PROJECT MANAGEMENT AS A CATALYST FOR IMPROVED QUALITY WITHIN ORGANISATIONS.

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by

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DECLARATION

I Nyameko Ntlokombini, declare that the contents of this dissertation represent my own unaided work, and the dissertation has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology. I further declare that al sources cited or quoted are indicated or acknowledged by means of a comprehensive list of references.

Signed at: _____ on this _____day of _____2009

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ABSTRACT

During the past decade, project management skills have become increasingly recognised as highly desirable for managers at all levels of organisations. Most people can benefit from the application of project management skills to some parts of their daily operations. The rapid growth of global markets and the introduction of total quality management, continuous improvement programmes and more recently, the drive to redesign business processes, all require some form of project management skills.

In spite of the obvious benefits from project management, research has shown that more often than not, the traditional practice of project management does exist within organisations. This then may lead to service failure; thus impacting adversely on the efficiency and image of the organisation. This dispensation also applies to projects undertaken by the Eskom, which will serve as objective of this research study.

The primary research objectives of this study are the following:

- To improve the quality of goods and services through the application of project management.
- To emphasise the importance of project management within an organisation.
- To demonstrate that project management, if used in conjunction with a quality management system, can improve service delivery.

It is anticipated that the research will lead to an improvement of the control of processes and the overall service or product quality delivered by Eskom.

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- My family, for their support and motivating me in times of hardship.
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CHAPTER 1: SCOPE OF RESEARCH

1.1 INTRODUCTION AND MOTIVATION

Research indicates that many organisations conduct self-assessments using assessment models such as the South African Excellence Model, with a view to improve organisational effectiveness. However, experience has shown that assessment models have not done much to improve organisational effectiveness. In most instances this is due to the fact that they are not revised to suit a particular business' needs. Eskom is amongst such companies who embark on self-assessments. The organisation uses different types of self-assessment, such as the World Association of Nuclear Operators (WANO) peer reviews, the Electricity Power Research Institute (EPRI) and other nuclear power plants to conduct audits and determine how far Eskom is with regard to compliance with standards and overall business performance.

With the above point of view in mind, such assessments are not giving the organisation an edge to remain competitive. The one aspect that can ensure that an organisation remain competitive is through managing projects from a quality perspective. Quality, in project management is described as using all three primary elements of project management to benefit the organisation, namely cost, quality and time. Benefiting the organisation can only be achieved through better utilisation of company resources, proper project planning and proper management of project cost.

In spite of the fact that the concept of project management is well known and practiced widely by a plethora of industries, many industries are unaware of what project management is although they may be using some aspects of it, in the likes of planning and costing.

In this modern day and age, it is crucial that people are well aware and informed of their roles and responsibilities, and how they fit into the whole organisation in order to benefit both parties (the organisation and employees). Eskom, being the

organisation serving as the research environment for this dissertation, is one of the organisations where project management is viewed as one of the most needed disciplines (Phidza, 2009:Interview). This is due to the fact that Eskom is currently embarking on the building of new power stations, continuously conducting modifications, and plant improvements to its various operating power stations, and attending to routine outages (Phidza, 2009:Interview). All these activities require a high level of project management skills, experience and expertise in order to achieve the required results and satisfy customers, through delivering a reliable and continuous electricity supply.

According to Mthandi (2009:Interview), employees who typically get involved outages, do not understand and know the importance of their responsibilities (either with respect to modification projects or outage projects). Furthermore, they also probably have no idea how important these outages are to the organisation. The importance of project management for Eskom is to have high level of competency in managing projects and outages, thus giving the company a competitive edge by completing the outages on schedule, releasing the contractors on time (to avoid unnecessary costs), and not to compromise on safety of everyone involved in the quality of the project (Mthandi, 2009:Interview).

Project management is characterised by methods of restructuring techniques, with the purpose of obtaining better control and use of existing resources (Day, 2003:3). The concept behind project management is being applied in diverse industries and organisations such as defense, construction, pharmaceuticals, chemicals, banking, law, advertising, printing and packaging industries to name but a few. The rapid rate of change in technology world wide place has created a need for quality deliverables, irrespective if they products and services. Project management as a discipline is considered by many as a possible solution to improved overall quality (Kerzner, 2006:2-3).

1. 2. BACKGROUND TO THE RESEARCH PROBLEM

Kerzner (2006:2), found that virtually all executives have the same opinion, namely that the solution to the majority of organisational problems involves the

requirement for improved control and utilisation of existing company resources. The concept of project management serves as a mechanism to achieve improved control and utilisation of resources and is considered as a possible solution for a universal problem. Taylor (2006:4), noted that the last forty years have witnessed a rapid and staggering change in technology and global competition. With these changes, the nature of business at Eskom has become more complex and more dynamic, such that project management is regarded as one of the core skills that the organisation requires for the near future.

1.3 STATEMENT OF THE RESEARCH PROBLEM

According to Cooper and Schindler (2006:96), the statement of the research problem pertains to a problem within the research environment, and will form the primary focus of the research. Against the above background the research problem to be researched within the ambit of this dissertation reads as follows: "Poor project management for the development of goods and services adversely impacting the ability of Eskom to provide quality deliverables to its consumers".

1.4 THE RESEARCH QUESTION

The research question to be researched within the ambit of this dissertation, reads as follows: "To what extent can sound project management principles be applied within Eskom to improve the quality of its deliverables to consumers?"

1.5 INVESTIGATIVE (SUB-) QUESTIONS

The investigative questions to be researched in support of the research question reads as follows:

- What principles are used within Eskom to ensure project success?
- What alternative mechanisms can be deployed to minimise project failure?
- How can project failures be prevented in future?
- What are key indicators that a project will succeed?

1.6 PRIMARY RESEARCH OBJECTIVES

The following are the primary research objectives of this dissertation.

- To improve the quality of goods and services through the application of project management within Eskom.
- To emphasis the importance of project management within the organisation.
- To focus on project management specialisation as a measure of quality improvement.
- To demonstrate that project management if used in conjunction with a quality management system, can improve service delivery.

1.7 THE RESEARCH PROCESS

The research process provides insight into the process of 'how' the research will be conducted from developing the proposal to submitting the dissertation. Remenyi, Williams, Money and Swartz (2002:64-65), explains that the research process as consisting of eight specific phases, which will be applied to this research study. The phases include:

- Reviewing the literature.
- Formalizing a research question.
- Establishing the methodology.
- Collecting evidence.
- Analyzing the evidence.
- Developing conclusions.
- Understanding the limitations of the research.
- Producing management guidelines or recommendations.

1.8 RESEARCH DESIGN AND METHODOLOGY

According to Yin (1994:19), a research design can be defined as, "…the logical sequence that connects the empirical data to a study's initial research question and ultimately, to its conclusions. Colloquially, a research design is an action plan from getting here to there, where here maybe defined as the set of questions to be answered, and there is some conclusions about the questions".

Case study is an empirical enquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident (Collis & Hussey, 2003:68-70). According to Collis and Hussey (2003: 68-70), case studies are often described as exploratory research used in areas where there are few theories or deficient body of knowledge. Furthermore, the case study is a comprehensive research strategy that comprises all-encompassing method, with the logic of design incorporating specific approaches to the data collection and data analysis (Collis & Hussey, 2003:66). Moreover, there are four types of case study research that according to Collis and Hussey (2003:66) can be identified:

- **Descriptive case study:** The objective is restricted to describing the current practice.
- **Illustrative case study:** A research attempts to illustrate new and possible innovative practices adopted by a company.
- **Experimental case study:** The research examines the difficulties of implementing new procedures and techniques in an organisation.
- **Explanatory case study:** Existing theory is used to understand and explain what is happening. In this research study, explanatory case study research will serve as research method (Collis & Hussey, 2003:66).

According to Yin (1994:1), case studies can be used in many situations. This includes the following:

- Policy, political science, and public administration research.
- Community psychology and sociology research.
- Organizational and management studies.
- City and regional planning research, such as studies of plans, neighborhoods or public agencies.
- Research into the social sciences, the academic disciplines as well as professional fields such as business administration, management sciences and social work.

1.9 DATA COLLECTION DESIGN AND METHODOLOGY

The data collection methodology that will be used within the ambit of this research is questionnaires. Questionnaires, fall within the ambit of a broader definition of 'survey research' or 'descriptive survey'. For absolute clarity, the concept of 'survey' is defined by Remenyi *et al.* (2002:290) as: "…the collection of a large quantity of evidence usually numeric, or evidence that will be converted to numbers, normally by means of a questionnaire". A questionnaire is a list of carefully structured questions, chosen after considerable testing with a view to elicit reliable responses from a chosen sample. The aim is to establish what a selected group of participants do, think or feel. A positivistic approach suggests structured 'closed' questions, while a phenomenological approach suggests unstructured 'open-ended' questions.

1.10 DATA VALIDITY AND RELIABILITY

According to Collis and Hussey (2003:186), 'validity' is concerned with the extent to which the research findings accurately represents what is happening. More specific, whether the data is a true picture of what is being studied. According to Cooper and Schindler (2006:318-320), three major forms of validity can be identified, namely 'content validity', 'criterion-related validity' and 'construct validity'.

Content validity according to Cooper and Schindler (2006:318-320) refers to the extent to which the data provides adequate coverage of the investigative questions yielding the study. Criterion-related validity according to Cooper and Schindler (2006:318-320), reflects the success of measures used for prediction and estimation. Construct validity according to Collis and Hussey (2003:57), relates to the problem that there are a number of phenomena, which are not directly observable, such as motivation and anxiety.

Reliability (also referred to as 'trustworthiness'), is concerned with the findings of the research (Collis & Hussey, 2003:186). The findings can be said to be reliable if you or anyone else repeated the research and obtained the same results. There

are three common ways of estimating the reliability of the responses to questions in questionnaires or interviews, namely:

- Test re-test method, which will be applied to this research study,
- the split halves method, and the
- internal consistency method (Collis & Hussey, 2003:186).

1.11 ETHICS

In the context of research, according to Saunders, Lewis and Thornhill (2001:130), "… ethics refers to the appropriateness of your behavior in relation to the rights of those who become the subject of your work, or are affected by it". The following ethics will be observed in the research study:

- **Informed consent:** Participants should be given the choice to participate or not to participate, and furthermore be informed in advance about the nature of the study.
- **Right to privacy:** The nature and quality of participants' performance must be kept strictly confidential.
- **Honesty with professional colleagues:** Findings must be reported in a complete and honest fashion, without misrepresenting what has been done or intentionally misleading others as to the nature of it. Data may not be fabricated to support a particular conclusion.
- **Confidentiality/Anonymity:** It is good research practice to offer confidentiality or anonymity, as this will lead to participants giving more open and honest responses (Saunders *et al.,* 2001:130).

1.12 RESEARCH ASSUMPTIONS

According to Leedy and Ormrod (2001:62-63), "Assumptions are what the researcher takes for granted. But taking things for granted may cause much misunderstanding. What we may tacitly assume, others may have never consider. If we act on our assumptions, and in the final result such actions make a big difference in the outcome, we may face a situation we are totally unprepared to accept. In research we try to leave nothing to chance in the hope of preventing any misunderstandings".

For the purpose of the proposed research, the following assumptions will apply:

- While procedures are in place to guide the process of project management within Eskom, they are not executed appropriately.
- Sound project management principles are in place but not always applied.

1.13 RESEARCH CONSTRAINTS

Due to the fact that individual persons may be compromised when details of non-delivery are uncovered during the research, people may be reluctant to divulge sensitive information.

1.14 CHAPTER AND CONTENT ANALYSIS

The following chapter will be applicable to the research study:

Chapter 1: The scope of the research.

Chapter 2: A holistic perspective of the research environment.

Chapter 3: Project management: A literature review.

Chapter 4: Data collection design and methodology.

Chapter 5: Data analysis and interpretation of results.

Chapter 6: Conclusion.

1.15 SIGNIFICANCE OF THE PROPOSED RESEARCH

Quality remains one of the key elements of any organisation, as quality invariable points to the most important aspect of company success, namely that of 'customer satisfaction'. To achieve this objective, there is a worldwide drive to improve customer satisfaction incrementally, for which various sustained improvement projects are being employed.

Project management, by its very application within organisations, ultimately culminate in the improvement of a product or service irrespective if the project is aimed to improve or to create a new project of service.

Customer satisfaction as the result of project management is an aspect not well understood and more often than not, ignored when projects are being managed. In this respect Cleland (2004:7), defines customer satisfaction as the idea that a project is only successful to the extend that it satisfies the needs of its intended users.

The value and significance of this research is nested in the fact that projects within Eskom should ultimately culminate in 'customer satisfaction' as opposed to 'customer dissatisfaction'. The value in delivering a quality project leading to customer satisfaction has an unmeasurable value to the clients of Eskom, an aspect which primarily mooted this research study.

CHAPTER 2: BACKGROUND ON RESEARCH ENVIRONMENT

2.1 THE NATURE OF ESKOM BUSINESS

Eskom generates, transmits and distributes electricity to industrial, mining, commercial, agricultural and residential customers and to redistributors. The organisation is operationally regulated in terms of the licenses granted by the National Electricity Regulator of South Africa (NERSA). Currently Eskom is embarking on different projects in the quest to expand its capacity. All the projects are aimed at improving organisational effectiveness and performance in a highly competitive marketplace (Menacere, 2009:Interview). Eskom also utilises other resources to ensure that the future or long term projects will succeed, one of which is benchmarking to best practices.

2.1.1 History of Eskom

Eskom was established in 1923 with the blessing of government and a handful of committed people. The new organisation occupied several first-storey rooms in Johannesburg's city centre. In its first year, the utility sold 80 million units of electricity (i.e. One unit = 1 kilowatt-hour) (Bennetts, Holz & Snow, 1980:15).

In 1927, the country's first hydro power station began operating commercially at Sabie. This was an important development for a semi-arid country. In 1930 Witbank power station was upgraded to 100 megawatts, and was the largest in South Africa producing some of the cheapest electricity in the world. In 1937, Eskom House opened, soaring 21 storeys above Johannesburg's streets to become the country's tallest building (Bennetts *et al*., 1980:15-17). In 1940 Klip power station with its pioneering cooling towers was completed.

According to Conradie and Messerschmidt (2000:187-200), during the 20th century early 90s, 20 different power stations have been built and Eskom was still the only shareholder in the business. The various types or power stations and their associated output are depicted in Table 2.1. In 1997 the organisation had 26 065

kilometers of transmission lines, which span the entire country and also carry power to neighboring countries

Table 2.1: Eskom power stations

Type	Number	Net maximum capacity
Gas / liquid fuel turbine	4 stations	1 378 MW
Hydroelectric	6 stations	600 MW
Pumped storage	2 stations	1 400 MW
Coal-fired	13 stations	33 566 MW
Nuclear	1 station	1 800MW

In 1994, South Africans undergo a major change by electing their first Democratic President. This major change brought various interests to different individuals. The first Democratic President (Dr Nelson Mandela) had a vision of Reconstruction and Developing South Africa (RDP). Eskom took an initiative and committed itself to electrify 1 750 000 RDP homes between the period of 1994 – 2000. Since the inception of RDP, the organisation's customer base capacity was increasing by over 30% each year (Conradie & Messerschmidt, 2000:298).

However, Eskom was not building any power stations at this point. The organisation should have managed the RDP houses as a project. The organisation did not anticipate the changes that will come with the 30% increase in capacity, hence the vision was poor. One of project management principles is to ensure customer satisfaction, by planning early for adequate customer products and services.

2.1.2 Electrification

Eskom remained on track to meet its RDP commitment to electrify 1 750 000 homes by the end of 1999 (Khoza, 1999:2). The total number of connections made during the year 1998 was 291 352 against a target of 289 849 connections. Of this total, 280 977 were direct domestic connections and 10 375 were farm worker houses connected through the incentive scheme. At the end of 1998 a cumulative

total of 1 451 503 homes had been electrified since January 1994 (Conradie & Messerschmidt, 2000:300-315).

The focus for electrification according to Conradie and Messerschmidt (2000: 310) continued to be increasing sales to new customers, reducing technical and non-technical losses and reducing capital and operating costs. In addition, Eskom made R315 million available to municipalities to facilitate electrification.

Irrespective of the organisation getting new customers, Eskom did not plan for change. As far as this research is concerned, the 'African renaissance' concept took Eskom by storm, calling for a drastic decision to electrify many houses without conducting proper planning. Project management encourages proper planning, whereby an organisation should prepare a project plan, do feasibility studies, derive projects from the business vision and watch for changes (Khoza, 1999:3).

In Eskom's environment, changes that should have been monitored were the exponential increase in demand. Questions that, should have been asked by the organisation are if it should increase the supply of electricity, and will it be able to maintain this in the next 5 years? That should have given the organisation an opportunity to review this RDP involvement (Khoza, 1999:4).

2.1.3 Reduction of Eskom's monopoly

In 1998 a White Paper was signed and according to Phidza (Stakeholder Manager Eskom) it was "envisaged that Eskom monopoly would be reduced by 30%" (Phidza, 2009: Interview). Hence Eskom stopped building new power stations and had to mothball others. At the time the base load was centred in the former Transvaal region.

The assumption at that time was that, there was sufficient electricity supply as required by the industry (Phidza, 2009:Interview). Whereas the demand was increasing and Eskom did not monitor the demand. The demand increased due to

insufficient planning, electrification of houses, the opening up of the economy and the supply of electricity to neighbouring countries.

In 2004, the government gave Eskom permission to build new power stations. A decision was made to recommission the mothballed stations, while exploring other means of energy. In 2008 Camden and Grootvlei power stations returned to service, with Camden having 8 units in operation, while Grootvlei has 2 units running (Phidza, 2009:Interview).

2.2 ENVIRONMENTAL MANAGEMENT

Eskom continues to strive towards integrating environmental considerations into its business planning and decision-making processes. Since 1997, a system was implemented to record environmental related expenditure. During 1998 approximately R185 million was spent on operating environmental activities, primarily in the Generation Group (Morgan, 1999:4). Included in the total research and development costs, R9 million was spent on environmental related research during 1998. This included research on air quality, alternative energy supply, water management, development of environmental tools and energy efficiency (Conradie & Messerschmidt, 2000:322-327). Eskom remains committed to research and minimising negative environmental impacts.

The environmental audit function continue to measure compliance with legislation and Eskom's environmental policy. All power stations have established and implemented an Environmental Management System (EMS) for their business. During 1998, audits were performed with emphasis on the implementation of EMS in the Generation Group. Areas of improvement, which were identified, are, improved formalisation and documentation of systems, and enhanced alignment with international standards (Conradie & Messerschmidt, 2000:324).

During 1998, nine contraventions were reported. Areas of non-conformance to legislation include water related contraventions (Conradie & Messerschmidt, 2000:327). Reported incidents have been investigated, and appropriate preventive measures to reduce the potential for recurrence, were implemented. Eskom's

policy according to Mthandi (2009:Interview), is to comply with legislation and where appropriate, in the interest of the sustainability of the business, and set standards where no legislation exists.

2.2.1 Environmental Impact Assessments

Eskom supports Government's commitment to Environmental Impact Assessment (EIA), as a tool of ensuring the protection of South Africa's environment, the sustainable use of natural resources, and the promotion of social and economic development (Morgan, 1999:5). All Groups integrate EIA into Eskom's business by ensuring that environmental impacts are assessed at various stages of every project cycle. The implementation of EIA regulations by the authorities and its impact on the lead-time of projects is being monitored for reporting to relevant stakeholders. The business areas continue to engage stakeholders in the projects concept and its application (Morgan, 1999:5).

2.2.2 Policy

During the 1999, the implementation of EMS compliant to ISO 14001 received top priority by the organisation. The strategy and action plan, detailing implementation of all elements of ISO 14001 to ensure compliance by the year 2002, was compiled. Accountability for the EMS was stipulated for the various managers; furthermore the implementation was integrated into the overall risk management strategy of the business (Conradie & Messerschmidt, 2000:328-330).

Eskom's commitment with respect to ISO14001 is reflected in the Corporate Directive and Procedure on EMS (Morgan, 1999:6). The corporate directive requires each group to implement the EMS in accordance with the South African Bureau of Standards – SABS/ ISO 14001 standard, in terms of the Standard Act No 290 of 1993.

The organisation participated and commented extensively on various policy and legislative initiatives, including the National Waste Management Strategy, the National State of the Environmental Report, the Coastal Management policy, draft

regulation of the National Water Act and the nuclear related processes (Khoza, 1999:3). The company continues to play a role in influencing the drafting of legislation which impacts upon its business to ensure that it maximizes its stakeholder and customer value.

