

UNDERSTANDING THE IMPACT OF VALUE
MANAGEMENT IN PUBLIC SERVICES:
SETTING UP A VALUE MANAGEMENT FRAMEWORK
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Abstract

The purpose of this research endeavour is to demonstrate how improving organisational performance and decision-making while taking quality and efficiency into account, aside cost, can still result in benefit for the public good. Presently, industry and commerce are experiencing substantial market upheavals owing to fierce competition, volatile markets, uncertain economies, and rapidly evolving technologies. The demands on public sector management in this context are significant, necessitating individuals with technical expertise and the capacity to adapt, innovate, and cooperate successfully as team members. Shifting from models that prioritise only cost-cutting and financial gains, this study advocates for public procurement through a formal, structured, value-based management methodology that involves stakeholders in a value mapping system to guarantee that strategy implementation encompasses projects genuinely required by the country, rather than merely serving as a public relations exercise. This research focused on investigating the use of Value Management (VM) approaches, including Value Engineering (VE), within the local context and, if absent, the potential advantages of creating a Value Management Framework in the local public service sector. Value Management has been greatly used and advocated in the public sector in countries such as the United States and the United Kingdom in various industries and scenarios. However, in small states, especially in Malta, studies regarding Value Management and its potential are few if any, hence it should be understood whether public organizations, including government departments, utilise value management techniques to address challenges such as cost overruns, while taking into account the requirements of customers and consumers of the respective products or services, along with the environmental and social benefits stipulated by public procurement regulations.

In order to discover this a mixed-method design using both quantitative and qualitative techniques for data collection in the context of Ambjent Malta was employed - quasi-experimental research design utilising the Value Management Approach and Value Management Workshops methodology. The research utilised a holistic case study design framework, namely Ambjent Malta, to form the intervention of the quasi-experiment method. This methodology employed three stages. During the first phase, baseline data was gathered to assess existing attitudes and use of Value Management techniques, with the objective of outlining the prerequisites for establishing the groundwork for a standardisation model. This was accomplished by a pre-test exploration. The second component of the study design was the intervention stage which included an information session using the same cohort of participants and a final stage post-test exercise to recalibrate the knowledge-sharing activity. The pre-test and post-test data were analysed using both qualitative and quantitative methods. Three cases (multiple units of analysis) were used throughout the whole framework. The analysis of post-test research outcomes encompassed five key pillars: the influence of job designation; the implementation of a systematic tool or framework to guarantee a cost-

benefit analysis in public contract allocation; holistic value-based adjudication, moving beyond lowest cost criteria; the alignment of the project's original intent and technical solutions with client requests and long-term sustainability goals; and the improvement of communication levels within project teams and stakeholders. Conclusions indicate that by tackling identified problems and using strengths, organisations may improve project results and attain sustainable value via proficient Value Management strategies.

The study concludes that Value Management techniques can markedly improve project efficiency, quality, and stakeholder satisfaction. By adopting a systematic Value Management framework, public organisations can attain improved alignment with client specifications and original objectives, decrease expenses, and establish effective communication channels among stakeholders. The research promotes the incorporation of a Value Management framework within the Maltese public service sector across several contributing domains, emphasising its capacity to provide sustainable and efficient project outputs amid fluctuating resource needs.

Keywords: Public sector management; value management; Malta; legal framework; process improvement; good governance; project management; decision-making process; proactive strategy; client objectives; pre-test; post-test methodology; Cost Reduction; and quality management.

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Chapter 1 - Introduction

1.1 Introduction/Background

Construction in Malta is a major contributor to many economic sectors, so the improvements to identified gaps can mean a significant change to legal, environmental, wellbeing and general trade. The local construction industry, in turn, is affected by many factors, most notably inadequate design scope, designs that do not meet the client's needs or requirements, rework, and project delays, amongst many other project components. Such factors potentially lead to cost overruns on projects and are a worldwide problem, not unique to Malta.

Budget overruns are unfortunately commonplace in the construction industry (Boloi & Price, 2003). In Malta, the local scenario is mainly divided into three funding models: Government funded projects, privately funded projects and public private partnerships (PPP). Both publicly and privately funded projects have experienced cost overruns. Locally and internationally, a few examples of projects which have encountered bottlenecks, resulting in cost and time overruns, which, could have been mitigated through Value Management (VM) models include, the Mater Dei General Hospital project, Malta; Salini Salt Pans Regeneration project, Malta; the HS2 high-speed railway, United Kingdom (Comptroller; Auditor General, 2020), Mexico's suspended airport (Espejo & O'Boyle, 2018), and Ethiopia's Grand Ethiopian Renaissance Dam. Large scale megaprojects are prominent in the Middle East, exemplified through projects such as the \$500 billion NEOM megaproject in Saudi Arabia or the \$50 billion Lusail City in Qatar (Schwab, 2018) (Lusail, 2019).

