful project completion, as it was found that needs are not always met or even more than required is provided. Project time management's main purpose is to formulate or to draw the project schedule, manage to that schedule and ensure the project finishes on time within appropriate timeframe. Project time management includes listing of project tasks and activities, sequencing those activities, developing the schedule and controlling the plans during the project execution. The score was 2.93 for

Project Time Management and matched the 2.99 obtained by Sonnekus and Labuschagne [1]. Project cost management ensures that the project completes within the approved budget, and involves constantly monitoring expenditure as the project progresses. A suggestion for improvement of project cost management could be the adoption of a standard process for e.g. resource planning, determining project budget, doing cost estimation and cost control, earned value analysis and depreciation and capital budgeting.

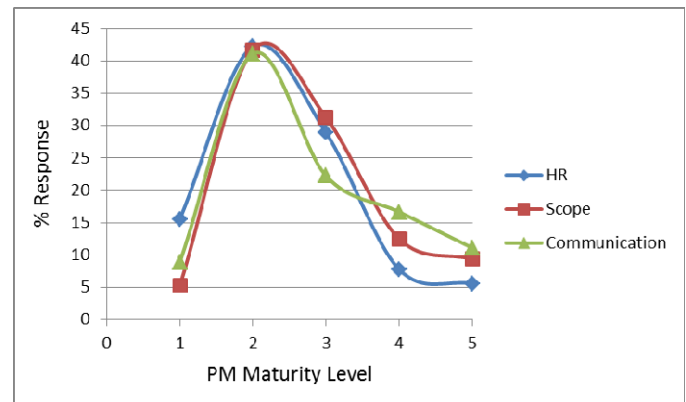


Figure 6: Per cent response per project management maturity level for the knowledge areas: Human Resources (HR), Scope and Communication.

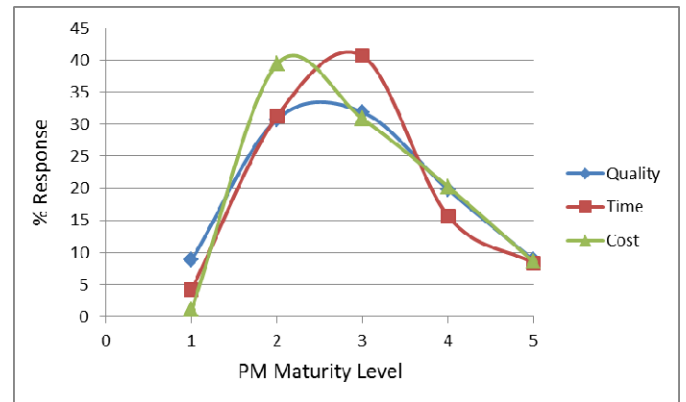


Figure 7: Per cent response per project management maturity level for the knowledge areas: Quality, Time and Cost.

The survey showed the company has a good awareness of risk management in its projects, with an average score of 3.10. At this level, the project risk management processes are used for projects and metrics are utilised to support risk decisions at the project and the program levels. At this company there is evidence of migration towards a higher level where management is enthusiastically engaged in organization-wide project risk management. Risk systems are starting to be fully integrated with time, cost and resource systems. According to Badri et al. [22] a mining company requires major efforts to minimise risks that could cause delays or not reaching goals as this could easily result from the very complex nature and factors that have an effect on this sector. Orsulak et al. [23] found that systematic risk management remains the most effective vehicle to cover all phases of a mining project's life cycle, whereas Royer [24] found that unmanaged or unmitigated risks are one of the primary causes of project failure.

The highest score of 3.21 which was obtained in this study, was for Procurement Management. Further investigation found that this was not due to preference by the Finance Department, which only formed 4% of the study population. The shape of the graph for Integration Management (Figure 8) could wrongly be interpreted that different views exist in the company on this knowledge area. Further investigations into whether this phenomenon resulted from preference by a specific division indicated the contrary, as 43 per cent of the respondents representing all divisions rated Integration at level 4 or 5. Although lower than the score of 3.75 by Labuschagne et al. [3], this company's Integration Management score (3.16) was slightly higher than what was found by Sonnekus and Labuschagne [1] for the IT industry in South Africa.

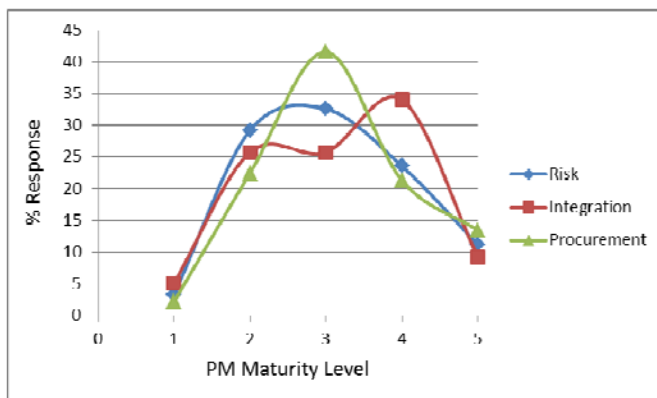


Figure 8: Per cent response per project management maturity level for the knowledge areas: Risk, Integration and Procurement.

V. CONCLUSIONS AND RECOMMENDATIONS

The survey results indicated that the perceived project management maturity at this company is between 2.63 and 3.21 with an average of 2.92. On the maturity scale, this company is at level 3 maturity. At level 3, it indicates that all

project management processes, methods, standards, and procedures are consistently implemented by staff members of the company. However, the company must continuously strive to improve its project management knowledge base. Spundak and Striga [25] stated that, although project maturity models have a number of shortcomings, they definitely contribute to the development of the project management body of knowledge and they represent a holistic view of the discipline. The results for the individual knowledge areas compared very well with previous studies on PMMM done on South African companies. Due to the nature of the mining industry the Risk knowledge area scored remarkably higher for this company than what was found for other industries in South Africa.

The results obtained from this study provide an indication of the level of PMM according to the PMMM, but the results should not be considered in isolation as other factors can also have an influence on the PMM of an organization. Future studies to investigate other factors that could influence PMM of an organization are, for example, the culture of the organization, line management involvement, project management methodology, application of project management software, etc.

Most of the gaps identified in various knowledge areas can be addressed by improving engagement between the different stakeholders of the product or process. Development work identified for the lower scoring knowledge areas, HR, project scope management and project communications management could include:

- Establishing professional development program for project management career paths.
- Involving all stakeholders in project planning, cost control, trade-off analysis, project charter preparation, kick-off meeting, scope of work statement, validation of the project scope and initiation of a change control process.
- Personnel executing the projects must involve end-users in determining what information is needed, how that information will be sent and managed, and how project performance will be reported.

On the highest scoring knowledge management areas, practices that must be continued include:

- The use of the company project management system to monitor project work and adherence to budget, schedule, quality of outputs and meeting of stakeholders expectations.
- Continuous integration with other parties within the company to facilitate a holistic approach to project work, e.g. use of the Finance department for procurement function and the Safety department to do risk assessments.

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