2.2.3 Environmental education

Education plays a vital role in providing employees with knowledge, skills and understanding of their environment and to ensure their activities are carried out in a responsible manner (Menacere, 2009:Interview). Eskom continue with environmental awareness that includes presentations, observation of environmental days, posters, articles in internal newspaper and an induction course for new employees

A working group, set up during 1997, co-ordinates environmental education throughout Eskom. The objectives are to ensure continual improvement of environmental education through co-ordination within the business, liaising with external bodies and ensuring that all environmental education is in line with applicable legislation, policies, procedures and ISO 14001 requirements (Conradie & Messerschmidt, 2000:328).

2.3 NEW BUSINESS VENTURES

In 1998, a number of African countries were visited with a view to promote sustainable, long-term commercial initiatives in line with the vision of an African Renaissance. By meeting with top utility and government officials, Eskom's management team has established strong links, and is building the foundations for future commercial ventures. African governments welcomed Eskom to assist them in meeting country's electricity needs (Conradie & Messerschmidt, 2000:333-340). These long term associations will enable all African electricity utilities to share their technical capabilities.

Eskom continued to actively partake in the maintenance and development of the Southern African Power Pool (SAPP). The first step in creating a totally

integrated electricity utility across the continent, paving the way for enhanced co-operation and economic growth across Africa (Conradie & Messerschmidt, 2000:335).

Eskom was actively exploring a number of possible joint ventures and partnerships in its core business areas of electricity generation, transmission and distribution. The company has also been involved in providing consulting and engineering services in Africa either directly or through its subsidiary companies. Contract work has been secured in the electricity sectors in Congo, Zanzibar, Namibia, Kenya, Botswana, DRC, Mozambique, Uganda and Zambia, as well as in Indonesia and Thailand. It is through these and similar initiatives that Eskom is acting as a catalyst for the renaissance of Africa (Conradie & Messerschmidt, 2000:333-340).

However, this strategy provides no sufficient capacity for the South African homes and industries. From December 2005, the Western Cape region experienced many blackouts and later other parts of the country as well. This had impacted very badly on South African economy, because many industries lost money due to lost time of no work and had to pay their employees, despite the electricity supply crises. The organisation once again had failed to plan for customer requirements and failed to understand their core business (Mthandi, 2009:Interview).

2.4 HUMAN CAPACITY DEVELOPMENT

Human capacity development is a phenomenon that encompasses all spheres of human beings. Job creation, HIV and AIDS, recognition of excellent performance, *et cetera* are amongst such aspects where human beings feel a need to be secured and appraised (Conradie & Messerschmidt, 2000:295).

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2.4.1 Job creation

Eskom has played a significant role in the areas of job creation and community development, and is considered by many to be a leading corporate role model. In order to consolidate these efforts, Eskom established the Eskom Development Foundation in 1998, with an initial contribution of R150 million (Conradie & Messerschmidt, 2000:294-295).

In addition, Eskom has made provisions of R50 million towards the Business Initiative for Job Creation and Human Capacity Development, which focuses on building a more resilient economy through creating employment opportunities (Conradie & Messerschmidt, 2000:295).

Once again the organisation had a poor vision with regard to recruitment. Some of Eskom's power stations are maintained by external contractors as opposed to Eskom own technicians and engineers. Eskom do not provide proper training to its employees.

2.4.2 HIV and AIDS

During 1998 Eskom took a comprehensive business approach to evaluate and respond to the impact of HIV and AIDS, on all its employees and their families. This included education on HIV/ AIDS prevention, treatment and management. In addition, Eskom undertook to contribute to research programmes endeavoring to find an HIV/AIDS vaccine (Conradie & Messerschmidt, 2000:304).

2.4.3 Awards

- Eskom received a special international HIV/AIDS award form the Global Business Council in London, for its comprehensive business approach in the HIV /AIDS field.
- The NOSCAR award – awarded to Koeberg, Lethabo and Matla power stations for their excellent safety performance (Khoza, 1999:5).

- The NOSA Terry Trophy – awarded to Vanderkloop power station for consistent excellent performance with regard to health and safety with a 21-year record of no disabling injuries.
- The NOSA 5-Star award – awarded to Arnot, Duvha and Tutuka power stations for meeting safety standards as stipulated by NOSA, and to Matimba power station for achieving two million man-hours without a disabling injury.
- The Edison Electric Institute award for being an outstanding utility in customer and community relations programmes.
- The prestigious Gold Award of the National Productivity Institute (NPI) to Matla power station for productivity management (Morgan, 1999:6-7).

CHAPTER 3: PROJECT MANAGEMENT: A LITERATURE REVIEW

3.1 THE CONCEPT 'PROJECT' DEFINED

ISO 10006: (2003:2), describes a project as, "a unique process, consisting of a set of coordinated and controlled activities with start and finish dates, undertaken to achieve the objective conforming to specific requirements, including the constraints of time, cost and resources". According to Young (1996:16), a project is something special by its nature and is perceived as being an activity outside normal operations. Furthermore, a project is clearly a practical activity carried out beyond the normal operation, therefore one will need to find a different approach to the work involved to achieve the desired results.

Kerzner (2006:4), define project management as, "the art of planning, organising, monitoring, controlling, and reporting of all aspects of a project and the motivation of all those involved in it to achieve the project objectives". Kerzner (2006:4), is further of the opinion that project management is the planning, organising, directing, and controlling of company resources for a relatively short-term objective that has been established to achieve a specific goal. Project management is further defined as, "a profession which is growing exponentially. It is both science and an art, and follows a systematic process" (Mulcahy, 2005:22).

Chapman (1997:**Online**), describe project management as, "a set of principles, practices, and techniques applied to lead project teams and control project schedule, cost, and performance risks to result in delighted customers".

Day (2003:1), is of the opinion that project management comprises of a theory of project and a theory of management. The theory of project comprises the following:

- Production metaphor,
- activity focus, and
- a transformation view of production.

The theory of management comprises the following:

- Planning,
- execution, and
- controlling.

3.2 CHARACTERISTICS OF A PROJECT.

According to Young (1996:17), a project is most unlikely to be repeated in exactly the same way by the same group of people, to give the same results. The following are some of the characteristics of a project:

- A project is not usually routine work but may include routine type tasks.
- Is focused on customer and customer expectations.
- A project has to be flexible to accommodate change as the work proceeds.
- A project has costs constraints, which must be clearly defined and understood to ensure that project remains viable at all times.
- It forces one to work in a different way.
- Involves risks at every step of the process and one must manage these risks to sustain the focus on the desired results.
- Projects provide an opportunity to learn new skills.
- There are risks involved to some extent.
- There are uncertainties.
- There are planned dates with specified cost and resources attached to every activity (Young, 1996:17).

Mulcahy (2005:27), in addition to the above is of the opinion that a project does not operate in a vacuum. Projects are impacted upon and have impact on the culture, management policies and procedures of the organisation they are part of. The best project managers look for these influences and manage them to the benefit of the project and the organisation.

Day (2003:1), believes that organisational success is largely dependant on the ability to successfully implement strategic and operational projects. Furthermore, that the international community shows great interest in the methods and practices of project management and at the same time scholars and researchers are paying

closer attention to the theoretical framework on which project management disciplines are based (Melgrati and Damiani, 2002 as cited by Day, 2003:1).

Koskela and Howell (2000) cited by Day (2003:2), found that customer requirements are difficult to establish in complex situations. They are seldom given, while requirements clarification plus inevitable change leads to disruption in the project's progress. Management is dependant on its theory and that a paradigmatic transformation of the discipline is needed (Day, 2003: 2).

3.3 PROJECT MANAGEMENT PRINCIPLES

According to Chapman (2001:**Online**), successful project management is better achieved by the intelligent application of sound principles. Project management principles are most often learned from experience, and they have universal validity for all projects. Project management is based on the following principles:

- **Figure out what business you are in, and then mind your own business:** Make sure your business is viable. Select projects that are good for your business, that are derived from the business vision and goals. Understand the business value in your project and watch for changes. Define the overall area of your responsibilities.
- **Understand the customer's requirements and put them under version control:** Thoroughly understand and document the customer requirements, obtain customer agreement in writing, and put requirements documents under version identification and change control. Requirements management is the leading success factor for systems development projects.
- **Prepare a project plan:** Prepare a plan that defines scope, schedule, cost, and approach for a reasonable project. Involve task owners in developing plans and estimates, to ensure feasibility and buy-in. Use a work breakdown structure to provide coherence and completeness to minimise unplanned work.
- **Build a good team with clear ownership:** Get good people and trust them. Establish clear ownership of well defined tasks. Track against a staffing plan. Create an environment in which team dynamics are encouraged.

- **Track project status and give it wide visibility:** Track progress and conduct frequent reviews. Provide wide visibility and communications of team progress, assumptions, and issues.
- **Use baseline controls:** Establish baselines for the product using configuration management and for the project using cost and schedule baseline tracking.
- **Write important stuff down, share it, and save it:** Document requirements, plans, procedures, and evolving designs. Without documentation it is impossible to have baseline controls and reliable communication. Record all information pertaining to important agreements and decisions, along with supporting evidence.
- **If it has not been tested, it does not work:** Develop test cases early to help with the understanding and verification of requirements. Use early testing to verify critical items and reduce technical risks.
- **Ensure customer satisfaction:** Keep the customers needs and requirements continuously in view. Plan early for adequate customer support products and services.
- **Be relentlessly pro-active:** Take initiative and be relentlessly proactive in applying these principles and identifying and solving problems as they arise. Periodically address project risks and confront them openly (Chapman, 2001:**Online**).

3.4 THE APPOINTMENT OF PROJECT RESOURCES

According to Young (1996:26), a project organisation is commonly established by default through a decision taken at an executive level to initiate a project. This leads to a project manager being appointed and a core team being assigned to the project. The team members are selected based on their previous project experience.

3.4.1 The role of project sponsor and Steering Committee

Structure of ownership can only be achieved through a clear definition at each level in the organisation, with clearly defined roles and responsibilities. The project sponsors as a rule come from senior management levels, where authority is

clearly defined. The project sponsor can operate as an individual or as a group to form a project steering committee that ensures everyone in the organisation focuses on the ultimate deliverable and to ensure that a quality product or service is delivered (Young, 1996:26).

The project sponsor for any project is accountable for the performance of their projects, and must demonstrate their concern for success to everyone involved. Their responsibilities include:

- Ensuring project objectives are always aligned to corporate needs.
- Selecting the project manager.
- Approving the project definition.
- Sustaining the project direction.
- Overseeing the project process and procedures, budget and control (Young, 1999:29).

According to Young (1996:29), a steering team or committee is a group of project sponsors that meet at regular intervals to review the status of all active projects, initiate new projects and decide the prioritisation of project activity in the organisation. Their responsibilities include:

- Ensuring projects are aligned to corporate objectives.
- Giving strategic direction.
- Ensuring environmental influences are considered (internally and externally).
- Resolving escalated issues.
- Approving start-up and abortion of projects.

3.4.2 The project manager

The project manager according to Burke (1999:275-276) is responsible for the project work from the beginning till the end of the project. Responsibilities include the following:

- Selecting the core team with the project sponsor.
- Identifying and managing the project stakeholders.
- Defining the project and securing stakeholder approval.
- Controlling costs.

- Leading the project team (Burke, 1999:275-276).

Goetsch and Davis (2002:110), and Denton (1999:28), point out that one of the aspects that ISO places emphasis on is human resources, work environment and customer relations, all aspects which are critical to ensure quality in the delivering of a project team.

According to Day (2003:5-10), human resources refer to resources required by employees in order to perform work of high quality. This is supported by Tricker & Sherring-Lucas (2001:121), that personnel whose work affect quality should be assigned based on their competency, skills, education and experience. Young (1996:47), believes that project leaders or managers should ensure that the right people with experience and appropriate skills are assigned to the project work, behaves in a cooperative manner that demonstrate a real concern to meet customer expectations.

3.4.3 The project stakeholders

According to Young (1996:34; and 2000:74), anyone in the organisation who potentially at some time has an interest in a project, is a stakeholder. As the project manager or leader, one needs to identify these people as they are certain to attempt to exert influence on how the project is being managed. Project team members as a rule are drawn from different departments with their line managers having agreed to release resources for some of the working weeks ahead. Line managers are often key stakeholders, they can have a significant impact on projects, and should their priorities change one could loose a promised resource. Other key stakeholders include:

- The customer,
- project sponsor,
- customer's user group, and
- the finance department (Young, 2000:74).

Young (1996:34), is of the opinion that, “as a project leader one has no authority over any of the stakeholders and it is a formidable challenge to manage them effectively and gain their help and support”.

3.5 PROJECT TEAM BUILDING

According to Nabe (2008:15), Total Quality Management ensures that management is responsible for developing the organisation’s vision, establishing guiding principles (Code of Conduct), setting the strategy and tactics for achieving the vision within the constrains of the guiding principles. This statement can also be applied to project management. All projects need a vision, a rich picture, where everyone in the project team unites to achieve one goal. Every team member relies on each other to play their parts and perform to the best of their abilities (Sallee, 2004:146).

Young (1996:41), suggests that a team leader should pay particular attention to avoiding the following:

- Confusion over many aspects of a project.
- Unclear responsibility.
- Unclear lines of authority.
- Unclear overall objectives.
- No commitment to project plan.
- Lack of direction.
- Conflict and personality clashes.
- Mistrust between team members.

Research has shown that well-led teams often lead to improved employee morale. According to Sallee (2004:147), each person must be committed to a mutual goal and to other team members. It is very important that team members be encouraged to support one another in times of project setbacks or delays.

For the purpose of project management, team building is critical and beneficial to the project and the organisation. According to Forster (2004:315), the five most important benefits of building a team are elaborated upon below:

- **Mutuality**: Is the need for mutual support and encouragement.
- **Recognition for personal achievement:** The opportunity for personal development.
- **Belonging:** The individual need for supportive, cohesive and friendly team relation.
- **Bounded power:** The need for authority and control over project resources, accountability and challenge, individual's ability to influence
- **Creative autonomy:** The opportunity for individuals to use their creativity and potential during the course of the project and enjoy good working conditions.

3.5.1 Stages of forming a project team

According to Turner (1999:427-428), team members must identify themselves with the team, and develop a common set of values or norms, before they can work together effectively as a team. The process of forming a team identity and a set of values take time. Project teams typically go through five stages of team formation such as forming, storming, norming, performing, and mourning. These aspects are elaborated upon below:

- **Forming:** Forster (2004:330), is of the opinion that the forming stage is when a team comes together with a sense of anticipation and commitment. Level of motivation is high for being selected for the project.
- **Storming:** As the team begins to work together, they find that they have differences about the best way of achieving the project's objectives, the project's overall aim, and different approaches for working on projects. At this stage, conflict or arguments can occur due to various differences that the team has come to realise.
- **Norming:** Team members begin to reach some consensus over various issues. Turner (1999:428), believes that this is done through negotiation, compromise and finding areas of commonality. As a result of this, the team begins to develop a sense of identity and follows a set of norms and values. These values form a basis on which the team members can work together and effectiveness and motivation begin to increase again towards the plateau (Turner, 1999:428).

- **Performing:** In this stage, once performance reaches the plateau, the team can work together effectively for the duration of the project. All members understand one another's responsibilities. They solve problems, make decisions and communicate relatively smooth (Heerkens, 2002:86). The project leader or manager has a role of maintaining this plateau of performance.
- **Mourning:** According to Turner (1999:428), one of two things can happen as the team reaches the end of the project. Either the effectiveness can rise as the members make a concerted effort to complete the project, or it can fall, as the team members regret the end of the task and the breaking up of the relationships they have formed.

3.5.2 The project team leader as a Communicator

Taylor (2006:20), expresses the opinion that although communication skills are important to us all, it is easy to see that some situations require better-developed communication skills than others. For example, effective communication in a social setting may not be as critical as effective communicating during negotiations or team building session. More specific, although effective communication is desirable in every human endeavor, project management is one of those endeavors. In a project management environment, there are four types of communication, which can be identified, namely:

- Formal written [project charter, status report].
- Informal written [project notes, memos].
- Formal oral [presentations].
- Informal oral [conversations, team meetings] (Taylor, 2006:20).

3.6 PROJECT MANAGEMENT KNOWLEDGE AREAS

According to Chapman (1997:**Online**), there are nine topic areas that define the scope of project management knowledge. They are integration, scope, time, cost, quality, human resources, communications, risk and procurement. Within each of these knowledge areas, there is a set of principles, practices and techniques to help

one manage the project risks and capture opportunities for success. These aspects are elaborated upon below:

3.6.1 Project integration management

According to Ritter (2008:**Online**), project integration management is a subset of project management, which includes the processes required to ensure that the various elements of the project are properly coordinated. It consists of:

- **Project plan development:** Integration and coordination of all project plans to create a consistent, coherent document.
- **Project plan execution:** Carrying out the project plan by performing the activities included.
- **Integrated change control:** Coordinate changes across the entire project (Ritter, 2008:**Online**).

3.6.2 Project scope management

According to Richman (2006:13), project scope management includes the processes required to ensure that the project includes all the work required, and only the work required to complete the project successfully. It consists of:

- **Initiation:** Authorise the project or phase.
- **Scope planning:** Develop a written statement of project scope.
- **Scope definition:** Subdividing major project deliverables into smaller manageable components.
- **Scope verification:** Formalise acceptance of the project scope.
- **Scope change control:** Define and implement mechanism for controlling changes in project scope (Richman, 2006:13).

3.6.3 Project time management

Ritter (2008:**Online**), refers to project time management as a subset of project management that includes the processes required to ensure timely completion of the project. It consists of:

- **Activity definition:** Identifying the specific activities that must be performed to produce the various project deliverables.
- **Activity sequencing:** Identify and document task sequencing.
- **Activity duration estimating:** Estimating the number of work periods that will be needed to complete individual activities.
- **Schedule development:** Analysing activity sequences, activity durations, and resource requirements to create the project schedule.
- **Schedule control:** controlling changes to the project schedule (Ritter, 2008:**Online**).

3.6.4 Project cost management

According to Burke (1999:6), project cost management is a subset of project management, which includes the processes required to ensure that the project is completed within the approved budget. It consists of the following:

- **Resource planning:** Determining what resources (people, equipment, material, etc) and what quantities are required for implementing the project tasks.
- **Cost estimating:** Estimate the cost of the required resources.
- **Cost budgeting:** Allocate the overall cost estimate to individual work activities.
- **Cost control:** Control changes in the project budget (Kerzner, 2006:612-637).

3.6.5 Project quality management

Burke (1999:6) and Kerzner (2006:833-835), avow that project quality management is a subset of project management that includes the processes required to ensure that the project will satisfy the needs for which it was undertaken. It consists of:

- **Quality planning:** Identify the quality standards relevant to the project and determining how to satisfy them.
- **Quality assurance:** Evaluate the overall project performance on a regular basis to provide confidence that the project will satisfy the applicable quality standards.

- **Quality control:** Monitor specific project results and determine if they satisfy quality requirements. Determining the means to eliminate unsatisfactory performance (Kerzner, 2006:845-848).

3.6.6 Project human resource management

Ritter (2008:**Online**), defines human resource management as a subset of project management that includes processes required to make the most effective use of the people involved with the project. It consists of:

- **Organisational planning:** Identify, document and assign roles and responsibilities.
- **Staff acquisition:** Get the human resources needed for the project.
- **Team development:** Develop individual and group skills to enhance project performance (Ritter, 2008:**Online**).

3.6.7 Project communication management

Burke (1999:7), defines project communication management as a subset of project management that includes the processes required to ensure timely and appropriate generation, collection, dissemation, storage and ultimate disposition of project information. It consists of the following:

- **Communications planning:** Determining "the information and communications needs of the stakeholders: who needs what information, when they will need it, and how it will be given to them" Ritter (2008: **Online**).
- **Information distribution:** Collecting and disseminating performance information. This includes status reporting, progress measurement and forecasting (Burke, 1999:247-253).
- **Administrative closure:** Generate, gather and dissemination of information to formalise a project or phase completion (Burke, 1999:247-253).

3.6.8 Project risk management

According to Kerzner (2006:709-711), risk management is a systematic process of identifying, analysing and responding to project risks. It includes maximising the probability and consequences of positive events and minimising the probability and consequences of adverse events to project objectives. It includes:

- **Risk management planning:** Deciding how to approach and plan the risk management activities for a project.
- **Risk identification:** Determining which risks might affect the project and document their characteristics.
- **Qualitative risk analysis:** Performing a qualitative analysis of risks and conditions to prioritise their effects on project objectives.
- **Quantitative risk analysis:** Measuring the probability and consequences of risks and estimating their implications for project objectives.
- **Risk response time:** Developing procedures and techniques to enhance opportunities and reduce threats form risks to the project's objectives (Burke, 1999:239).
- **Risk monitoring and control:** Monitoring residual risks, identifying new risks, executing risk reduction plans and evaluating their effectiveness throughout the project life cycle (Kerzner, 2006:718-742).