A closer look at a local general hospital (Mater Dei) reveals that the project scope changed from a planned 500 bed specialist hospital project with a budget of €98.1 million to a 1,000-bed general hospital which was to serve as Malta's main Hospital and was completed at a budget of €487.7 million (Farrugia, 2020). Such project scope adjustments have a significant influence on cost management, and if done nonchalantly, the long-term impact on small state public financing mechanisms cannot be ignored.

In this regard, the Salini Salt Pans regeneration project was stalled for two years because the project scope increased, the schedule was unrealistic and project planning was inadequate, which, in turn, resulted in the suspension of EU funds. Given these instances, as well as the importance of construction to Malta's GDP and economy, the advantages of applying appropriate cost management to building projects is now crucial. However, it became clearly evident early on in this research that applying concepts in value management as a technique to support cost control is not always straightforward, especially after the initial body of literature was examined. Significant benefits can be achieved only when value management is applied in time, with particular reference to the multitude of potential soft benefits that can be extracted upon application. Given the lack of local and international research on the implementation of value management in various areas, particularly the service sector, a gap

was discovered that necessitated additional investigation, as indicated by the title of this research study.

1.2 Statement of the Problem: A Case Study for Ambjent Malta (AM)

In today's economic climate, most developed economies are concerned about the impact of public spending and government borrowing requirements on the economy. Therefore, efficiency in the delivery of public services and the way in which public institutions must use the financial and human resources at their disposal while reducing costs and improving quality, has become increasingly important over the last 30 years (Dalli Gonzi, 2019). As a result, the public sector is now under pressure, like that of the private sector, to deliver to stakeholders by demonstrating efficiency, accountability and transparency while implementing policy and adapting to change (Crawford & Helm, 2009). In this study, it was established that for the purpose of the doctoral objectives, using Ambjent Malta Department (AM) as a case study was suitable, given the researcher formed an integral part of the department. Set up in 2018, it is tasked with the conservation and improvement of Malta's natural capital and biodiversity throughout rural, urban, coastal, and maritime environments. The AM is tasked with executing green infrastructure initiatives and habitat restoration efforts to preserve and rehabilitate natural areas and protected places, including regions under the Natura 2000 network.

Since its establishment and in collaboration with various public entities and non-governmental organisations invested in Malta's natural capital, AM has executed numerous environmental initiatives, including the installation of green walls in urban spaces, eradication of invasive and non-native flora and planting of over 60,000 indigenous species throughout the Islands. It has embarked on landscaping endeavours and the management of protected areas. AM is also executing initiatives to enhance Malta's tree coverage and foster environmental consciousness, including the 34U sponsorship program and the planting of indigenous trees or shrubs for each birth. Given the process that pertain strongly to this department in the areas of procurement, a study with its main focus on value management presented an ideal case. The *raison d'être* was built upon the understanding that value management, as a concept, is considered as one of the ideal mechanisms in procurement systems to ensure that the best value for money can be attained, while taking into account the needs of the customer and the users of the product/service.

As prescribed in the Public Procurement regulations with the core value of the Public Service Management Code playing a greater role, the contextualising of this problem and the application of value management begins to take shape. Investment in procurement methodologies brings the benefits applicable to a country like Malta to the forefront. As projects and services utilise the tender system to conform with principles outlined in public sector procurement processes, the objectives to obtain quality projects that adhere to time

frames and ever-restricting project costs are a crucial case to be studied. Additionally, as market changes have impacted the scarcity of raw materials and logistical inflations, the problem-solving exercise for the public sector requires incorporating models for sustaining long-term cost management for the benefit of investors, taxpayers and private individuals, within such a research project.

In the first phase of this doctoral study, the literature attempts to examine how Value Management (VM) methods could form an integral part of procurement processes whereby tenders, awarded on the basis of the Most Economically Advantageous Tender (MEAT)/ Best Price Quality Ratio (BPQR) or principle of Lowest Cost, can support the adjudication cycles, and address quality requirements whether for 'project scope' principles or for technical requirements. The extent or possibility of this application will be determined as an integral part of this undertaking. It was critical to examine the use of Value Management (VM) in the public service environmental sector, to confirm or negate whether substantial deficiencies in VM understanding and execution among participants existed. Internationally, comparisons and data confirmed that the incorporation of VM concepts into procurement procedures has improved procurement results and project success exists.

To investigate the problem further within the 'Ambjent Malta' context, a number of cases were made available to the researcher and selected through adjudicating criteria. The first case study about the establishment of a *Bird Observatory at L-Għadira s-Safra* offered the possibility of highlighting existing gaps and problems related to stakeholder involvement and decision-making. In this regard, during the early discussions with the team and the supervisor, the researcher was being directed towards the statement problem, and it seemed relevant to the study to organise and formulate any data collection or analysis through organised stages. This seemed to emerge clearer as the data collection stages progressed. The second case study made available to the researcher concentrated on the *Rehabilitation of the Old Radar Station* located in Marfa, Mellieħa. This case stressed that an investigation into the problems related to VM use, decision-making, and the setting up of project goals was required given that in some stages VM use was very rudimentary. Gaps related to the formation of systematic frameworks for assessing project requirements and devising solutions to such needs in public sector projects were apparent, so the case data allowed problems related to conservation objectives and VM principles evident at the start, to emerge. This issue seemed to pertain to a heightened need for comprehending effective methods in public sector circles that could harmonise cost-effectiveness and environmental stewardship.