3.6.9 Project procurement management

Kerzner (2006:804), defines project procurement management as a subset of project management that includes the processes to acquire goods and services to attain project scope from outside the performing organization . It consists of:

- **Procurement planning:** Determine what to procure and by when.
- **Solicitation planning:** Document product requirements and identifying potential sources.
- **Solicitation:** Obtaining quotations, bids, offers or proposals as appropriate.
- **Source selection:** Choosing from among potential sellers.
- **Contract administration:** Managing the relationship with the seller or supplier.

- **Contract closeout:** Completion and settlement of the contract, including resolution of any open item (Kerzner, 2006:805-826).

3.7 PROJECT COMMUNICATION MANAGEMENT

According to Burke (1999:246), project communication management is about how well one presents, distribute the information required for the project. This includes communication skills, presentation skill, writing skills and all aspects of project reporting. These aspects are elaborated upon below:

3.7.1 Communication Skills

According to Taylor (2006:19), the word 'communicate' comes form the Latin word communis, which means "common". The idea is to come together on a common ground of understanding. All means for transferring information, emotions, or thoughts fall within the purview of communication. Therefore communication includes oral, written and nonverbal communication means between two people.

3.7.2 Developing Presentation Skills

Taylor (2006:26), avers that project managers regularly communicate on a one-to-one basis, as well as in groups and to groups. Presentation skills are basic skill requirements that can be used in each of these settings, and they can be learned with a little guidance and practice. Some steps one needs to take to present information include the following:

- **Prepare the content:** Determine what it is one need to relay to a project team.
- **Determine how to deliver the content in the best way possible:** This may require news skills such as how to use PowerPoint or other presentation programs.
- **Prepare for the actual event:** If one will be presenting in person at a meeting, the presentation will be different than, say, a written presentation. Most project information is relayed in meetings. One may want to prepare an agenda, book a room, send out permeating materials, and make sure

everything that is needed to make the presentation is in the room. The more a person prepare for a presentation, the better it will go (Burke, 1999:248).

3.7.3 Developing Writing Skills

Taylor (2006:28), asserts that in project management, "there are typically a plethora of reports to complete in addition to the constant requirements for oral communications". It should be obvious that developing writing skills to the maximum extent will ensure the greatest success for a project manager.

Writing skills can be learned and developed just as speaking skills can. Although some people seem to have a gift, their words flow effortlessly. It is helpful to approach writing as a process. With a few steps to guide the process along, writing can become less tedious and much more productive. One of the major challenges in writing is to be reader-focused, that is, focusing on the reader's needs rather than presenting one's own agenda (Taylor, 2006:28-30).

3.7.4 Project Reporting

In the world of project management, many reports follow a predetermined format. Often, templates often report are prepared ahead of time, so filling in the blanks is all that is required (Burke, 1999:248). Although this approach ensures that reporting is standardised and saves preparation time, it can also create an attitude that the reports are routine. Project management reports may be routine in the sense of reoccurring on a regular basis, but they should never be considered routine information.

This step requires analysing the purpose of the document and its audience as a result of answering the following questions.

- Why is this document important?
- Who are the readers of this document and what is their stake in project?
- What should this report convey to the reader?
- What is the breadth of the readers' understating of this project now? Would an overview be helpful or required?
- How will readers to react?

- What type of information or style of presentation of the information will help the reader?
- Of all the information that has to be presented, what is the one thing that one wants readers to remember (Burke, 1999:246-248))?

Too many people start writing without giving much thought to the content requirements. It seems to be in human nature to want to start on a project immediately, whether the project is writing a report or managing the installation of a complex information technology system. One of the best ways to determine what needs to be in the document is to make an outline. It is simple, and applicable to all kinds of documents. In the case of a typical, routinely required project management reports, there will be a corporate policy about format and probably a template to follow. In such cases, using the outline method for generating ideas is applicable, with the template headings serving as major outline headings (Burke, 1999:248).

The communication plan for the project details who needs to be informed of the project's progress. The plan according to Burke (1999:250-253) also details the type of information that each recipient needs. For example, a financial officer may only want to know how the spending curve looks like against the actual expenditure. The project manager in turn needs to generate ideas and information and sort the information according to the data to be provided. Once the information is organised under appropriate headings, data can be transferred into the correct template headings. The objective is to ensure that all pertinent data is included in the final report (Burke, 1999:250-253).

Many organisations usually through their project management office, provide templates for project reports. This practice provides a ready-made format that can be used to prepare the report. The project manager may have to revise the template, but regardless of whether the template fits the situation exactly or not, the template should be used as the basis for developing the document (Burke, 1999:253).

Taylor (2006:35), noted that using the information that has been organised and properly sequenced, write the first draft, using the report template if one is required. Address each heading of the report as quickly as possible without regard to the amount of information being supplied. The objective is to get as much mileage from the document as possible, to use the document to describe completely and thoroughly the problem. Status, or whatever message one need to transmit. More is better in this case, at least to the extent that free rein is given to ones effort to be thorough in presenting all relevant project information (Taylor, 2006:35).

3.8 PROJECT LIFE CYCLE PROCESSES

According to Richman (2006:12), the following are major processes in managing projects in five groups.

- **Initiating:** Defining and authorising the project.
- **Planning:** Defining and refining the project objectives.
- **Executing:** Integrating people and other resources to carry out the project plan.
- **Monitoring and controlling:** Measuring and monitoring variances from the project plan and taking corrective action when necessary.
- **Closing:** Formally accepting the result of the project and bringing the project to an orderly end.

Each of the above groups has a number of interrelated processes that must be carried out for the success of the project.

3.9 PROJECT INITIATING AND DEFINITION PHASE

According to Young (2000:57), the definition phase is where many projects go wrong, often because there is no clear definition or it has remained confused with so many different stakeholders.

3.9.1 Project organisation chart

As a project manager or leader, it is suggested that one draws up a list to show who is involved in the project, and record the following information:

- Name and job title or position.
- Location.
- Contact telephone number and e-mail address.
- Date assigned to the project.
- Name of their line manager and contact information.
- Distribution list (Mthandi, 2009:Interview).

Date the document and issue to everyone who needs to know, this is an essential communication document for resource planning. It also ensures that there is clarity about who is committed to the project. Ensure that the line managers of everyone in the team receive this information; they are stakeholders and need to confirm their commitment by agreeing to these new assignments (Mthandi, 2009:Interview).

3.9.2 Statement of requirements

The statement of requirements is derived from the discussion with the stakeholders, with regard to their needs and expectations. This document should involve all the team to decide just what can be provided to satisfy the needs and may take several meetings. The document should record:

- Needs and expectation identified and to whom attributed.
- How these needs can be met in practice?
- Which needs cannot be satisfied yet and why?
- What assumptions have been made at this stage?
- What the project is about and what is not included?

The statement must always be qualified as being based on available information at the date of preparation, as new data may become available later (Young, 2000:61).

3.9.3 Project objective statement

According to Young (2000:62), the information recorded here must be derived working with the customer recording:

- A statement of background.
- The project purpose, why we are doing this now?
- The overall project objective, in 25-30 words.
- The primary deliverables of the project with expected delivery dates.
- The primary benefits to be gained, quantified financially in the business case.
- The cost of the project.
- What skills are required, particularly those not currently available.
- Any identified interfaces with other active projects.

Ensure all deliverables and benefits satisfy the SMART test:

- **Specific:** Clearly defined with completion criteria.
- **Measurable:** Understood metrics are available to identify delivery.
- **Achievable:** Within the current environment and skills available.
- **Realistic:** Not trying to get the impossible with many unknowns.
- **Time bound:** Is limited by a delivery date based on real needs.

It is also valid to identify any important aspects of the proposed strategy for the project. For example, examining several options; using sub-contractors for part of the work [where skills are missing]; using consultants for support and advice; re-using known methods, processes or technology. Young (2000: 62-63), suggests that it is preferred this data to be included in the scope of work statement.

3.9.4 Scope of work statement

Young (1996:70; 2000:63), believes that the scope of work statement is a convenient place to record other useful data and cross references to past reports and relevant projects. The document also includes:

- The project boundary limits identified (i.e. what you are not going to do).
- The standards and specifications that are applicable.
- Internal and external product specification.

- Mandatory standards imposed by the legislation.
- Process and customer specifications.
- Standard operating procedures.
- Purchasing procedures.
- Quality procedures.
- Testing specifications and procedures.
- Sub-contract terms and conditions imposed on third parties.
- Any exceptions to these standards.
- Where the standards and specifications are kept for reference.
- How success is to be measured.
- Assumptions made in the project.

The scope of work statement is a useful place to locate any other relevant information that supports and clarifies the project definition.

3.9.5 Risk assessment

According to Young (2000:79), a risk is an inherent property of any change activity and is considered exclusively as a future phenomenon. Risks may happen in project work, but it is very difficult to write down any specific universal rules for managing risks, as risks are subject to perception.

Risk management shows the way to minimise or even avoid the 'show-stoppers' that can cost huge sums to correct. Many risks are well hidden away in the schedule and unless one looks for them, will impact all efforts at a time one least wishes to know. There are many benefits associated with risk management which includes:

- Predicting the serious threats to the project before they happen.
- Enabling mitigation actions to be implemented immediately.
- Enabling contingency plans to be derived in advance.
- Improved decision making in managing the project portfolio.
- Helping to create a 'no surprises' environment for the project.
- Creating clear ownership of the risks so they are carefully monitored.

Some people will argue that managing risks is a costly activity, but never as costly as correcting the issues that occur later (Young, 2000:80).

Risk management is a vital and fundamental part of the project management process that impacts the probability of success. The need for risk management is related to the degree of complexity, innovation and amount of cross-functional working. Small projects confined to one functional area often use a small team and the need for risk management depends on the level of innovation involved. Therefore, increasing complexity of the project and innovation with more cross-functional working increases the need for a structured approach to risk management.

- **Identifying the risks**

According to Young (2000:83), use a team brainstorming session to initially identify risks during the definition phase of the project. A question that should be answered is: 'What could go wrong at any time during this project?' The risk could be due to external or internal factors. It is preferable to conduct this part of the process after having had some dialogue with key stakeholders. One can use checklists that have been developed from data generated from past projects, as they serve as a convenient starting point to get the risk identification process going.

Collect and review the list of risks and then conduct a preliminary analysis to eliminate duplicates. It is useful during this analysis to ask what is impacted if the risk happens. It may be one of the following:

- **Cost:** The overall cost of the work.
- **Schedule:** The time the project will take.
- **Scope:** The project deliverables and quality of the work.

If there is no impact on these three elements then ask if it really is a risk. This is where a project leader should use a judgment to focus the risk to those that are considered controllable in some way (Young, 2000:83).

- **Assessing the risks**

Young (2000:84-85), is of the opinion that all projects have risks at the outset because of the many unknown factors. In practice risks disappear and new risks appear as the project progresses. Risk assessment requires answers to some key questions:

- What exactly is the risk?
- How serious is it as a threat to the project?
- What could be done to minimise its impact on success?

Having identified all the risks, review the list making, and then record those on a project risk log giving each a number, name and date identified. Then attempt to establish two characteristics for each risk:

- What is the probability of it happening?
- What is the likely impact on the project if it happens?

This assessment can only be subjective based on the previous experience of a team leader and a project team. As a project team, for each risk identified a consensus should be reached before proceeding, thus bear in mind that anything that could go wrong and threaten the project is a potential risk and must not be ignored.

- **Monitoring risks**

Young (2000:89), suggests that once risks to the project have been identified and action plans derived, then they should be monitored to make sure prompt action is taken when appropriate. Risks change with time so careful monitoring is essential as the project proceeds. Effective monitoring is a key activity towards achieving project success. If risks happen they become issues that have a time related cost impact. Unresolved issues do not disappear, they just accumulate and threaten to impact the whole project.

3.9.6 Approval of project definition

The final step in the definition process is to present the documented definition to the project sponsor and customer for approval. Young (1996:80), suggests that to get the approval and agreement is often best carried out in a meeting to enable the project leader or manager to explain any decisions that have been taken.

The following documents are normally required for the approval of project definition. They are:

- The project organisation chart.
- The project stakeholder list.
- The scope of work statement.
- The project risk log.
- The risk management evaluation forms (especially for risks that are ranked as high risk).
- The project brief (Young, 1996:80).

3.10 PROJECT PLANNING

Burton and Michael (1994:24), define 'project' as work that has a beginning and an end, and the satisfactory outcome of a project as a product. Projects also mean change. Change requires planning. From the concept to the outcome, practical planning is what makes the change happen. When one plans, there is always a preparing for a need to produce the product. From any perspective, planning is a powerful management tool. Ultimately a plan is a powerful communication tool for decision making.

According to Kerzner (2006:398), planning is a tool used to determine what needs to be done, by whom, and by when, in order to fulfill assigned responsibilities. There are nine major components of planning phase:

- **Objective:** A goal, target, or quota to be achieved by a certain time.
- **Program:** The strategy to be followed and major actions to be taken in order to achieve the objectives.

- **Schedule:** A plan that indicates when an individual or group activities or accomplishments will be started and/ or completed.
- **Budget:** Planned expenditures required to achieve or exceed objectives.
- **Forecast:** A projection of what will happen by a certain time.
- **Organisation:** A design of the number and kinds of positions, along with corresponding duties and responsibilities, required to achieve objectives.
- **Policy:** A policy is a general guide for decision making and individual actions.
- **Procedure:** A detailed method for carrying out a policy.
- **Standard:** A level of individual or group performance defined as adequate or acceptable (Kerzner, 2006:398).

From the corporate plan to the project plan, nothing should be planned in isolation. Burton and Michael (1994:24), believes that the mission statement of an organisation is usually the *fons et origo,* the foundation or beginning, from which subsequent planning originates. One may feel they have what is an outstanding idea. Are you sure it meets your company's mission statement and divisional objectives. It is important that a person understands the larger organisational picture and relate to individual work.

Burton and Michael (1994:29-30), affirm that fast track planning techniques using specially designed worksheets enable rapid assessment of what the project requires. It pays to think big as one begins to plan, (big in the sense of extending one's thinking).

- Beyond that first perceived vision.
- Beyond an individual personal involvement in the project.

In all planning, stick with the big picture. See the whole. If you are planning chunks of work, see where your bit fit into the whole.

Once the design of a big picture summary plan is complete, one will have to:

- Analyse the situation as follows:
  - Vision identified,
  - purpose identified,
  - current situation, and

- strategy identified.

- Set out in logical sequence what has to be completed (chunks of work) to achieve the vision.
- Linked a decoded each chunk of work (Day, 2003:6).

According to Burton and Michael (1994:63), an estimate of a chunk of project work includes:

- Duration (time it will take from start to finish).
- Skills (level of skill will affect timing and cost).
- Equipment and materials.
- Costs and constraints.
- Contingencies (effect on time and cost).
- Quality requirements (level of quality will affect time and cost).
- Risk (of not meeting, cost, time, quality requirement).

When the project leader have estimated the duration for each element of work, he or she should enter the duration for each element on a logic diagram. Using the Critical Path Method (CPM), the duration should be calculated for the whole project and critical areas identified. Critical areas are where elements of work, if not completed on time, affect the end date of the project.

3.10.1 Types of plans

Burton and Michael (1994:23-24), express the view that the overall plan consists of two main types of plans, namely the big picture (the summary plan), and the smaller picture plans (more detailed than the big picture). In varying degrees of detail, the following may become sub-sets of the summary plans.

- **Task plans:** Task plans define what has to be done to complete the project.
- **Resource plans:** These plans determine people resources, materials and equipment needed to achieve the project objective.
- **Cost plans:** Are plans that illustrate the cost of each task.
- **Communication plan:** A plan that define all areas of internal and external communication. Burke (1999:91), is of the opinion that communication plans consist of communication planning, information distribution, a schedule of project meetings, progress reporting and administrative closeout.

- **Time control plan:** This defines the duration of each task (due by dates) and monitor and control actual time taken against the estimated time.
- **Quality plans:** These plans outline a quality management system that is designed to guide and enable the project to meet the required standards. It may include pre-qualifying project personnel and suppliers, developing of procedures, quality inspections and quality documentation (Burke, 1999:91).
- **Risk management plan:** This plan includes the process of identifying, analysing, and responding to project risk. It consists of risk identification, risk quantification and impact, response development and risk control.
- **Baseline Plan:** Burke (1999:91), noted that baseline plans is a portfolio of documents to guide the project through the execution and project control cycle, in order to achieve the project's objectives.

3.11 PROJECT FINALISATION AND CLOSE-OUT

This is the last stage of a project life-cycle. During this close-out stage, the team should maintain vigilance to ensure that all the work is completed, in a timely and efficient manner. Furthermore, the team's focus must switch back to the purpose of the project. They must remember why they are undertaking the project; they are not doing the work for its own sake, but to achieve business benefits (Turner, 1999:328).

As the project draws to a close, the team should ensure all work is completed in a timely and efficient manner. The following can aid this process:

- Producing checklists of outstanding work to ensure all loose ends are tied up.
- Planning and controlling at lower levels of work breakdown to provide better control.
- Holding more control meetings to ensure that problems are identified and solved sufficiently early.
- Creating a task force with special responsibility for completing outstanding work.
- Planning the run-down of the project team as the work runs down to ensure people are released for other work.

- Closing contracts with suppliers and subcontractors to ensure that no unnecessary costs are booked.
- Supporting the project manager by a deputy with finishing skills.

Research indicates that skills required to finish the project are different to those required to start it up and run it. As a result, Turner (1999:330), suggests that it may be appropriate to change project managers or leaders during the final stage. However, if this change is to be seamless, the new manager must be a former deputy, who has been involved for quite some time.

3.11.1 Benefits utilisation

Many project managers view their job as complete when the project is handed over to the users or customers. However, obtaining benefits from the project is the final step in control process. There are four steps in any control process, the following are:

- **Planning the results.**

From the beginning there must be a clear definition of the project's purpose and the benefits expected from the operation of the facility. This is a clear statement of the criteria by which the project will be judged to be successful, stated as part of the project strategy.

- **Monitor the achievement.**

Following commission, the expected benefits must be audited. For example, if the facility is a manufacturing planning system, one should check whether the inventory is falling, the work in progress is falling and the lead times are being reduced.

- **Calculate variances.**

Determine the cause of any difference between the expected benefits and those obtained. This requires measuring the revenue stream and profitability of the project. The cause may be that the users are not using the product to its full capacity, either deliberately or inadvertently.

- **Then take action.**

According to Turner (1999:333), in some cases a small amount of additional training of users is all that is required to achieve the actual benefit. Projects involve considerable risk, because of their uniqueness and novel, and so it is quite likely that they carry some small imperfections which can be easily corrected.

3.11.2 Project hand over

Young (2000:149), supports Turner (1999:331), in the opinion that when handing over a project, there should be an acceptance process plan from the beginning. This will have included what completion means to the customer and their user group. Furthermore, this is to ensure that the specific criteria which have been agreed, are still valid. Project completion is signified by the following key issues:

- Planning for the transition.
- Ensure that all project tasks are completed.
- Ensure that agreed deliverables are completed.
- Training materials are prepared, where and when required.
- Documentation manuals are finished.
- Testing is completed.
- Ensuring a definite cut over.

Young (2000:149), emphasise that all completion criteria must be measurable by agreed metrics, to prevent conflict from arising. Once an agreed process is produced with a handover checklist, be ready to implement the final stages of the project.

3.11.3 Disbanding the team

Team members may face the end of the project with mixed feelings. The cycle of team formation show the team going 'into mourning' at the end of the project, and performance dropping. Key elements in this process involve the following:

- Planning the run-down of the resources in advance.
- Returning resources promptly to their line managers.
- End of project party.

- Debriefing meeting.
- Rewarding achievement.
- Disciplining under achievement.
- Counseling all staff.

3.11.4 Post completion reviews

There are many ways of reviewing the success and failures of the project. However for the purpose of this research study, the process reviews to be considered include debriefing meetings and post-completion audits.

- **Debriefing meetings:** It is worthwhile on most projects to hold a meeting of all personnel who attended the project launch workshop to review the assumptions made. This meeting may last from two hours to a day, depending entirely on the project size.

- **Post-completion audits:** According to Turner (1999:336), post-completion audits are worthwhile to be considered especially on larger projects. This is a formal review of the project against a checklist, which is often conducted by external consultants. Furthermore, better lessons are often learned from either failures or successes, therefore it is crucial for the organisation to use such lessons for future projects in order to better their project management skills.

CHAPTER 4: PROJECT MANAGEMENT SURVEY DESIGN AND METHODOLOGY

4.1 THE SURVEY ENVIRONMENT

Koeberg Nuclear Power Station (KNPS), one of Eskom power generation stations consists of various functional or departmental areas, each with a unique role in the delivery of projects for and on behalf of Eskom Limited. The various functional areas, which will serve as the research survey environment, include the following:

- Nuclear Engineering, which consists of Engineering Program Department (EPD), Project Engineering (PE) and Design Engineering (DE).
- Plant Engineering, which is made up of Electrical System Engineering (ESE) and Conventional System Engineering (CSE).
- Maintenance department, with various other functional areas including Instrumentation Mechanical Services (IMS), Maintenance Support Services (MSS and ENS), Inspection and Test (I&T) and Maintenance of Mechanical Primary Systems (MMPS).
- Occupational Health and Safety (OH&S), which is part of Nuclear Services.

4.2 AIM OF THIS CHAPTER

The aim of this chapter and the survey contained therein is to determine what the key factors are for poor project management implementation within the Nuclear Portfolio. The ultimate objective being to solve the research problem as defined in Chapter 1, Paragraph 1.3, and which reads as follows:

> *"Poor project management for the development of goods and services adversely impacting the ability of Eskom to provide quality deliverables to its consumers".*

4.3 CHOICE OF SAMPLING METHOD

Koeberg Nuclear Power Station, one of Eskom's power generation stations consists of various functional or departmental areas, each with a unique role in the delivery of projects for and on behalf of Eskom Limited. The various departmental areas, listed in Paragraph 4.1 above will serve as the individual strata for the research survey. The above to ensure that each identifiable strata of the population were taken into account (Collis & Hussey, 2003:157).

4.4 THE TARGET POPULATION

With any survey, it is necessary to clearly define the target population, which Collis and Hussey (2003:157), define as follows:

> *"A population is any precisely defined set of people or collection of items which is under consideration".*

The 'sampling frame' defined by Vogt (1993) and cited by Collis and Hussey (2003:155-160), as 'a list or record of the population from which all the sampling units are drawn. For this survey, 94 employees, randomly selected from Koeberg Nuclear Power Station at various organisational levels represent the sampling frame. This transposes in different number of employees from different organisation levels being randomly selected from the following identified research strata:

- Engineering Programs Department: 20 employees.
- Project Engineering: 15 employees.
- Design Engineering: 12 employees.
- Plant Engineering: 7 employees
- Maintenance departments: 36 employees.
- Occupational Health and Safety: 4

The organisation has a five level hierarchy, which is made up as follows:

- **Executive:** The executive, support the organisations' directors and manages a business divisional area.

- **Strategic Business Unit Manager (SBU):** Responsible to the Executive and manages a functional area.
- **Business Unit Manager (BU):** Responsible to a SBU manager and manages a business unit within a departmental area.
- **Certified Professional (CP) and Specialist:** A professional individual who is responsible to a BU and often stand-in as a departmental manager on BU's absence.
- **Bargaining Unit:** Individual employees either semi-skilled or skilled individual, often reports to the CP and or Specialist (Mthandi, 2009:Interview).

The 'managerial' levels includes senior technical employees and 'specialists', which are referred to as Managerial Unit Specialists (MUS) or Business Unit Specialists (BUS). Their primary role is to provide technical guidance and expertise to their managerial counterparts. The target population was specifically chosen in order to validate the practicality of the concepts as presented here. The risk of bias, which cannot be statistically eliminated, is recognised by the author based on the very definition of the target population as well as the number of respondents selected.

4.5 DATA COLLECTION

According to Emory and Cooper (1995:278), three primary types of data collection (survey) methods can be distinguished namely:

- Personal interviewing.
- Telephone interviewing.
- Self-administered questionnaires/surveys.

Self administered questionnaires served as the primary data collection method in this dissertation.

Interviews, according to Collis and Hussey (2003:64), are associated with both positivist and phenomenological methodologies. They are a method of collecting data in which selected participants are asked questions in order to find out what

they do, think or feel. The use of personal interviews as an additional element to the data collection process is in the opinion of the author important, since this allows for the identification of issues within the target environment, which may not be readily identifiable using a pure survey questionnaire. Furthermore, according to Hussey and Hussey (2003:64), interviews are associated with both positivist and phenomenological methodologies as employed within the ambit of this dissertation.

The data collection method used in the survey, falls within the context of a survey, defined by Hussey and Hussey (2003:60), as:

> *"A sample of subjects being drawn from a population and studied to make inferences about the population"*

More specific, the survey conducted in this dissertation falls within the ambit of the 'descriptive survey' as defined by Ghauri, Grønhaug and Kristianslund (1995:64).

The data collection method used fall within the ambit of both the definitions attributed to the concepts 'survey' and 'field study'. 'Survey', according to Gay and Diebl (1992:238), is an attempt to collect data from members of a population in order to determine the current status of that population with respect to one or more variables, while Kerlinger (1986:372), define 'field study' as non-experimental scientific inquiries aimed at discovering the relations and interactions among … variables in real … structures. As in the case of most academic research, the collection of data forms an important part of the overall dissertation content.

4.6 MEASUREMENT SCALES

The survey will be based on the well-known Lickert scale, whereby respondents were asked to respond to questions or statements (Parasuraman 1991:410). The reason for choosing the Lickert scale, the fact that the scale can be used in both respondent-centred (how responses differ between people) and stimulus-centred

(how responses differ between various stimuli) studies, most appropriate to glean data in support of the research problem in question (Emory and Cooper 1995:180-181). The advantages in using the popular Lickert scale according to Emory and Cooper (Emory and Cooper 1995:180-181) are:

- Easy and quick to construct.
- Each item meets an empirical test for discriminating ability.
- The Lickert scale is probably more reliable than the Thurston scale, and it provides a greater volume of data than the Thurston differential scale.
- The Lickert scale is also treated as an interval scale.

According to Remenyi, Money & Twite (1995:224), interval scales facilitate meaningful statistics when calculating means, standard deviation and Pearson correlation coefficients.

4.7 THE DEMAND FOR A QUALITATIVE RESEARCH STRATEGY

While this author acknowledges that a number of strategies can be applied in similar research projects, the well-known concepts of objectivity, reliability etcetera, inherited from the empirical analytical paradigm, is suggested for business research in more or less the traditional way. Quoting Thorndike & Hagen, these concepts are defined by Emory & Cooper (1995:156), as follows:

- **Practicality:** Practicality is concerned with a wide range of factors of economy, convenience, and interpretability.
- **Validity:** Validity refers to the extent to which a test measures what we actually wish to measure. Yin (2003:34), identifies 3 subsets to the concept validity, namely: Construct validity, internal validity and external validity.
- **Reliability:** Reliability has to do with the accuracy and precision of a measurement procedure.

4.8 SURVEY SENSITIVITY

Research conducted in areas of a sensitive nature as in the case of this survey, pose particular challenges to the researcher. The following guidelines from

various academics serve to illustrate the mitigation process, which can be deployed in an instance where research is conducted in areas of a sensitive nature:

- A qualitative investigation of a particularly sensitive nature conducted by Oskowitz & Meulenberg-Buskens (1997:83), qualified the importance of handling mission critical issues as identified above when the authors stated:

  "Thus any type of qualitative investigation could benefit from the researchers being skilled and prepared, and the sensitive nature of an investigation into a stigmatizing condition made the need for such an undertaking even more imperative in the current study".

- The sensitivity of certain issues and issues identified as impacting the research negatively in the environments being evaluated, not only demand intimate personal involvement, but also demand the 'personal and practical experience' of the researcher. This view was upheld by Meulenberg-Buskens (1997:83), as being imperative to assure quality in qualitative research being undertaken. Checkland (1989:152), supports this view however extends the concept with the opinion that: "The researcher becomes a participant in the action, and the process of change itself becomes the subject of research".

4.9 SURVEY DESIGN

Collis and Hussey (2003:60), are of the opinion that, 'if research is to be conducted in an efficient manner and make the best of opportunities and resources available, it must be organised. Furthermore, if it is to provide a coherent and logical route to a reliable outcome, it must be conducted systematically using appropriate methods to collect and analyse the data. A survey should be designed in accordance with the following stages:

- **Stage one:** Identify the topic and set some objectives.
- **Stage two:** Pilot a questionnaire to find out what people know and what they see as the important issues.
- **Stage three:** List the areas of information needed and refine the objectives.
- **Stage four:** Review the responses to the pilot.
- **Stage five:** Finalise the objectives.

- **Stage six:** Write the questionnaire.
- **Stage seven:** Re-pilot the questionnaire.
- **Stage eight:** Finalise the questionnaire.
- **Stage nine:** Code the questionnaire.

The survey design to be used in this instance is that of the descriptive survey as opposed to the analytical survey. The descriptive survey is according to Collis and Hussey (2003:10), frequently used in business research in the form of attitude surveys. The descriptive survey as defined by Ghauri, Grønhaug and Kristianslund (1995:60), has furthermore the characteristics to indicate how many members of a particular population have a certain characteristic. Particular care was taken to avoid bias in the formulation of the questions.

The statements within the survey have been designed with the following principles in mind:

- Avoidance of double-barreled statements.
- Avoidance of double-negative statements.
- Avoidance of prestige bias.
- Avoidance of leading statements.
- Avoidance of the assumption of prior knowledge.

Statements were so formulated as to allow the same respondents to respond to each of the two questionnaires, to determine if a paradigm shift occurred after the concept of 'project management' was adopted.

4.10 THE VALIDATION SURVEY QUESTIONS

The author has developed survey questionnaires which are contained in annexure D for ease of reference. Due to the fact that face-to-face interviews are highly structured, questions were prepared and piloted to ensure they reflected a high degree of 'validity', Babbie (2005:285).

4.11 CONCLUSION

In this chapter, the 'knowledge management' survey design and methodology was addressed under the following functional headings:

- Survey environment.
- Aim of the chapter.
- Choice of sampling method.
- Target population.
- Data collection.
- Measurement scales.
- Demand for a qualitative research strategy.
- Survey sensitivity.
- Survey design.
- Survey questions.

In Chapter 5, results from the survey will be analysed in detail and conclusions drawn.

CHAPTER 5: ANALYSIS OF RESULTS

5.1 INTRODUCTION

Data analysis is “the process of bringing order, structure and meaning to the mass of collected data” (de Vos 2002, 339). This chapter discusses the results of the data analysis of the survey conducted at Eskom. The aim of this study is to determine whether poor project management for the development of goods and services adversely impact the ability of Eskom to provide quality deliverables to its consumers. The data obtained from the completed questionnaires will be presented and analysed by means of various analyses (uni-variate, bi-variate and multivariate) as it comes applicable.

The data has been analysed by using SAS software. Descriptive statistics and frequency tables displayed in Paragraph 5.2 shows the distributions department responses and statement responses. As a measure of central tendency, Table 5.3 shows the means and standard deviation of the continuous variables / ordinal variables. Comparative statistics for comparing information for the different departments using Chi-square tests, Kruskal Wallis tests and Mann-Whitney tests / Wilcoxon two sample tests are shown in Annexure C.

5.2 ANALYSIS METHOD

Analysis methods comprise of different types of methods used in analysing the data. Amongst them include the validation of survey results, data format, inferential statistics, preliminary analysis and graphical displays.

5.2.1 Validation Survey Results

A descriptive analysis of the survey results returned by the research questionnaire respondents are reflected below. The responses to the questions obtained through the questionnaires are indicated in table format for ease of reference. Each variable is tested to fall within the boundaries.

5.2.2 Data Format

The data received from the questionnaires was captured in Microsoft Excel. It was then imported into SAS-format through the SAS ACCESS module. This information was analysed by the custodian of this document.

5.2.3 Preliminary Analysis

The reliability of the statements in the questionnaire posted to the sample respondents drawn at the Financial Services business unit of the SAPS are tested by using the Cronbach Alpha tests. (See Paragraph 5.3.1). Descriptive statistics was performed on all variables; displaying means, standard deviations, frequencies, percentages, cumulative frequencies and cumulative percentages. These descriptive statistics are discussed in Paragraphs 5.3.2 and 5.3.3. (See also computer printout in Annexure A).

5.2.4 Inferential Statistics

The following inferential statistics are performed on the data:

- Cronbach Alpha test.
- Kruskal Wallis test for data from more than 2 independent samples.
- Mann – Whitney test or Wilcoxon two sample test.

5.2.5 Technical report with graphical displays

A written report with explanations of all variables and their outcome has been compiled. A Cross analysis of variables where necessary was performed, attaching statistical probabilities to indicate the magnitude of differences or associations.

All inferential statistics are discussed in Paragraphs 5.3.4, 5.3.5 and 5.3.6.

5.2.6 Assistance to researcher

The conclusions made by the researcher, is validated by the statistical report. Help is given to interpret the outcome of the data. The final report written by the researcher was validated and checked by a qualified statistician to exclude any misleading interpretations.

5.2.7 Sample

The target population is a few departments at Eskom. The sample that realized is 94.

5.3 ANALYSIS

In total 94 respondents from 4 different departments of Eskom answered the questionnaire posted to them. The distribution of the respondents from the different departments is shown in Table 5.1. The items (statements) in the questionnaires will be tested for reliability in the following paragraph.

TABLE 5. 1: Distribution of respondents according to department

Variables	Categories	Frequency	Percentage out of total
Department			
1. Plant Engineering	Plant Engineering	7	7.4%
2. Maintenance Departments	IMS	5	5.3%
	MMPS	12	12.8%
	MSS	12	12.8%
	I&T	7	7.4%
3. Nuclear engineering departments	EPD	20	21.3%
	PE	15	16.0%
	DE	12	12.8%
4. Nuclear services	OH&S	4	4.3%

5.3.1 Reliability Testing

Cronbach's Alpha is an index of reliability associated with the variation accounted for by the true score of the "underlying construct". Construct is the hypothetical variables that are being measured (Cooper & Schindler, 2006:216-217). Another way to put it would be that Cronbach's alpha measures how well a set of items (or variables) measures a single uni-dimensional latent construct.

The reliability test (Cronbach's Alpha Coefficient) was done on all the items (statements) which represent the measuring instrument of this survey, with respect to the responses rendered in this questionnaire.

TABLE 5. 2: Cronbach's Alpha Coefficients.

Statements	**Variable nr.**	**Correlation with total**	**Cronbach's Alpha Coefficient**
1.1 Team members are encouraged to use their creativeness and innovation.	Q1_01	0.2666	0.9457
1.2 Every team member has a clear understanding of their role and responsibility in the project.	Q1_02	0.4637	0.9432
1.3 Every team member is encouraged to partake in decision making and their input is taken into account.	Q1_03	0.5628	0.9423
1.4 Team members do respect one another and support each other in their project.	Q1_04	0.6108	0.9418
1.5 Team members are trained in certain skills that they require to accomplish the project objectives.	Q1_05	0.5422	0.9425
1.6 Team work is regarded as means to personal development and gives a sense of belonging.	Q1_06	0.4310	0.9435
1.7 The project team has all the skills required for the success of the project.	Q1_07	0.6105	0.9418
1.8 Good time management practise is encouraged.	Q1_08	0.4234	0.9435
2.1 Statements of customer requirements are always defined, clearly understood and documented.	Q2_01	0.7428	0.9402
2.2 Statements of customer requirements are always defined, clearly understood.	Q2_02	0.7420	0.9402

Statements	Variable nr.	Correlation with total	Cronbach's Alpha Coefficient
2.3 Statements of customer requirements are always clearly understood and documented.	Q2_03	0.7217	0.9405
2.4 There are procedures in place to guide in identifying customer needs.	Q2_04	0.5228	0.9427
2.5 Customer requirements are prioritised according to accepted and approved procedures.	Q2_05	0.5248	0.9426
2.6 Customer representative has the authority to decide on behalf of the customers.	Q2_06	0.4898	0.9430
2.7 Customer liaison has the authority to decide on behalf of the customers.	Q2_07	0.5100	09728
2.8 Resources are always planned in advance to ensure project objectives will be met.	Q2_08	0.7015	0.9407
2.9 Resource loadings and capacities are optimised and agreed.	Q2_09	0.7387	0.9403
2.10 Gantt chart always reflects an agreed schedule.	Q2_10	0.4742	0.9432
2.11 Project objectives and clearly defined and communicated to the rest of the team.	Q2_11	0.7499	0.9402
2.12 Projects are conducted or perform in line with project management principles.	Q2_12	0.6107	0.9418
2.13 Project risk log is always reviewed and updated as required.	Q2_13	0.5792	0.9421
2.14 Sound project management procedures are in place to guide teams.	Q2_14	0.5024	0.9429
3.1 The project manager or leader always advise and coach when necessary.	Q3_01	0.6927	0.9409
3.2 The project leader recognises and praises the individual and team efforts.	Q3_02	0.6059	0.9418
3.3 The project leader reacts positively to performance issues pertaining to the project.	Q3_03	0.7241	0.9407
3.4 The project leader actively supports team and individual efforts with guidance and assistance.	Q3_04	0.6507	0.9415
3.5 The project leader actively resolves conflict and other issues promptly.	Q3_05	0.6445	0.9416
3.6 The project leader or manager holds regular	Q3_06	0.5907	0.9421

Statements	Variable nr.	Correlation with total	Cronbach's Alpha Coefficient
meetings (one-to-one) to discuss project and team / individual performance.			
3.7 Project manager's authority is always confirmed in writing.	Q3_07	0.6221	0.9417
Cronbach's Coefficient Alpha for standardized variable			**0.9436**
Cronbach's Coefficient Alpha for raw variables			**0.9439**

According to the Cronbach's Alpha Coefficients (Table 5.2) for all the items in the questionnaire and the summarized Alpha of 0.9439 for raw variables (use the alpha for raw variables because the scale for all the items is the same) this measuring instrument proves to be reliable and consistent because it is more than 0.7 which is the acceptable level.

5.3.2 Descriptive Statistics

Table 5.2 shows the descriptive statistics for all the variables in the questionnaire measuring project management as a whole and project management principals in place in Eskom with the frequencies in each category and the percentage out of total number of questionnaires. It is of importance to note that the descriptive statistics are based on the total sample. In some cases there were no answers given (left blank) in the questionnaire. These are shown as "unknown". These descriptive statistics are also shown in Annexure A.

TABLE 5. 3: Descriptive statistics for categorical variables

Variables	Categories	Frequency	Percentage out of total
Biographic Variables			
1. Department.	Plant Engineering	7	7.4%
	Maintenance Departments	36	38.3%
	Nuclear Engineering Departments	47	50.0%
	Nuclear Services	4	4.3%

Variables	Categories	Frequency	Percentage out of total
2. Detailed Department	Plant Engineering	7	7.4%
	IMS	5	5.3%
	MMPS	12	12.8%
	MSS	12	12.8%
	I&T	7	7.4%
	EPD	20	21.3%
	PE	15	16.0%
	DE	12	12.8%
	OH&S	4	4.3%
Measuring instrument			
1.1 Team members are encouraged to use their creativeness and innovation.	Unknown	1	1.1%
	Strongly agree	10	10.6%
	Agree	43	45.7%
	Neutral	21	22.3%
	Disagree	17	18.1%
	Strongly disagree	2	2.1%
1.2 Every team member has a clear understanding of their role and responsibility in the project.	Unknown	0	0.0%
	Strongly agree	14	14.9%
	Agree	55	58.5%
	Neutral	17	18.1%
	Disagree	7	7.4%
	Strongly disagree	1	1.1%
1.3 Every team member is encouraged to partake in decision making and their input is taken into account.	Unknown	0	0.0%
	Strongly agree	18	19.2%
	Agree	46	48.9%
	Neutral	17	18.1%
	Disagree	13	13.8%
	Strongly disagree	0	0.0%
1.4 Team members do respect one another and support each other in their project.	Unknown	0	0.0%
	Strongly agree	22	23.4%
	Agree	45	47.9%
	Neutral	19	20.2%
	Disagree	8	8.5%

Variables	Categories	Frequency	Percentage out of total
	Strongly disagree	0	0.0%
1.5 Team members are trained in certain skills that they require to accomplish the project objectives.	Unknown	1	1.1%
	Strongly agree	18	19.2%
	Agree	42	44.7%
	Neutral	22	23.4%
	Disagree	10	10.6%
	Strongly disagree	1	1.1%
1.6 Team work is regarded as means to personal development and gives a sense of belonging.	Unknown	1	1.1%
	Strongly agree	14	14.9%
	Agree	51	54.3%
	Neutral	22	23.4%
	Disagree	6	6.4%
	Strongly disagree	0	0.0%
1.7 The project team has all the skills required for the success of the project.	Unknown	0	0.0%
	Strongly agree	10	10.6%
	Agree	46	48.9%
	Neutral	27	28.7%
	Disagree	10	10.6%
	Strongly disagree	1	1.1%
1.8 Good time management practise is encouraged.	Unknown	0	0.0%
	Strongly agree	21	22.3%
	Agree	56	59.6%
	Neutral	16	17.0%
	Disagree	1	1.1%
	Strongly disagree	0	0.0%
2.1 Statements of customer requirements are always defined, clearly understood and documented.	Unknown	1	1.1%
	Strongly agree	16	17.0%
	Agree	37	39.4%
	Neutral	20	21.3%
	Disagree	18	19.2%
	Strongly disagree	2	2.1%
2.2 Statements of customer requirements are always	Unknown	1	1.1%
	Strongly agree	12	12.8%

Variables	Categories	Frequency	Percentage out of total
defined, clearly understood.	Agree	41	43.6%
	Neutral	19	20.2%
	Disagree	20	21.3%
	Strongly disagree	1	1.1%
2.3 Statements of customer requirements are always clearly understood and documented.	Unknown	1	1.1%
	Strongly agree	12	12.8%
	Agree	39	41.5%
	Neutral	20	21.3%
	Disagree	21	22.3%
	Strongly disagree	1	1.1%
2.4 There are procedures in place to guide in identifying customer needs.	Unknown	3	3.2%
	Strongly agree	22	23.4%
	Agree	42	44.7%
	Neutral	21	22.3%
	Disagree	6	6.4%
	Strongly disagree	0	0.0%
2.5 Customer requirements are prioritised according to accepted and approved procedures.	Unknown	3	3.2%
	Strongly agree	17	18.1%
	Agree	45	47.9%
	Neutral	23	24.5%
	Disagree	5	5.3%
	Strongly disagree	1	1.1%
2.6 Customer representative has the authority to decide on behalf of the customers.	Unknown	3	3.2%
	Strongly agree	7	7.4%
	Agree	41	43.6%
	Neutral	30	31.9%
	Disagree	13	13.8%
	Strongly disagree	0	0.0%
2.7 Customer liaison has the authority to decide on behalf of the customers.	Unknown	4	4.3%
	Strongly agree	4	4.3%
	Agree	35	37.2%
	Neutral	38	40.4%
	Disagree	12	12.8%

Variables	Categories	Frequency	Percentage out of total
	Strongly disagree	1	1.1%
2.8 Resources are always planned in advance to ensure project objectives will be met.	Unknown	4	4.3%
	Strongly agree	16	17.0%
	Agree	40	42.6%
	Neutral	17	18.1%
	Disagree	15	16.0%
	Strongly disagree	2	2.1%
2.9 Resource loadings and capacities are optimised and agreed.	Unknown	5	5.3%
	Strongly agree	9	9.6%
	Agree	41	43.6%
	Neutral	22	23.4%
	Disagree	15	16.0%
	Strongly disagree	2	2.1%
2.10 Gantt chart always reflects an agreed schedule.	Unknown	7	7.4%
	Strongly agree	6	6.4%
	Agree	32	34.0%
	Neutral	30	31.9%
	Disagree	19	20.2%
	Strongly disagree	0	0.0%
2.11 Project objectives and clearly defined and communicated to the rest of the team.	Unknown	4	4.3%
	Strongly agree	22	23.4%
	Agree	41	43.6%
	Neutral	16	17.0%
	Disagree	10	10.6%
	Strongly disagree	1	1.1%
2.12 Projects are conducted or perform in line with project management principles.	Unknown	4	4.3%
	Strongly agree	14	14.9%
	Agree	50	53.2%
	Neutral	21	22.3%
	Disagree	4	4.3%
	Strongly disagree	1	1.1%
2.13 Project risk log is always reviewed and updated as	Unknown	4	4.3%
	Strongly agree	12	12.8%

Variables	Categories	Frequency	Percentage out of total
required.	Agree	32	34.0%
	Neutral	36	38.3%
	Disagree	9	9.6%
	Strongly disagree	1	1.1%
2.14 Sound project management procedures are in place to guide teams.	Unknown	3	3.2%
	Strongly agree	14	14.9%
	Agree	45	47.9%
	Neutral	26	27.7%
	Disagree	5	5.3%
	Strongly disagree	1	1.1%
3.1 The project manager or leader always advise and coach when necessary.	Unknown	3	3.2%
	Strongly agree	25	26.6%
	Agree	43	45.7%
	Neutral	16	17.0%
	Disagree	7	7.4%
	Strongly disagree	0	0.0%
3.2 The project leader recognises and praises the individual and team efforts.	Unknown	3	3.2%
	Strongly agree	20	21.3%
	Agree	42	44.7%
	Neutral	20	21.3%
	Disagree	9	9.6%
	Strongly disagree	0	0.0%
3.3 The project leader reacts positively to performance issues pertaining to the project.	Unknown	3	3.2%
	Strongly agree	18	19.2%
	Agree	45	47.9%
	Neutral	21	22.3%
	Disagree	7	7.4%
	Strongly disagree	0	0.0%
3.4 The project leader actively supports team and individual efforts with guidance and assistance.	Unknown	4	4.3%
	Strongly agree	19	20.2%
	Agree	46	48.9%
	Neutral	22	23.4%
	Disagree	3	3.2%

Variables	Categories	Frequency	Percentage out of total
	Strongly disagree	0	0.0%
3.5 The project leader actively resolves conflict and other issues promptly.	Unknown	3	3.2%
	Strongly agree	9	9.6%
	Agree	44	46.8%
	Neutral	31	33.0%
	Disagree	7	7.4%
	Strongly disagree	0	0.0%
3.6 The project leader or manager holds regular meetings (one-to-one) to discuss project and team / individual performance.	Unknown	3	3.2%
	Strongly agree	17	18.1%
	Agree	38	40.4%
	Neutral	17	18.1%
	Disagree	17	18.1%
	Strongly disagree	2	2.1%
3.7 Project manager's authority is always confirmed in writing.	Unknown	3	3.2%
	Strongly agree	20	21.3%
	Agree	34	36.2%
	Neutral	20	21.3%
	Disagree	16	17.0%
	Strongly disagree	1	1.1%

TABLE 5. 4: Descriptive statistics for ordinal variables

Variable	N	Mean	Standard Deviation	Range
1.1 Team members are encouraged to use their creativeness and innovation.	93	2.55	0.9837	4
1.2 Every team member has a clear understanding of their role and responsibility in the project.	94	2.21	0.8279	4
1.3 Every team member is encouraged to partake in decision making and their input is taken into account.	94	2.27	0.9295	3
1.4 Team members do respect one another and support each other in their project.	94	2.14	0.8450	3
1.5 Team members are trained in certain skills that	93	2.29	0.9392	4

	they require to accomplish the project objectives.				
1.6	Team work is regarded as means to personal development and gives a sense of belonging.	93	2.22	0.7781	3
1.7	The project team has all the skills required for the success of the project.	94	2.43	0.8612	4
1.8	Good time management practise is encouraged.	94	1.97	0.6632	3
2.1	Statements of customer requirements are always defined, clearly understood and documented.	93	2.49	1.0594	4
2.2	Statements of customer requirements are always defined, clearly understood.	93	2.54	1.0061	4
2.3	Statements of customer requirements are always clearly understood and documented.	93	2.57	1.0151	4
2.4	There are procedures in place to guide in identifying customer needs.	91	2.12	0.8542	3
2.5	Customer requirements are prioritised according to accepted and approved procedures.	91	2.21	0.8500	4
2.6	Customer representative has the authority to decide on behalf of the customers.	91	2.54	0.8341	3
2.7	Customer liaison has the authority to decide on behalf of the customers.	90	2.68	0.8049	4
2.8	Resources are always planned in advance to ensure project objectives will be met.	90	2.41	1.0374	4
2.9	Resource loadings and capacities are optimised and agreed.	89	2.55	0.9654	4
2.10	Gantt chart always reflects an agreed schedule.	87	2.71	0.8880	3
2.11	Project objectives and clearly defined and communicated to the rest of the team.	90	2.19	0.9703	4
2.12	Projects are conducted or perform in line with project management principles.	90	2.20	0.7961	4
2.13	Project risk log is always reviewed and updated as required.	90	2.50	0.8900	4
2.14	Sound project management procedures are in place to guide teams.	91	2.27	0.8309	4
3.1	The project manager or leader always advise and coach when necessary.	91	2.05	0.8738	3
3.2	The project leader recognises and praises the	91	2.20	0.8972	3

	individual and team efforts.				
3.3	The project leader reacts positively to performance issues pertaining to the project.	91	2.19	0.8421	3
3.4	The project leader actively supports team and individual efforts with guidance and assistance.	90	2.10	0.7651	3
3.5	The project leader actively resolves conflict and other issues promptly.	91	2.40	0.7729	3
3.6	The project leader or manager holds regular meetings (one-to-one) to discuss project and team / individual performance.	91	2.44	1.0668	4
3.7	Project manager's authority is always confirmed in writing.	91	2.38	1.0517	4

5.3.3 Uni-Variate Graphs

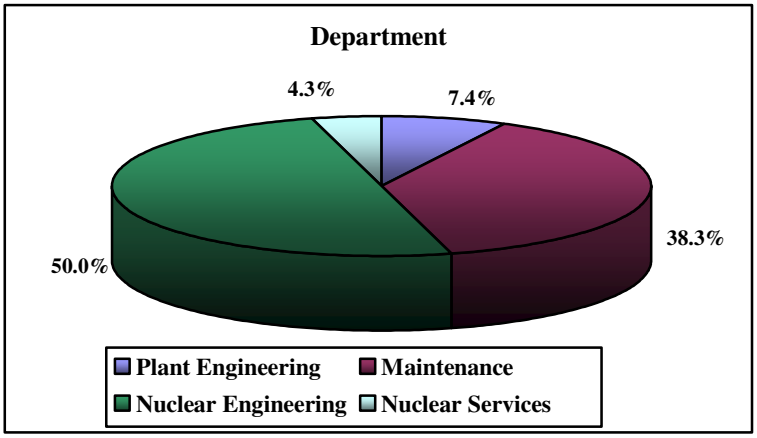

FIGURE 5. 1: Pie with 3D visual effect department distribution

The sample consists mainly out of respondents from the Nuclear Engineering and Maintenance departments.

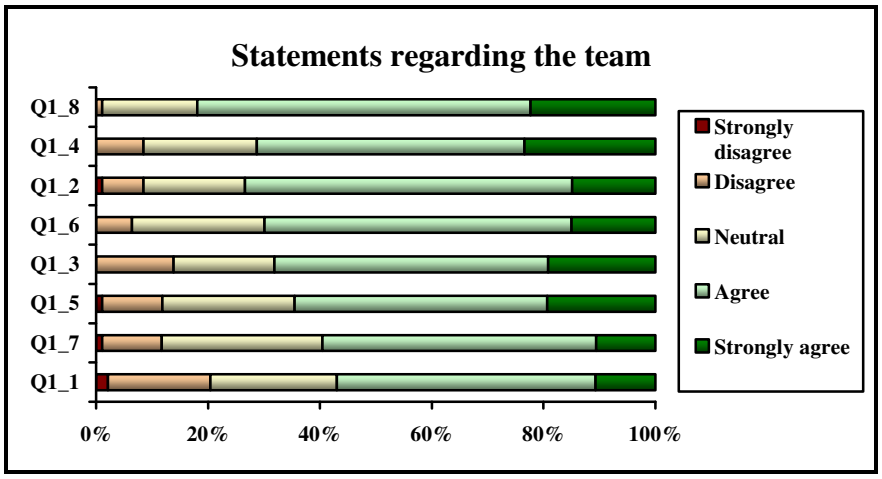

FIGURE 5. 2: Statements regarding the team

The majority of the sample mostly "Agree" to "Strongly Agree" with all the statements referring to the project team and the following statements are the top half with respect to responding "Agree to strongly agree":

- Good time management practises is encouraged (Question 8) (81.9%).
- Team members do respect one another and support each other in their project (Question 4) (71.3%).
- Every team member has a clear understanding of their role and responsibilities in the project (Question 2) (73.4%).
- Team work is regarded as means to personal development and gives a sense of belonging (Question 6) (69.2%).

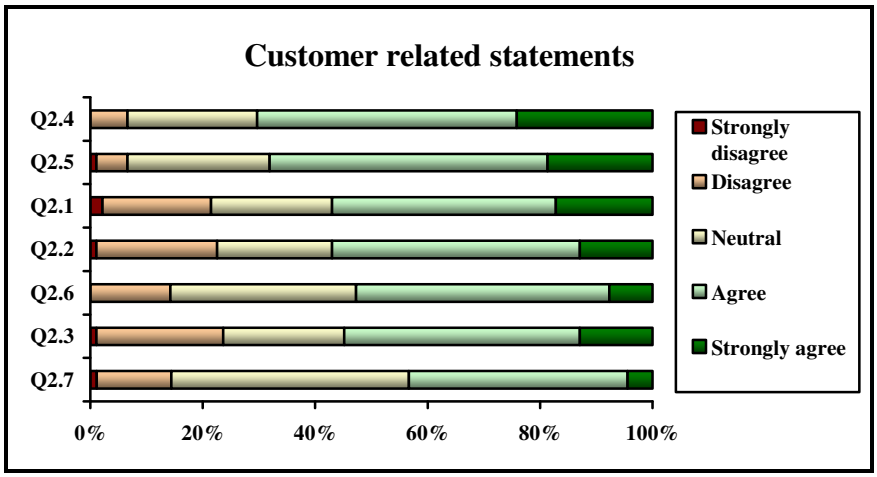

FIGURE 5. 3: Customer related statements

The majority of the sample mostly "Agree" to "Strongly Agree" with all the statements regarding customers and the following statements are those that were agreed on the most:

- There are procedures in place to guide in identifying customer needs (68.1%).
- Customer requirements are prioritised according to accepted and approved procedures (66.0%)
- Statements of customer requirements are always defined, clearly understood and documented (56.4%).
- Statements of customer requirements are always defined and clearly understood (56.4%).

It is of importance to note that more than a fifth on average, of the respondents, is neutral.

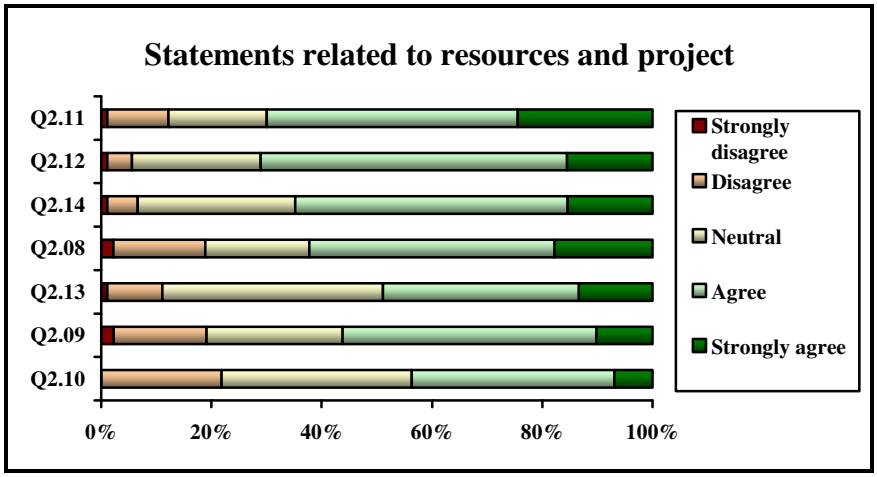

FIGURE 5.4: Statements related to resources and projects

The majority of the sample mostly "Agree" to "Strongly Agree" with all the statements related to resources and project objectivities and the following statements are those that were agreed on the most:

- Project objectives are clearly defined and communicated to the rest of the team (67.0%).
- Projects are conducted or performed in line with project management principles (68.1%)
- Sound project management procedures are in place to guide teams (62.8%).
- Resources are always planned in advance to ensure project objectives will be met (59.6%).

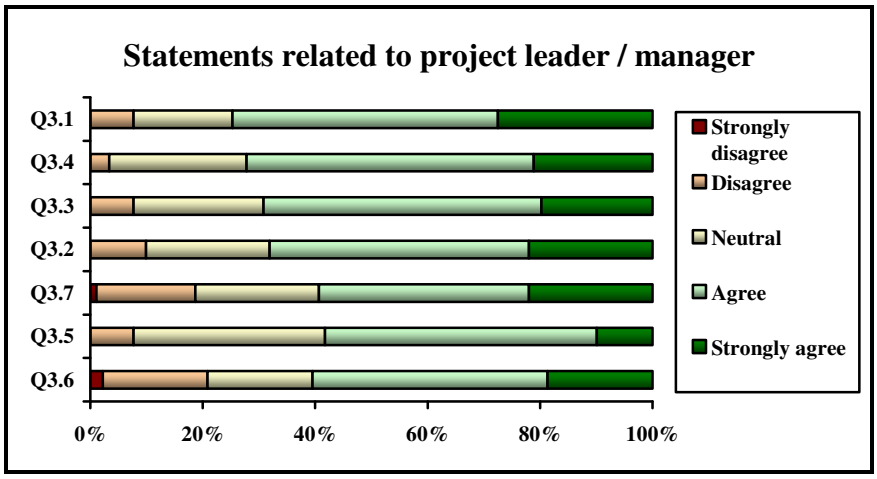

FIGURE 5. 5: Statements related to project leader

The majority of the sample mostly "Agree" to "Strongly Agree" with all the statements related to project leader or manager and the following statements are those that were agreed on the most:

- The project leader or manager always advice and coach when necessary (72.3%).
- The project leader actively supports team and individual efforts with guidance and assistance (69.1%)
- The project leader reacts positively to performance issues pertaining to the project (67.1%).
- The project leader recognises and praises the individual and team efforts (66.0%).

5.3.4 Comparative Statistic

Comparisons are made between the departments with respect to the responses on the statements made (Measuring instrument). The cross analysis by using chi-square testing result in that some of the cells have expected frequencies of less than 5, which result in a warning from the SAS software that the chi-square test is not valid. To overcome this problem only the main departments (By grouping the sub departments) were used and the scale for the responses were changed to only 3 responses (Agree, Neutral, Disagree) by aggregating the "agree" and "strongly agree" category to the new "Agree" category, and the same was done to the "disagree" and "strongly disagree" categories to the new "Disagree" category.

This did not help much because of the fact that very little of the respondents indicated the "disagree" or "strongly disagree" category. To overcome the problem a Kruskal Wallis test were done to compare the responses of the different departments.

The Kruskal Wallis test is a non-parametric test used to compare three or more independent groups of sampled data and is an extension of the Mann Whitney test which compares two independent groups from sampled data. It does not make any assumptions of the distribution of the data and is an alternative to the independent group analysis of variance (ANOVA), when the assumption of normality or equal variance is not met. The ranks of the data rather than the raw data are used to calculate the statistic.

Table 5.5 will show all the statistically significant differences. However note must be taken that all the comparisons (significant and not significant) will be attached in Annexure C.

SAS computes a P-value (Probability value) that measure statistical significance which automatically incorporate the chi-square values. Results will be regarded as significant if the p-values are smaller than 0.05, because this value presents an acceptable level on a 95% confidence interval ($p \leq 0.05$). The p-value is the probability of observing a sample value as extreme as, or more extreme than, the value actually observed, given that the null hypothesis is true. This area represents the probability of a Type 1 error that must be assumed if the null hypothesis is rejected (Cooper & Schindler, 2001:509).

The p-value is compared to the significance level (α) and on this basis the null hypothesis is either rejected or not rejected. If the p value is less than the significance level, the null hypothesis is rejected (if p value $<\alpha$, reject null). If the p value is greater than or equal to the significance level, the null hypothesis is not rejected (if p value $\geq\alpha$, don't reject null). Thus with $\alpha=0.05$, if the p value is less than 0.05, the null hypothesis will be rejected. The p value is determined by using

the standard normal distribution. The small p value represents the risk of rejecting the null hypothesis.

A difference has statistical significance if there is good reason to believe the difference does not represent random sampling fluctuations only. Results will be regarded as significant if the p-values are smaller than 0.05, because this value is used as cut-off point in most behavioural science research.

TABLE 5. 5: Kruskal Wallis test for statistically significant comparisons between departments

Question / Statement	Sample Size	Chi-Square	DF	P-Value
2.1 Statements of customer requirements are always defined, clearly understood and documented.	93	9.0005	3	0.0293*
2.2 Statements of customer requirements are always defined and clearly understood.	93	7.9998	3	0.0460*

This Kruskal Wallis test for comparing the departments indicates that in the "Nuclear Engineering department" statement 2.1 and statement 2.2 scored significantly higher if compared with other departments.

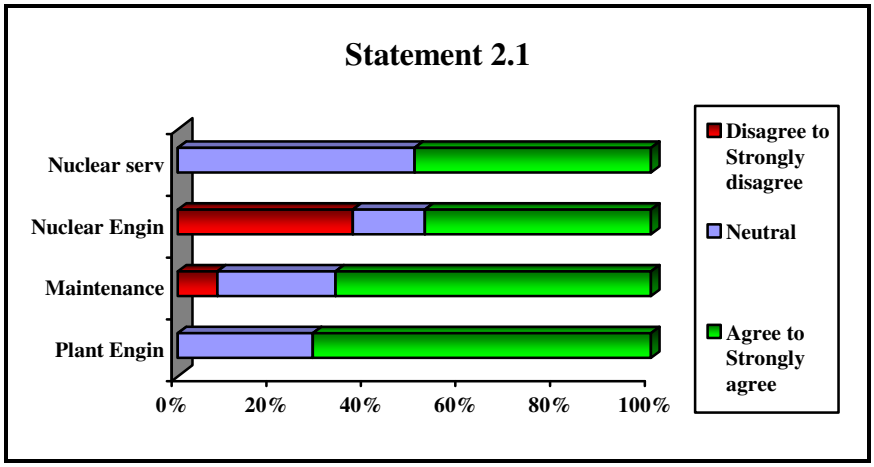

FIGURE 5. 6: 100% stack bar for level of department versus Q2.1

Figure 5.6 indicates that 37.0% of the respondents "disagree to strongly disagree" that "statements of customer requirements are always defined, clearly understood and documented".

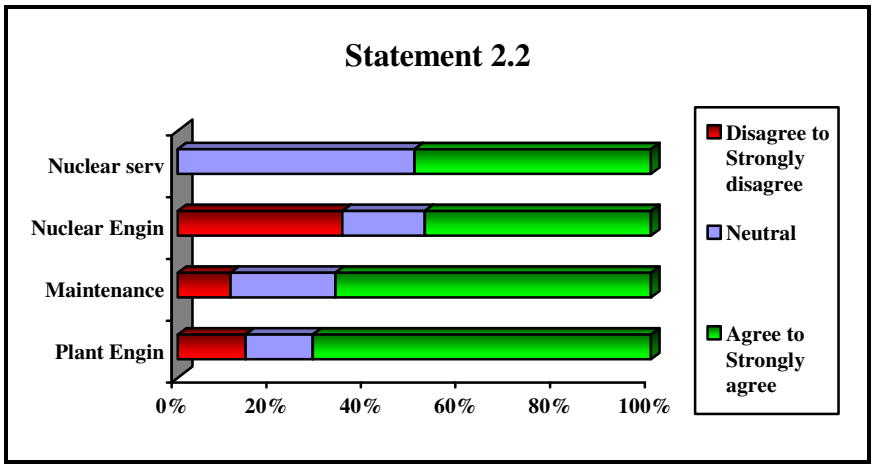

FIGURE 5. 7: 100% stack bar for level of department versus Q2.2

Figure 5.7 indicates that 34.8% of the respondents "disagree to strongly disagree" that "statements of customer requirements are always defined and clearly understood".

CHAPTER 6: CONCLUSION

6.1 INTRODUCTION

The research thus far indicates that project management serves as a catalyst and a mechanism to improve quality and usage of resources. Project management at Eskom (Koeberg Nuclear Power Station) has been proven to be of importance during outages and modification projects, which shows how proficient project management is when aligned with organisational vision and goals.

The concept of project management serves as a restructuring technique with the purpose of obtaining a better control and use of existing resources. This technique has been applied in Eskom, and has proven as such during the outages (shutdown) and modification projects. Project management can be applied to many different industries, as proven by this study. It has also proven to be considered as a possible solution to improve overall quality.

6.2 THE RESEARCH PROBLEM REVISITED

The research problem which has been researched within the ambit of this dissertation, reads as follows: “Poor project management for the development of goods and services adversely impacting the ability of Eskom to provide quality of deliverables to its consumers”.

To ensure that the research problem has been answered by this research study, findings from the study indicate that there are sound project management principles in place, which guide project leaders in order to manage projects successfully. However, this does not occur. To elaborate on this statement, the following aspects were observed and research:

- Since 2006, when the researcher joined the organisation, there has never been an outage that was completed on schedule. Outages are always extended by days to a week or so. This alone increase costs to the company, as contractors are never released on the agreed time.

- In December 2005, Eskom was confronted with an issue of a bolt that was left in one of the plant systems. This alone cost the organisation huge amounts of money. This was due to improper management of the projects.

Furthermore, the above aspects demonstrate that poor project management leads to poor management of quality, and in turn leads to poor quality which costs.

6.3 THE RESEARCH QUESTION REVISITED

The research question which has been researched within the ambit of this dissertation, reads as follows: "To what extent can sound project management principles be applied within organisations to improve the quality of goods and services?"

This research indicate that sound project management principles can be applied on improving the quality of goods and services, through better use of existing resources, participation in teamwork, communication of project goals, understanding customer requirements, managing quality and managing time.

6.4 THE INVESTIGATIVE QUESTIONS REVISITED

The investigative questions which have been researched within the ambit of this dissertation read are analysed hereunder to place the overall research perspective:

- What principles are used in Eskom to ensure a success of a project?

Prepare a project plan and get people with high level skills to maintain power stations (Chapman, 2001:Online).

- What alternative mechanisms can be deployed to minimise project failure?

Young (1996:70; 2000:63), believes that customer specifications, mandatory standards, quality procedures all need to be documented, approved by the customer and be understood by every team member, before embarking on a project. Furthermore, Cleland (2004:4), confirms that well-defined, delegated authority and efficient project monitoring could minimise project failures.

- How can project failures be prevented in future?

According to Young (1996:26), to ensure that project failures are prevented in future, team members should be selected based on their competency, previous

project experience, skills and education. In addition, project failures can be prevented through effective project planning, appropriate organizational design, senior management commitment and customer interaction (Cleland, 2004:4).

- What are key indicators that a project will succeed?

According to Day (2003:1), one of key indicators of project success depends entirely on the organisation ability to successfully implement strategic and operational projects. Moreover Cleland (2004:23-24), is of the opinion that key indicators to ensure that a project will succeed are defined below:

- **Project efficiency:** Meeting the budget and schedule expectations.
- **Impact on customer:** Impact on customer refers to meet technical speficications, addressing customer needs by creating a project that is used by the customer.
- **Business success:** Refers to whether the project achieved significant commercial success or generated a large market share.
- **Future potential:** The project will open new markets or new lines of product, or developed a new technology.

6.5 KEY RESEARCH OBJECTIVES REVISITED

The following are the key research objectives of this dissertation.

- To improve the quality of goods and services through the application of project management within Eskom. Chapter 5 of this research study indicates that there are procedures in place to guide teams in identifying customer needs.
- To emphasise the importance of project management within Eskom. Kerzner (2006:1-3), believes that the importance of project management to obtain better control and use of existing company resources in order to achieve business goals.
- To focus on project management specialisation as a measure of quality improvement. There is an understanding that project management is one of the possible solutions to improve overall quality (Kerzner, 2006:4).
- To demonstrate that project management if used in conjunction with a quality management system, can improve Eskom service delivery. Chapter 5 of this research indicates that Eskom management encourages team work. Customer

requirements are understood. Moreover, there are procedures in place to guide project teams, however not always executed appropriately.

6.6 FINDINGS AND CONCLUSIONS

As for the results obtained through this survey the following analogies can be drawn from this research:

- Good time management practises is encouraged in the four departments of Eskom.
- Team members do respect one another and support each other in their project.
- Every team member has a clear understanding of their role and responsibilities in the project.
- Team work is regarded as means to personal development and gives a sense of belonging.
- There are procedures in place to guide in identifying customer needs.
- Customer requirements are prioritised according to accepted and approved procedures.
- Project objectives are clearly defined and communicated to the rest of the team.
- Projects are conducted or performed in line with project management principles.
- Sound project management procedures are in place to guide teams.
- The project leader or manager always advice and coach when necessary.
- The project leader actively supports team and individual efforts with guidance and assistance.
- The project leader reacts positively to performance issues pertaining to the project.
- The project leader recognises and praises the individual and team efforts.

6.7 RECOMMENDATIONS

The following recommendations are made to mitigate the research problem and provide answer to the research problem.

- Create training opportunities for employees to understand the importance and benefits of project management.
- Eliminate activities that do not allow employees to be creative and go beyond the call of duty.
- Place emphasis on project leaders or managers to communicate effectively the roles and responsibilities of project teams, and ensure that roles are well understood.
- Create an atmosphere of trust, openness and co-operation.
- Provide training in order for employees to be well skilled in order to manage projects successfully.
- Invest time to do proper project planning.
- Be firm and keep projects schedule.
- Have a planning model to work from that fits the organisation (Cleland, 2004:47).
- Document the goals, objectives, mission statement and other guiding items.
- Use a team approach to planning, so every team member knows what is happening.
- Use a disciplined approach to planning the projects.
- Where possible, eliminate activities that normally extend outages schedules.
- Stick to the project budget.
- Release external contractors on agreed time.
- Ensure that all team members understand customer requirements and expectations.
- Treat and manage every function within an organisation as a process.
- Ensure that all new employees understand exactly their tasks and are trained to execute such tasks.
- Identify and align business needs with individual strengths and competencies in order to achieve desired results.
- Always derive and align projects with a business vision.

6.8 FINAL CONCLUSION

While the responses were of positive in nature, there are real issues from the researcher's point of view with the management of projects in Eskom. These issues pertain to the following:

- When Eskom got involved in electrification of RDP houses, they did not plan it properly, and did not anticipate the effects that this electrification will bring. Hence the demand increased and the electricity supply decreased due to insufficient project planning.
- Insufficient planning and supply of electricity to neighbouring countries are one of aspects that have increased the demand. Eskom did not anticipate this.
- Eskom depends on external contractors for the maintenance of its power stations, as opposed to using its own staff. The research shows that this is due to poor vision and lack of business understanding.

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Annexure A:

Descriptive statistics for each variable

Q1_01	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	1	1.06	1	1.06
Strongly agree	10	10.64	11	11.70
Agree	43	45.74	54	57.45
Neutral	21	22.34	75	79.79
Disagree	17	18.09	92	97.87
Strongly disagree	2	2.13	94	100.00

Chi-Square Test for Equal Proportions

Chi-Square	77.3191
DF	5
Pr > ChiSq	<.0001
Sample Size	94

Q1_02	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Strongly agree	14	14.89	14	14.89
Agree	55	58.51	69	73.40
Neutral	17	18.09	86	91.49
Disagree	7	7.45	93	98.94
Strongly disagree	1	1.06	94	100.00

Chi-Square Test for Equal Proportions

Chi-Square	95.3617
DF	4
Pr > ChiSq	<.0001
Sample Size	94

Q1_03	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Strongly agree	18	19.15	18	19.15
Agree	46	48.94	64	68.09
Neutral	17	18.09	81	86.17
Disagree	13	13.83	94	100.00

Chi-Square Test for Equal Proportions

Chi-Square	29.3191
DF	3
Pr > ChiSq	<.0001
Sample Size	94

Q1_04	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Strongly agree	22	23.40	22	23.40
Agree	45	47.87	67	71.28
Neutral	19	20.21	86	91.49
Disagree	8	8.51	94	100.00

Chi-Square Test for Equal Proportions

Chi-Square	30.8511
DF	3
Pr > ChiSq	<.0001
Sample Size	94

Q1_05	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	1	1.06	1	1.06
Strongly agree	18	19.15	19	20.21
Agree	42	44.68	61	64.89
Neutral	22	23.40	83	88.30
Disagree	10	10.64	93	98.94
Strongly disagree	1	1.06	94	100.00

Chi-Square Test for Equal Proportions

Chi-Square	76.6809
DF	5
Pr > ChiSq	<.0001
Sample Size	94

Q1_06	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	1	1.06	1	1.06
Strongly agree	14	14.89	15	15.96
Agree	51	54.26	66	70.21
Neutral	22	23.40	88	93.62
Disagree	6	6.38	94	100.00

Chi-Square Test

for Equal Proportions

Chi-Square 82.4894
DF 4
Pr > ChiSq <.0001
Sample Size = 94

Q1_07	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Strongly agree	10	10.64	10	10.64
Agree	46	48.94	56	59.57
Neutral	27	28.72	83	88.30
Disagree	10	10.64	93	98.94
Strongly disagree	1	1.06	94	100.00

Chi-Square Test
for Equal Proportions

Chi-Square 68.0213
DF 4
Pr > ChiSq <.0001
Sample Size = 94

Q1_08	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Strongly agree	21	22.34	21	22.34
Agree	56	59.57	77	81.91
Neutral	16	17.02	93	98.94
Disagree	1	1.06	94	100.00

Chi-Square Test
for Equal Proportions

Chi-Square 69.1489
DF 3
Pr > ChiSq <.0001
Sample Size = 94

Q2_01	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	1	1.06	1	1.06
Strongly agree	16	17.02	17	18.09
Agree	37	39.36	54	57.45
Neutral	20	21.28	74	78.72
Disagree	18	19.15	92	97.87
Strongly disagree	2	2.13	94	100.00

Chi-Square Test
for Equal Proportions

Chi-Square 56.2553
DF 5
Pr > ChiSq <.0001
Sample Size = 94

Q2_02	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	1	1.06	1	1.06
Strongly agree	12	12.77	13	13.83
Agree	41	43.62	54	57.45
Neutral	19	20.21	73	77.66
Disagree	20	21.28	93	98.94
Strongly disagree	1	1.06	94	100.00

Chi-Square Test
for Equal Proportions

Chi-Square 71.1915
DF 5
Pr > ChiSq <.0001
Sample Size = 94

Q2_03	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	1	1.06	1	1.06
Strongly agree	12	12.77	13	13.83
Agree	39	41.49	52	55.32
Neutral	20	21.28	72	76.60
Disagree	21	22.34	93	98.94
Strongly disagree	1	1.06	94	100.00

Chi-Square Test
for Equal Proportions

Chi-Square 66.0851
DF 5
Pr > ChiSq <.0001
Sample Size = 94

Q2_04	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	3	3.19	3	3.19
Strongly agree	22	23.40	25	26.60
Agree	42	44.68	67	71.28
Neutral	21	22.34	88	93.62

Disagree	6	6.38	94	100.00

Chi-Square Test for Equal Proportions

Chi-Square	51.4255
DF	4
Pr > ChiSq	<.0001
Sample Size = 94	

Q2_05	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	3	3.19	3	3.19
Strongly agree	17	18.09	20	21.28
Agree	45	47.87	65	69.15
Neutral	23	24.47	88	93.62
Disagree	5	5.32	93	98.94
Strongly disagree	1	1.06	94	100.00

Chi-Square Test
for Equal Proportions
Chi-Square 89.7021
DF 5
Pr > ChiSq <.0001
Sample Size = 94

Q2_06	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	3	3.19	3	3.19
Strongly agree	7	7.45	10	10.64
Agree	41	43.62	51	54.26
Neutral	30	31.91	81	86.17
Disagree	13	13.83	94	100.00

Chi-Square Test
for Equal Proportions
Chi-Square 55.3617
DF 4
Pr > ChiSq <.0001
Sample Size = 94

Q2_07	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	4	4.26	4	4.26
Strongly agree	4	4.26	8	8.51
Agree	35	37.23	43	45.74
Neutral	38	40.43	81	86.17
Disagree	12	12.77	93	98.94
Strongly disagree	1	1.06	94	100.00

Chi-Square Test
for Equal Proportions
Chi-Square 87.6596
DF 5
Pr > ChiSq <.0001
Sample Size = 94

Q2_08	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	4	4.26	4	4.26
Strongly agree	16	17.02	20	21.28
Agree	40	42.55	60	63.83
Neutral	17	18.09	77	81.91
Disagree	15	15.96	92	97.87
Strongly disagree	2	2.13	94	100.00

Chi-Square Test
for Equal Proportions
Chi-Square 58.5532
DF 5
Pr > ChiSq <.0001
Sample Size = 94

Q2_09	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	5	5.32	5	5.32
Strongly agree	9	9.57	14	14.89
Agree	41	43.62	55	58.51
Neutral	22	23.40	77	81.91
Disagree	15	15.96	92	97.87
Strongly disagree	2	2.13	94	100.00

Chi-Square Test
for Equal Proportions
Chi-Square 65.5745
DF 5
Pr > ChiSq <.0001
Sample Size = 94

Q2_10	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	7	7.45	7	7.45
Strongly agree	6	6.38	13	13.83
Agree	32	34.04	45	47.87
Neutral	30	31.91	75	79.79
Disagree	19	20.21	94	100.00

Chi-Square Test
for Equal Proportions
Chi-Square 32.0638
DF 4
Pr > ChiSq <.0001
Sample Size = 94

Q2_11	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	4	4.26	4	4.26
Strongly agree	22	23.40	26	27.66

Agree	41	43.62	67	71.28
Neutral	16	17.02	83	88.30
Disagree	10	10.64	93	98.94
Strongly disagree	1	1.06	94	100.00

Chi-Square Test
for Equal Proportions

Chi-Square	68.0000
DF	5
Pr > ChiSq	<.0001

Sample Size = 94

Q2_12	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	4	4.26	4	4.26
Strongly agree	14	14.89	18	19.15
Agree	50	53.19	68	72.34
Neutral	21	22.34	89	94.68
Disagree	4	4.26	93	98.94
Strongly disagree	1	1.06	94	100.00

Chi-Square Test
for Equal Proportions

Chi-Square	108.3404
DF	5
Pr > ChiSq	<.0001

Sample Size = 94

Q2_13	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	4	4.26	4	4.26
Strongly agree	12	12.77	16	17.02
Agree	32	34.04	48	51.06
Neutral	36	38.30	84	89.36
Disagree	9	9.57	93	98.94
Strongly disagree	1	1.06	94	100.00

Chi-Square Test
for Equal Proportions

Chi-Square	69.5319
DF	5
Pr > ChiSq	<.0001

Sample Size = 94

Q2_14	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	3	3.19	3	3.19
Strongly agree	14	14.89	17	18.09
Agree	45	47.87	62	65.96
Neutral	26	27.66	88	93.62
Disagree	5	5.32	93	98.94
Strongly disagree	1	1.06	94	100.00

Chi-Square Test for Equal Proportions

Chi-Square	93.1489
DF	5
Pr > ChiSq	<.0001

Sample Size = 94

Q3_01	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	3	3.19	3	3.19
Strongly agree	25	26.60	28	29.79
Agree	43	45.74	71	75.53
Neutral	16	17.02	87	92.55
Disagree	7	7.45	94	100.00

Chi-Square Test for Equal Proportions

Chi-Square	54.2979
DF	4
Pr > ChiSq	<.0001

Sample Size = 94

Q3_02	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	3	3.19	3	3.19
Strongly agree	20	21.28	23	24.47
Agree	42	44.68	65	69.15
Neutral	20	21.28	85	90.43
Disagree	9	9.57	94	100.00

Chi-Square Test for Equal Proportions

Chi-Square	47.1702
DF	4
Pr > ChiSq	<.0001

Sample Size = 94

Q3_03	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	3	3.19	3	3.19
Strongly agree	18	19.15	21	22.34
Agree	45	47.87	66	70.21
Neutral	21	22.34	87	92.55
Disagree	7	7.45	94	100.00

Chi-Square Test for Equal Proportions

Chi-Square	57.4894
DF	4
Pr > ChiSq	<.0001

Sample Size = 94

Q3_04	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	4	4.26	4	4.26
Strongly agree	19	20.21	23	24.47
Agree	46	48.94	69	73.40
Neutral	22	23.40	91	96.81
Disagree	3	3.19	94	100.00

Chi-Square Test for Equal Proportions

Chi-Square	64.8298
DF	4
Pr > ChiSq	<.0001

Sample Size = 94

Q3_05	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	3	3.19	3	3.19
Strongly agree	9	9.57	12	12.77
Agree	44	46.81	56	59.57
Neutral	31	32.98	87	92.55
Disagree	7	7.45	94	100.00

Chi-Square Test for Equal Proportions

Chi-Square	67.4894
DF	4
Pr > ChiSq	<.0001

Sample Size = 94

Q3_06	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	3	3.19	3	3.19
Strongly agree	17	18.09	20	21.28
Agree	38	40.43	58	61.70
Neutral	17	18.09	75	79.79
Disagree	17	18.09	92	97.87
Strongly disagree	2	2.13	94	100.00

Chi-Square Test for Equal Proportions

Chi-Square	54.3404
DF	5
Pr > ChiSq	<.0001

Sample Size = 94

Q3_07	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	3	3.19	3	3.19
Strongly agree	20	21.28	23	24.47
Agree	34	36.17	57	60.64
Neutral	20	21.28	77	81.91
Disagree	16	17.02	93	98.94
Strongly disagree	1	1.06	94	100.00

Chi-Square Test for Equal Proportions

Chi-Square	47.8298
DF	5
Pr > ChiSq	<.0001

Sample Size = 94

Department	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Plant Engineering	7	7.45	7	7.45
IMS	5	5.32	12	12.77
MMPS	12	12.77	24	25.53
MSS	12	12.77	36	38.30
I&T	7	7.45	43	45.74
EPD	20	21.28	63	67.02
PE	15	15.96	78	82.98
DE	12	12.77	90	95.74
OH&S	4	4.26	94	100.00

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   Chi-Square Test
for Equal Proportions
ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
Chi-Square    20.5106
DF                  8
Pr > ChiSq     0.0086
   Sample Size = 94
```

Reliable testing

Simple Statistics

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum	Label
Q1_01	83	2.57831	0.98922	214.00000	1.00000	5.00000	Q1_01
Q1_02	83	2.25301	0.83875	187.00000	1.00000	5.00000	Q1_02
Q1_03	83	2.31325	0.94904	192.00000	1.00000	4.00000	Q1_03
Q1_04	83	2.15663	0.89008	179.00000	1.00000	4.00000	Q1_04
Q1_05	83	2.32530	0.95136	193.00000	1.00000	5.00000	Q1_05
Q1_06	83	2.22892	0.80130	185.00000	1.00000	4.00000	Q1_06
Q1_07	83	2.50602	0.87476	208.00000	1.00000	5.00000	Q1_07
Q1_08	83	2.01205	0.63427	167.00000	1.00000	4.00000	Q1_08
Q2_01	83	2.50602	1.05198	208.00000	1.00000	5.00000	Q2_01
Q2_02	83	2.56627	1.01444	213.00000	1.00000	5.00000	Q2_02
Q2_03	83	2.60241	1.02338	216.00000	1.00000	5.00000	Q2_03
Q2_04	83	2.13253	0.86632	177.00000	1.00000	4.00000	Q2_04
Q2_05	83	2.22892	0.83118	185.00000	1.00000	5.00000	Q2_05
Q2_06	83	2.54217	0.83083	211.00000	1.00000	4.00000	Q2_06
Q2_07	83	2.68675	0.79523	223.00000	1.00000	5.00000	Q2_07
Q2_08	83	2.43373	1.06144	202.00000	1.00000	5.00000	Q2_08
Q2_09	83	2.55422	0.97846	212.00000	1.00000	5.00000	Q2_09
Q2_10	83	2.69880	0.87979	224.00000	1.00000	4.00000	Q2_10
Q2_11	83	2.20482	0.98475	183.00000	1.00000	5.00000	Q2_11
Q2_12	83	2.20482	0.80787	183.00000	1.00000	5.00000	Q2_12
Q2_13	83	2.51807	0.90205	209.00000	1.00000	5.00000	Q2_13
Q2_14	83	2.28916	0.84867	190.00000	1.00000	5.00000	Q2_14
Q3_01	83	2.10843	0.88362	175.00000	1.00000	4.00000	Q3_01
Q3_02	83	2.25301	0.89502	187.00000	1.00000	4.00000	Q3_02
Q3_03	83	2.24096	0.84954	186.00000	1.00000	4.00000	Q3_03
Q3_04	83	2.13253	0.76143	177.00000	1.00000	4.00000	Q3_04
Q3_05	83	2.43373	0.76816	202.00000	1.00000	4.00000	Q3_05
Q3_06	83	2.46988	1.07451	205.00000	1.00000	5.00000	Q3_06
Q3_07	83	2.44578	1.03891	203.00000	1.00000	5.00000	Q3_07

Cronbach Coefficient Alpha

Variables	Alpha
Raw	0.943903
Standardized	0.943571

Cronbach Coefficient Alpha with Deleted Variable

Deleted Variable	Raw Variables: Correlation with Total	Raw Variables: Alpha	Standardized Variables: Correlation with Total	Standardized Variables: Alpha	Label
Q1_01	0.266565	0.945671	0.266281	0.945004	Q1_01
Q1_02	0.463688	0.943238	0.460093	0.943004	Q1_02
Q1_03	0.562841	0.942302	0.565122	0.941902	Q1_03
Q1_04	0.610775	0.941782	0.612325	0.941403	Q1_04
Q1_05	0.542237	0.942530	0.535157	0.942218	Q1_05
Q1_06	0.431052	0.943510	0.426267	0.943356	Q1_06
Q1_07	0.610544	0.941791	0.612849	0.941398	Q1_07
Q1_08	0.423414	0.943509	0.424192	0.943378	Q1_08
Q2_01	0.742783	0.940196	0.737800	0.940063	Q2_01
Q2_02	0.742019	0.940234	0.736665	0.940076	Q2_02
Q2_03	0.721669	0.940472	0.716022	0.940297	Q2_03
Q2_04	0.522797	0.942677	0.520238	0.942375	Q2_04
Q2_05	0.524817	0.942647	0.520181	0.942375	Q2_05
Q2_06	0.489826	0.942982	0.492371	0.942667	Q2_06
Q2_07	0.509950	0.942783	0.510782	0.942474	Q2_07
Q2_08	0.701508	0.940708	0.701485	0.940453	Q2_08
Q2_09	0.738698	0.940311	0.737058	0.940071	Q2_09
Q2_10	0.474230	0.943176	0.475844	0.942840	Q2_10
Q2_11	0.749891	0.940173	0.749304	0.939940	Q2_11
Q2_12	0.610679	0.941842	0.609411	0.941434	Q2_12
Q2_13	0.579242	0.942109	0.571554	0.941834	Q2_13
Q2_14	0.502404	0.942870	0.500499	0.942582	Q2_14
Q3_01	0.692697	0.940938	0.698721	0.940483	Q3_01
Q3_02	0.605869	0.941832	0.614508	0.941380	Q3_02

Q3_03	0.724141	0.940677	0.729577	0.940152	Q3_03
Q3_04	0.650677	0.941544	0.655600	0.940943	Q3_04
Q3_05	0.644472	0.941587	0.645893	0.941046	Q3_05
Q3_06	0.590743	0.942101	0.596039	0.941576	Q3_06
Q3_07	0.622105	0.941678	0.618573	0.941337	Q3_07

Annexure B:

Inferential statistics

The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable Q1_01
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	36	1602.00	1692.0	119.094109	44.500000
Nuclear Engineering Departments	46	2213.50	2162.0	122.244533	48.119565
Nuclear Services	4	133.50	188.0	49.605131	33.375000
Plant Engineering	7	422.00	329.0	64.505960	60.285714

Average scores were used for ties.

Kruskal-Wallis Test

Chi-Square	3.5170
DF	3
Pr > Chi-Square	0.3186

Wilcoxon Scores (Rank Sums) for Variable Q1_02
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	36	1549.50	1710.00	114.285198	43.041667
Nuclear Engineering Departments	47	2474.50	2232.50	117.549989	52.648936
Nuclear Services	4	99.00	190.00	47.454345	24.750000
Plant Engineering	7	342.00	332.50	61.721061	48.857143

Kruskal-Wallis Test

Chi-Square	6.8788
DF	3
Pr > Chi-Square	0.0759

Wilcoxon Scores (Rank Sums) for Variable Q1_03
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	36	1688.50	1710.00	119.736825	46.902778
Nuclear Engineering Departments	47	2321.50	2232.50	123.157354	49.393617
Nuclear Services	4	102.00	190.00	49.718011	25.500000
Plant Engineering	7	353.00	332.50	64.665276	50.428571

Kruskal-Wallis Test

Chi-Square	3.3735
DF	3
Pr > Chi-Square	0.3375

Wilcoxon Scores (Rank Sums) for Variable Q1_04
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	36	1526.50	1710.00	119.831041	42.402778
Nuclear Engineering Departments	47	2238.00	2232.50	123.254261	47.617021
Nuclear Services	4	276.00	190.00	49.757131	69.000000
Plant Engineering	7	424.50	332.50	64.716159	60.642857

Kruskal-Wallis Test

Chi-Square	6.1785
DF	3
Pr > Chi-Square	0.1032

Wilcoxon Scores (Rank Sums) for Variable Q1_05
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score

Maintenance departments	36	1366.00	1692.0	119.355616	37.944444
Nuclear Engineering Departments	46	2406.50	2162.0	122.512957	52.315217
Nuclear Services	4	208.00	188.0	49.714054	52.000000
Plant Engineering	7	390.50	329.0	64.647603	55.785714

Kruskal-Wallis Test
Chi-Square 7.5770
DF 3
Pr > Chi-Square 0.0556

Wilcoxon Scores (Rank Sums) for Variable Q1_06
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	36	1449.00	1692.0	114.685352	40.250000
Nuclear Engineering Departments	46	2372.50	2162.0	117.719150	51.576087
Nuclear Services	4	196.50	188.0	47.768794	49.125000
Plant Engineering	7	353.00	329.0	62.118008	50.428571

Kruskal-Wallis Test
Chi-Square 4.5359
DF 3
Pr > Chi-Square 0.2091

Wilcoxon Scores (Rank Sums) for Variable Q1_07
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	36	1605.00	1710.00	119.008014	44.583333
Nuclear Engineering Departments	47	2235.50	2232.50	122.407723	47.563830
Nuclear Services	4	207.00	190.00	49.415388	51.750000
Plant Engineering	7	417.50	332.50	64.271673	59.642857

Kruskal-Wallis Test
Chi-Square 2.2127
DF 3
Pr > Chi-Square 0.5294

Wilcoxon Scores (Rank Sums) for Variable Q1_08
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	36	1657.50	1710.00	113.006854	46.041667
Nuclear Engineering Departments	47	2268.00	2232.50	116.235127	48.255319
Nuclear Services	4	157.00	190.00	46.923542	39.250000
Plant Engineering	7	382.50	332.50	61.030677	54.642857

Kruskal-Wallis Test
Chi-Square 1.2746
DF 3
Pr > Chi-Square 0.7352

Wilcoxon Scores (Rank Sums) for Variable Q2_01
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	36	1420.50	1692.0	121.264342	39.458333
Nuclear Engineering Departments	46	2531.00	2162.0	124.472176	55.021739
Nuclear Services	4	170.50	188.0	50.509077	42.625000
Plant Engineering	7	249.00	329.0	65.681443	35.571429

Kruskal-Wallis Test
Chi-Square 9.0005

DF	3
Pr > Chi-Square	0.0293

Wilcoxon Scores (Rank Sums) for Variable Q2_02
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	36	1440.50	1692.0	119.861912	40.013889
Nuclear Engineering Departments	46	2507.50	2162.0	123.032647	54.510870
Nuclear Services	4	165.50	188.0	49.924937	41.375000
Plant Engineering	7	257.50	329.0	64.921832	36.785714

Kruskal-Wallis Test

Chi-Square	7.9998
DF	3
Pr > Chi-Square	0.0460

Wilcoxon Scores (Rank Sums) for Variable Q2_03
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	36	1439.00	1692.0	120.460687	39.972222
Nuclear Engineering Departments	46	2437.50	2162.0	123.647261	52.989130
Nuclear Services	4	216.50	188.0	50.174338	54.125000
Plant Engineering	7	278.00	329.0	65.246152	39.714286

Kruskal-Wallis Test

Chi-Square	6.0863
DF	3
Pr > Chi-Square	0.1075

Wilcoxon Scores (Rank Sums) for Variable Q2_04
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	35	1625.50	1610.0	114.671661	46.442857
Nuclear Engineering Departments	45	2051.50	2070.0	117.845564	45.588889
Nuclear Services	4	174.00	184.0	48.318972	43.500000
Plant Engineering	7	335.00	322.0	62.808255	47.857143

Kruskal-Wallis Test

Chi-Square	0.1042
DF	3
Pr > Chi-Square	0.9913

Wilcoxon Scores (Rank Sums) for Variable Q2_05
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	35	1472.0	1610.0	113.437358	42.057143
Nuclear Engineering Departments	45	2169.0	2070.0	116.577098	48.200000
Nuclear Services	4	228.0	184.0	47.798877	57.000000
Plant Engineering	7	317.0	322.0	62.132200	45.285714

Kruskal-Wallis Test

Chi-Square	2.0914
DF	3
Pr > Chi-Square	0.5537

Wilcoxon Scores (Rank Sums) for Variable Q2_06
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	35	1735.50	1610.0	114.301670	49.585714
Nuclear Engineering Departments	45	2071.50	2070.0	117.465333	46.033333
Nuclear Services	4	112.00	184.0	48.163070	28.000000
Plant Engineering	7	267.00	322.0	62.605603	38.142857

Kruskal-Wallis Test

Chi-Square	3.5909
DF	3
Pr > Chi-Square	0.3092

Wilcoxon Scores (Rank Sums) for Variable Q2_07
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score

44.500000	Maintenance departments	35	1557.50	1592.50	112.277454
46.077778	Nuclear Engineering Departments	45	2073.50	2047.50	115.156830
46.333333	Nuclear Services	3	139.00	136.50	41.342567
46.428571	Plant Engineering	7	325.00	318.50	61.682967

Kruskal-Wallis Test

Chi-Square	0.0986
DF	3
Pr > Chi-Square	0.9920

Wilcoxon Scores (Rank Sums) for Variable Q2_08
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	36	1355.0	1638.00	114.886089	37.638889
Nuclear Engineering Departments	43	2212.0	1956.50	117.139259	51.441860
Nuclear Services	4	219.0	182.00	48.327968	54.750000
Plant Engineering	7	309.0	318.50	62.806903	44.142857

Kruskal-Wallis Test

Chi-Square	6.7064
DF	3
Pr > Chi-Square	0.0819

Wilcoxon Scores (Rank Sums) for Variable Q2_09
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	35	1385.50	1575.0	111.776478	39.585714
Nuclear Engineering Departments	43	2095.00	1935.0	114.349077	48.720930
Nuclear Services	4	201.50	180.0	47.408802	50.375000
Plant Engineering	7	323.00	315.0	61.599256	46.142857

Kruskal-Wallis Test

Chi-Square	2.9678
DF	3
Pr > Chi-Square	0.3966

Wilcoxon Scores (Rank Sums) for Variable Q2_10
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	34	1457.00	1496.0	108.971774	42.852941
Nuclear Engineering Departments	43	1954.50	1892.0	111.659890	45.453488
Nuclear Services	3	185.00	132.0	40.750871	61.666667
Plant Engineering	7	231.50	308.0	60.747812	33.071429

Kruskal-Wallis Test

Chi-Square	3.3279
DF	3
Pr > Chi-Square	0.3438

Wilcoxon Scores (Rank Sums) for Variable Q2_11
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	36	1408.50	1638.00	114.155482	39.125000
Nuclear Engineering Departments	43	2149.50	1956.50	116.394323	49.988372
Nuclear Services	4	229.00	182.00	48.020631	57.250000
Plant Engineering	7	308.00	318.50	62.407489	44.000000

Kruskal-Wallis Test

Chi-Square	4.8024
DF	3
Pr > Chi-Square	0.1869

Wilcoxon Scores (Rank Sums) for Variable Q2_12
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score

Maintenance departments	36	1587.0	1638.00	109.414889	44.083333
Nuclear Engineering Departments	43	1999.0	1956.50	111.560757	46.488372
Nuclear Services	4	229.0	182.00	46.026454	57.250000
Plant Engineering	7	280.0	318.50	59.815861	40.000000

Kruskal-Wallis Test

Chi-Square	1.5846
DF	3
Pr > Chi-Square	0.6629

Wilcoxon Scores (Rank Sums) for Variable Q2_13
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	36	1359.00	1638.00	114.401835	37.750000
Nuclear Engineering Departments	44	2269.00	2002.00	116.732050	51.568182
Nuclear Services	3	119.50	136.50	41.918440	39.833333
Plant Engineering	7	347.50	318.50	62.542167	49.642857

Kruskal-Wallis Test

Chi-Square	6.5998
DF	3
Pr > Chi-Square	0.0858

Wilcoxon Scores (Rank Sums) for Variable Q2_14
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	36	1715.0	1656.0	113.728035	47.638889
Nuclear Engineering Departments	44	2007.0	2024.0	116.227851	45.613636
Nuclear Services	4	148.0	184.0	47.678717	37.000000
Plant Engineering	7	316.0	322.0	61.976009	45.142857

Kruskal-Wallis Test

Chi-Square	0.7274
DF	3
Pr > Chi-Square	0.8667

Wilcoxon Scores (Rank Sums) for Variable Q3_01
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	36	1641.00	1656.0	114.785993	45.583333
Nuclear Engineering Departments	44	1982.50	2024.0	117.309063	45.056818
Nuclear Services	4	183.50	184.0	48.122250	45.875000
Plant Engineering	7	379.00	322.0	62.552542	54.142857

Kruskal-Wallis Test

Chi-Square	0.8415
DF	3
Pr > Chi-Square	0.8395

Wilcoxon Scores (Rank Sums) for Variable Q3_02
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	36	1707.00	1656.0	115.551663	47.416667
Nuclear Engineering Departments	44	1838.50	2024.0	118.091563	41.784091
Nuclear Services	4	228.00	184.0	48.443245	57.000000
Plant Engineering	7	412.50	322.0	62.969793	58.928571

Kruskal-Wallis Test

Chi-Square	4.0875
DF	3
Pr > Chi-Square	0.2522

Wilcoxon Scores (Rank Sums) for Variable Q3_03
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	36	1674.00	1656.0	114.170924	46.500000
Nuclear Engineering Departments	44	1993.50	2024.0	116.680475	45.306818
Nuclear Services	4	197.00	184.0	47.864392	49.250000
Plant Engineering	7	321.50	322.0	62.217361	45.928571

Kruskal-Wallis Test

Chi-Square	0.1209
DF	3
Pr > Chi-Square	0.9892

Wilcoxon Scores (Rank Sums) for Variable Q3_04
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	36	1616.50	1638.00	111.447776	44.902778
Nuclear Engineering Departments	43	1906.00	1956.50	113.633513	44.325581
Nuclear Services	4	238.00	182.00	46.881608	59.500000
Plant Engineering	7	334.50	318.50	60.927217	47.785714

Kruskal-Wallis Test

Chi-Square	1.5525
DF	3
Pr > Chi-Square	0.6702

Wilcoxon Scores (Rank Sums) for Variable Q3_05
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	36	1621.0	1656.0	113.330888	45.027778
Nuclear Engineering Departments	44	1937.0	2024.0	115.821974	44.022727
Nuclear Services	4	276.0	184.0	47.512219	69.000000
Plant Engineering	7	352.0	322.0	61.759583	50.285714

Kruskal-Wallis Test

Chi-Square	4.1515
DF	3
Pr > Chi-Square	0.2456

Wilcoxon Scores (Rank Sums) for Variable Q3_06
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	36	1607.50	1656.0	117.385062	44.652778
Nuclear Engineering Departments	44	1961.00	2024.0	119.965262	44.568182
Nuclear Services	4	228.50	184.0	49.211869	57.125000
Plant Engineering	7	389.00	322.0	63.968903	55.571429

Kruskal-Wallis Test

Chi-Square	2.0400
DF	3
Pr > Chi-Square	0.5642

Wilcoxon Scores (Rank Sums) for Variable Q3_07
Classified by Variable Department

Department	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
Maintenance departments	36	1548.00	1656.0	118.258657	43.000000
Nuclear Engineering Departments	44	2108.50	2024.0	120.858059	47.920455

	Nuclear Services	4	177.00	184.0	49.578110
44.250000					
	Plant Engineering	7	352.50	322.0	64.444968
50.357143					

Kruskal-Wallis Test

Chi-Square	0.9824
DF	3
Pr > Chi-Square	0.8055

Annexure C:

Descriptive statistics by department

---------- Department=Plant Engineering ----------

Q1_01	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	2	28.57	2	28.57
Neutral	3	42.86	5	71.43
Disagree to Strongly disagree	2	28.57	7	100.00

Sample Size = 7

Q1_02	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	6	85.71	6	85.71
Disagree to Strongly disagree	1	14.29	7	100.00

Sample Size = 7

Q1_03	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	4	57.14	4	57.14
Neutral	3	42.86	7	100.00

Sample Size = 7

Q1_04	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	4	57.14	4	57.14
Neutral	2	28.57	6	85.71
Disagree to Strongly disagree	1	14.29	7	100.00

Sample Size = 7

Q1_05	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	3	42.86	3	42.86
Neutral	3	42.86	6	85.71
Disagree to Strongly disagree	1	14.29	7	100.00

Sample Size = 7

Q1_06	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	5	71.43	5	71.43
Neutral	2	28.57	7	100.00

Sample Size = 7

Q1_07	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	3	42.86	3	42.86
Neutral	2	28.57	5	71.43
Disagree to Strongly disagree	2	28.57	7	100.00

Sample Size = 7

Q1_08	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	6	85.71	6	85.71
Neutral	1	14.29	7	100.00

Sample Size = 7

Q2_01	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	5	71.43	5	71.43
Neutral	2	28.57	7	100.00

Sample Size = 7

Q2_02	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	5	71.43	5	71.43
Neutral	1	14.29	6	85.71
Disagree to Strongly disagree	1	14.29	7	100.00

Sample Size = 7

Q2_03	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	5	71.43	5	71.43
Neutral	1	14.29	6	85.71
Disagree to Strongly disagree	1	14.29	7	100.00

Sample Size = 7

Q2_04	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	4	57.14	4	57.14
Neutral	3	42.86	7	100.00

Sample Size = 7

Q2_05	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	5	71.43	5	71.43
Neutral	2	28.57	7	100.00

Sample Size = 7

Q2_06	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	5	71.43	5	71.43
Neutral	2	28.57	7	100.00

Sample Size = 7

Q2_07	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	3	42.86	3	42.86
Neutral	3	42.86	6	85.71
Disagree to Strongly disagree	1	14.29	7	100.00

Sample Size = 7

Q2_08	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	5	71.43	5	71.43
Neutral	1	14.29	6	85.71
Disagree to Strongly disagree	1	14.29	7	100.00

Sample Size = 7

Q2_09	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	4	57.14	4	57.14
Neutral	2	28.57	6	85.71
Disagree to Strongly disagree	1	14.29	7	100.00

Sample Size = 7

Q2_10	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	4	57.14	4	57.14
Neutral	3	42.86	7	100.00

Sample Size = 7

Q2_11	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	5	71.43	5	71.43
Neutral	1	14.29	6	85.71
Disagree to Strongly disagree	1	14.29	7	100.00

Sample Size = 7

Q2_12	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	6	85.71	6	85.71
Neutral	1	14.29	7	100.00

Sample Size = 7

Q2_13	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	2	28.57	2	28.57
Neutral	5	71.43	7	100.00

Sample Size = 7

Q2_14	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	5	71.43	5	71.43
Neutral	1	14.29	6	85.71
Disagree to Strongly disagree	1	14.29	7	100.00

Sample Size = 7

Q3_01	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	3	42.86	3	42.86
Neutral	4	57.14	7	100.00

Sample Size = 7

Q3_02	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	3	42.86	3	42.86
Neutral	2	28.57	5	71.43
Disagree to Strongly disagree	2	28.57	7	100.00

Sample Size = 7

Q3_03	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	5	71.43	5	71.43
Neutral	2	28.57	7	100.00

Sample Size = 7

Q3_04	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	4	57.14	4	57.14
Neutral	3	42.86	7	100.00

Sample Size = 7

Q3_05	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	4	57.14	4	57.14
Neutral	2	28.57	6	85.71
Disagree to Strongly disagree	1	14.29	7	100.00

Sample Size = 7

Q3_06	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	3	42.86	3	42.86
Neutral	1	14.29	4	57.14
Disagree to Strongly disagree	3	42.86	7	100.00

Sample Size = 7

Q3_07	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	3	42.86	3	42.86
Neutral	2	28.57	5	71.43
Disagree to Strongly disagree	2	28.57	7	100.00

Sample Size = 7

---------- Department=Maintenance departments ----------

Q1_01	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	20	55.56	20	55.56
Neutral	10	27.78	30	83.33
Disagree to Strongly disagree	6	16.67	36	100.00

Sample Size = 36

Q1_02	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	27	75.00	27	75.00
Neutral	7	19.44	34	94.44
Disagree to Strongly disagree	2	5.56	36	100.00

Sample Size = 36

Q1_03	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	23	63.89	23	63.89
Neutral	6	16.67	29	80.56
Disagree to Strongly disagree	7	19.44	36	100.00

Sample Size = 36

Q1_04	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	27	75.00	27	75.00
Neutral	5	13.89	32	88.89
Disagree to Strongly disagree	4	11.11	36	100.00

Sample Size = 36

Q1_05	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	27	75.00	27	75.00
Neutral	8	22.22	35	97.22
Disagree to Strongly disagree	1	2.78	36	100.00

Sample Size = 36

Q1_06	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	28	77.78	28	77.78
Neutral	5	13.89	33	91.67
Disagree to Strongly disagree	3	8.33	36	100.00

Sample Size = 36

Q1_07	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	23	63.89	23	63.89
Neutral	8	22.22	31	86.11
Disagree to Strongly disagree	5	13.89	36	100.00

Sample Size = 36

Q1_08	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	29	80.56	29	80.56
Neutral	6	16.67	35	97.22
Disagree to Strongly disagree	1	2.78	36	100.00

Sample Size = 36

Q2_01	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	24	66.67	24	66.67
Neutral	9	25.00	33	91.67
Disagree to Strongly disagree	3	8.33	36	100.00

Sample Size = 36

Q2_02	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	24	66.67	24	66.67
Neutral	8	22.22	32	88.89
Disagree to Strongly disagree	4	11.11	36	100.00

Sample Size = 36

Q2_03	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	23	63.89	23	63.89
Neutral	9	25.00	32	88.89

Disagree to Strongly disagree	4	11.11	36	100.00

Sample Size = 36

Q2_04	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	22	62.86	22	62.86
Neutral	12	34.29	34	97.14
Disagree to Strongly disagree	1	2.86	35	100.00

Effective Sample Size = 35
Frequency Missing = 1

Q2_05	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	26	74.29	26	74.29
Neutral	8	22.86	34	97.14
Disagree to Strongly disagree	1	2.86	35	100.00

Effective Sample Size = 35
Frequency Missing = 1

Q2_06	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	16	45.71	16	45.71
Neutral	13	37.14	29	82.86
Disagree to Strongly disagree	6	17.14	35	100.00

Effective Sample Size = 35
Frequency Missing = 1

Q2_07	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	17	48.57	17	48.57
Neutral	12	34.29	29	82.86
Disagree to Strongly disagree	6	17.14	35	100.00

Effective Sample Size = 35
Frequency Missing = 1

Q2_08	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	26	72.22	26	72.22
Neutral	6	16.67	32	88.89
Disagree to Strongly disagree	4	11.11	36	100.00

Sample Size = 36

Q2_09	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	22	62.86	22	62.86
Neutral	8	22.86	30	85.71
Disagree to Strongly disagree	5	14.29	35	100.00

Effective Sample Size = 35
Frequency Missing = 1

Q2_10	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	13	38.24	13	38.24
Neutral	17	50.00	30	88.24
Disagree to Strongly disagree	4	11.76	34	100.00

Effective Sample Size = 34
Frequency Missing = 2

Q2_11	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	29	80.56	29	80.56
Neutral	4	11.11	33	91.67
Disagree to Strongly disagree	3	8.33	36	100.00

Sample Size = 36

Q2_12	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	27	75.00	27	75.00
Neutral	6	16.67	33	91.67
Disagree to Strongly disagree	3	8.33	36	100.00

Sample Size = 36

Q2_13	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	23	63.89	23	63.89
Neutral	11	30.56	34	94.44
Disagree to Strongly disagree	2	5.56	36	100.00

Sample Size = 36

Q2_14	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	19	52.78	19	52.78
Neutral	16	44.44	35	97.22
Disagree to Strongly disagree	1	2.78	36	100.00

Sample Size = 36

Q3_01	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	27	75.00	27	75.00
Neutral	4	11.11	31	86.11
Disagree to Strongly disagree	5	13.89	36	100.00

Sample Size = 36

Q3_02	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	21	58.33	21	58.33
Neutral	11	30.56	32	88.89
Disagree to Strongly disagree	4	11.11	36	100.00

Sample Size = 36

Q3_03	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	23	63.89	23	63.89
Neutral	7	19.44	30	83.33
Disagree to Strongly disagree	6	16.67	36	100.00

Sample Size = 36

Q3_04	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	25	69.44	25	69.44
Neutral	8	22.22	33	91.67
Disagree to Strongly disagree	3	8.33	36	100.00

Sample Size = 36

Q3_05	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	21	58.33	21	58.33
Neutral	12	33.33	33	91.67
Disagree to Strongly disagree	3	8.33	36	100.00

Sample Size = 36

Q3_06	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	23	63.89	23	63.89
Neutral	6	16.67	29	80.56
Disagree to Strongly disagree	7	19.44	36	100.00

Sample Size = 36

Q3_07	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	24	66.67	24	66.67
Neutral	7	19.44	31	86.11
Disagree to Strongly disagree	5	13.89	36	100.00

Sample Size = 36

**-------------------- Department=Nuclear Engineering Departments ----------
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Q1_01	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	28	60.87	28	60.87
Neutral	7	15.22	35	76.09
Disagree to Strongly disagree	11	23.91	46	100.00

Effective Sample Size = 46
Frequency Missing = 1

Q1_02	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	32	68.09	32	68.09
Neutral	10	21.28	42	89.36
Disagree to Strongly disagree	5	10.64	47	100.00

Sample Size = 47

Q1_03	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	33	70.21	33	70.21
Neutral	8	17.02	41	87.23
Disagree to Strongly disagree	6	12.77	47	100.00

Sample Size = 47

Q1_04	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	35	74.47	35	74.47
Neutral	9	19.15	44	93.62
Disagree to Strongly disagree	3	6.38	47	100.00

Sample Size = 47

Q1_05	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	28	60.87	28	60.87
Neutral	10	21.74	38	82.61
Disagree to Strongly disagree	8	17.39	46	100.00

Effective Sample Size = 46
Frequency Missing = 1

Q1_06	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	29	63.04	29	63.04
Neutral	14	30.43	43	93.48
Disagree to Strongly disagree	3	6.52	46	100.00

Effective Sample Size = 46
Frequency Missing = 1

Q1_07	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	28	59.57	28	59.57
Neutral	15	31.91	43	91.49
Disagree to Strongly disagree	4	8.51	47	100.00

Sample Size = 47

Q1_08	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	39	82.98	39	82.98
Neutral	8	17.02	47	100.00

Sample Size = 47

Q2_01	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	22	47.83	22	47.83
Neutral	7	15.22	29	63.04
Disagree to Strongly disagree	17	36.96	46	100.00

Effective Sample Size = 46
Frequency Missing = 1

Q2_02	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	22	47.83	22	47.83
Neutral	8	17.39	30	65.22
Disagree to Strongly disagree	16	34.78	46	100.00

Effective Sample Size = 46
Frequency Missing = 1

Q2_03	Frequency	Percent	Cumulative Frequency	Cumulative Percent

Agree to Strongly agree	22	47.83	22	47.83
Neutral	7	15.22	29	63.04
Disagree to Strongly disagree	17	36.96	46	100.00

Effective Sample Size = 46
Frequency Missing = 1

Q2_04	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	34	75.56	34	75.56
Neutral	6	13.33	40	88.89
Disagree to Strongly disagree	5	11.11	45	100.00

Effective Sample Size = 45
Frequency Missing = 2

Q2_05	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	29	64.44	29	64.44
Neutral	11	24.44	40	88.89
Disagree to Strongly disagree	5	11.11	45	100.00

Effective Sample Size = 45
Frequency Missing = 2

Q2_06	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	23	51.11	23	51.11
Neutral	15	33.33	38	84.44
Disagree to Strongly disagree	7	15.56	45	100.00

Effective Sample Size = 45
Frequency Missing = 2

Q2_07	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	18	40.00	18	40.00
Neutral	21	46.67	39	86.67
Disagree to Strongly disagree	6	13.33	45	100.00

Effective Sample Size = 45
Frequency Missing = 2

Q2_08	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	23	53.49	23	53.49
Neutral	9	20.93	32	74.42
Disagree to Strongly disagree	11	25.58	43	100.00

Effective Sample Size = 43
Frequency Missing = 4

Q2_09	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	22	51.16	22	51.16
Neutral	11	25.58	33	76.74
Disagree to Strongly disagree	10	23.26	43	100.00

Effective Sample Size = 43
Frequency Missing = 4

Q2_10	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	21	48.84	21	48.84
Neutral	8	18.60	29	67.44
Disagree to Strongly disagree	14	32.56	43	100.00

Effective Sample Size = 43
Frequency Missing = 4

Q2_11	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	27	62.79	27	62.79
Neutral	9	20.93	36	83.72
Disagree to Strongly disagree	7	16.28	43	100.00

Effective Sample Size = 43
Frequency Missing = 4

Q2_12	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	29	67.44	29	67.44
Neutral	12	27.91	41	95.35
Disagree to Strongly disagree	2	4.65	43	100.00

Effective Sample Size = 43
Frequency Missing = 4

Q2_13	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	17	38.64	17	38.64

Neutral	19	43.18	36	81.82
Disagree to Strongly disagree	8	18.18	44	100.00

Effective Sample Size = 44
Frequency Missing = 3

Q2_14	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	31	70.45	31	70.45
Neutral	9	20.45	40	90.91
Disagree to Strongly disagree	4	9.09	44	100.00

Effective Sample Size = 44
Frequency Missing = 3

Q3_01	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	35	79.55	35	79.55
Neutral	7	15.91	42	95.45
Disagree to Strongly disagree	2	4.55	44	100.00

Effective Sample Size = 44
Frequency Missing = 3

Q3_02	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	36	81.82	36	81.82
Neutral	5	11.36	41	93.18
Disagree to Strongly disagree	3	6.82	44	100.00

Effective Sample Size = 44
Frequency Missing = 3

Q3_03	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	32	72.73	32	72.73
Neutral	11	25.00	43	97.73
Disagree to Strongly disagree	1	2.27	44	100.00

Effective Sample Size = 44
Frequency Missing = 3

Q3_04	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	34	79.07	34	79.07
Neutral	9	20.93	43	100.00

Effective Sample Size = 43
Frequency Missing = 4

Q3_05	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	28	63.64	28	63.64
Neutral	13	29.55	41	93.18
Disagree to Strongly disagree	3	6.82	44	100.00

Effective Sample Size = 44
Frequency Missing = 3

Q3_06	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	28	63.64	28	63.64
Neutral	7	15.91	35	79.55
Disagree to Strongly disagree	9	20.45	44	100.00

Effective Sample Size = 44
Frequency Missing = 3

Q3_07	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	24	54.55	24	54.55
Neutral	10	22.73	34	77.27
Disagree to Strongly disagree	10	22.73	44	100.00

Effective Sample Size = 44
Frequency Missing = 3

---------- Department=Nuclear Services ----------

Q1_01	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	3	75.00	3	75.00
Neutral	1	25.00	4	100.00

Sample Size = 4

Q1_02	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	4	100.00	4	100.00

Sample Size = 4

Q1_03	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	4	100.00	4	100.00

Sample Size = 4

Q1_04	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	1	25.00	1	25.00
Neutral	3	75.00	4	100.00

Sample Size = 4

Q1_05	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	2	50.00	2	50.00
Neutral	1	25.00	3	75.00
Disagree to Strongly disagree	1	25.00	4	100.00

Sample Size = 4

Q1_06	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	3	75.00	3	75.00
Neutral	1	25.00	4	100.00

Sample Size = 4

Q1_07	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	2	50.00	2	50.00
Neutral	2	50.00	4	100.00

Sample Size = 4

Q1_08	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	3	75.00	3	75.00
Neutral	1	25.00	4	100.00

Sample Size = 4

Q2_01	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	2	50.00	2	50.00
Neutral	2	50.00	4	100.00

Sample Size = 4

Q2_02	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	2	50.00	2	50.00
Neutral	2	50.00	4	100.00

Sample Size = 4

Q2_03	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	1	25.00	1	25.00
Neutral	3	75.00	4	100.00

Sample Size = 4

Q2_04	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	4	100.00	4	100.00

Sample Size = 4

Q2_05	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	2	50.00	2	50.00
Neutral	2	50.00	4	100.00

Sample Size = 4

Q2_06	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	4	100.00	4	100.00

Sample Size = 4

Q2_07	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	1	33.33	1	33.33
Neutral	2	66.67	3	100.00

Effective Sample Size = 3
Frequency Missing = 1

Q2_08	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	2	50.00	2	50.00
Neutral	1	25.00	3	75.00
Disagree to Strongly disagree	1	25.00	4	100.00

Sample Size = 4

Q2_09	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	2	50.00	2	50.00
Neutral	1	25.00	3	75.00
Disagree to Strongly disagree	1	25.00	4	100.00

Sample Size = 4

Q2_10	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Neutral	2	66.67	2	66.67
Disagree to Strongly disagree	1	33.33	3	100.00

Effective Sample Size = 3
Frequency Missing = 1

Q2_11	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	2	50.00	2	50.00
Neutral	2	50.00	4	100.00

Sample Size = 4

Q2_12	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	2	50.00	2	50.00
Neutral	2	50.00	4	100.00

Sample Size = 4

Q2_13	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	2	66.67	2	66.67
Neutral	1	33.33	3	100.00

Effective Sample Size = 3
Frequency Missing = 1

Q2_14	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	4	100.00	4	100.00

Sample Size = 4

Q3_01	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	3	75.00	3	75.00
Neutral	1	25.00	4	100.00

Sample Size = 4

Q3_02	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	2	50.00	2	50.00
Neutral	2	50.00	4	100.00

Sample Size = 4

Q3_03	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	3	75.00	3	75.00
Neutral	1	25.00	4	100.00

Sample Size = 4

Q3_04	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	2	50.00	2	50.00
Neutral	2	50.00	4	100.00

Sample Size = 4

Q3_05	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Neutral	4	100.00	4	100.00

Sample Size = 4

Q3_06	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	1	25.00	1	25.00
Neutral	3	75.00	4	100.00

Sample Size = 4

Q3_07	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Agree to Strongly agree	3	75.00	3	75.00
Neutral	1	25.00	4	100.00

Sample

Annexure D

4.10.1 PROJECT MANAGEMENT QUESTIONNAIRE: IMPLEMENTATION OF PROJECT MANAGEMENT

Question 1: Team members are encouraged to use their creativeness and innovation. To what extent do you agree with the following statements?

Question 2: Every team member has a clear understanding of their role and responsibilities in the project. To what extent do you agree with the following statements?

Question 3: Every team member is encouraged to partake in decision making and their input is taken into account. To what extent do you agree with the following statements?

Question 4: Team members do respect one another and support each other in their project. To what extent do you agree with the following statements?

Question 5: Team members are trained on certain skills that they require to accomplish the project objectives. To what extent do you agree with the following statements?

Question 6: Team work is regarded as means to personal development and gives a sense of belonging. To what extent do you agree with the following statements?

Question 7: The project team has all the skills required for the success of the project. To what extent do you agree with the following statements?

Question 8: Good time management practise is encouraged. To what extent do you agree with the following statements?

QUESTIONS TO EMPLOYEES, PROJECT LEADERS and MANAGERS

Question 1: Statements of customer requirements are always defined, clearly understood and documented. To what extent do you agree with the following statements?

Question 2: Statements of customer requirements are always defined and clearly understood. To what extent do you agree with the following statements?

Question 3: Statements of customer requirements are always clearly understood and documented. To what extent do you agree with the following statements?

Question 4: There are procedures in place to guide in identifying customer needs. To what extent do you agree with the following statements?

Question 5: Customer requirements are prioritised according to accepted and approved procedures. To what extent do you agree with the following statements?

Question 6: Customer representative has the authority to decide on behalf of the customers. To what extent do you agree with the following statements?

Question 7: Customer liaison has the authority to decide on behalf of the customers. To what extent do you agree with the following statements?

Question 8: Resources are always planned in advance to ensure project objectives will be met. To what extent do you agree with the following statements?

Question 9: Resource loadings and capacities are optimised and agreed. To what extent do you agree with the following statements?

Question 10: Gantt chart always reflects an agreed schedule. To what extent do you agree with the following statements?

Question 11: Project objectives are clearly defined and communicated to the rest of the team. To what extent do you agree with the following statements?

Question 12: Projects are conducted or perform in line with project management principles. To what extent do you agree with the following statements?

Question 13: Project risk log is always reviewed and updated as required. To what extent do you agree with the following statements?

Question 14: Sound project management procedures are in place to guide teams. To what extent do you agree with the following statements?

QUESTIONS TO EMPLOYEES, PROJECT LEADERS and MANAGERS

Question 1: The project manager or leader always advise and coach when necessary. To what extent do you agree with the following statements?

Question 2: The project leader recognises and praises the individual and team efforts. To what extent do you agree with the following statements?

Question 3: The project leader reacts positively to performance issues pertaining to the project. To what extent do you agree with the following statements?

Question 4: The project leader actively supports team and individual efforts with guidance and assistance. To what extent do you agree with the following statements?

Question 5: The project leader actively resolves conflict and other issues promptly. To what extent do you agree with the following statements?

Question 6: The project leader or manager holds regular meetings (one-to-one) to discuss project and team / individual performance. To what extent do you agree with the following statements?

Question 7: Project manager's authority is always confirmed in writing. To what extent do you agree with the following statements?