The third case study available to the researcher, constituted the *Buskett Public Convenience* project, relating to a statement problem which was identified in the relationship between VM's capacity to enhance solutions, and the possibilities of obtaining stakeholder agreement. Thus, understanding these steps relating to the statement problem of this study, enabled the researcher to concentrate on the ultimate result of the investigation, on the existing state of

knowledge and the deficiencies in understanding where the research endeavour would aim to exploit.

1.3 Research Gap

The research gap concerning the query or issue which had not yet been addressed by any of the existing studies or research in this field, pertained to the extent of VM application in public sector procurement projects in Malta. This study, using prior MSc research data as a basis, sought to examine the degree of VM application via a novel approach known as the quasi-experimental research approach, which had not been previously used, at least locally. Consequently, the primary objective was to emphasise the advantages of VM tools and methodologies in the context of public service entities that are engaged in relevant, contextual projects. Data consolidated from the MSc results seemed to make the case that a need to optimise organisational decision-making and performance through value-based methodologies, with the goal to enhance project efficiency and cost-effectiveness. The benefits were not limited to cost but also include quality and efficiency.

The data collected in the study conducted by the researcher in 2017 initially forming part of a Masters in Science in Project Management based at the Faculty for the Built Environment, titled as follows: - 'Factors Causing Budget Overruns in the Maltese Construction Industry', identified a list of thematic factors which affirmed that cost overruns in the local construction industry (obtained through data collated from the study) existed, as well as the extent of project cost overruns in Malta (expressed as a percentage) of 5 to 10% according to 42.3% of construction practitioners (Mifsud Grimaud, Factors causing budget overruns in the Maltese Construction Industry, 2017). One of the concluding results revealed that 'value management' could be utilised as a cost overrun reduction component with its potential for application in major projects. Thus, building upon past data, this study intended to explore this phenomenon further in an attempt to understand the extent of its application through multiple cases.

In this regard, the overall aim is to conclude the benefits, not only in terms of cost, but especially in terms of the quality and efficiency that can be provided by VM tools and methodologies when applied to public service entities as can be utilised within a value management framework.

Executing significant projects by enhancing organisational decision-making and performance for effectiveness and efficiency using value-driven techniques is key to public sector enterprise. The researcher's exposure to in-house planning and data gathering, furthermore highlighted a need for a focused approach towards public procurement and objective achievement within a constrained timeframe. Organisational processes indicated that the underutilisation of Function Analysis Exercises may have represented a deficiency in the overall management of these activities.

Other critical criteria, such as enhancing the visitor experience and ensuring accessibility, were generally addressed via technical and economic solutions formed part of the general understanding for the research gaps in this study. Overall, project users demonstrate heightened satisfaction when the project's progress and results aligned with the original objectives (Dalli Gonzi, 2019); thus, it is essential to identify the obstacles that may impede or facilitate the establishment of a management framework in this regard. Furthermore, the research supports VM's effectiveness in enhancing project results, fostering stakeholder engagement, and advancing essential sustainability ideas. This is further discussed in Chapter 2 of this doctoral work.

The definition of Value Management and its evolution, as outlined in the European Standard (EN12973), represents a fundamental concept integrated within current management systems and methodologies. It emphasises value and function-oriented thinking, behaviour, and methods, particularly aimed at motivating individuals, enhancing skills, and promoting synergies and innovation to optimise the organisation's overall performance (European Committee for Standardisation (CEN), 2020). In this regard, the output of any research study often aims to enhance a product, process, or improve a service. Supported by a need to facilitate standards in the context of public procurement processes, the doctoral study looked towards the aim of building or incorporating standards (such as a Standard Operating Procedure, SOP) substantiated by the concepts arising from the need for comprehensive VM integration, proactive stakeholder involvement, and ongoing methodological enhancement to use VM's potential in its entirety.

Frameworks that include best practices from worldwide standards which could be tailored to the Maltese context ensures the integration of well-established and defined standards for incorporating environmental targets, particularly in projects managed by the Environmental Department, which in this case was relevant for the Ambient Malta Department. Frameworks established via literature studies, statistical and thematic analyses, and stakeholder input guarantee relevance and application (Langford & Male, 2001), serving as the essential foundation for this project and its pursuit of a cost-benefit strategy for the public sector.

1.4 Purpose of the Study and Research Objectives

The research aim for this study has been developed below:

To investigate whether the techniques of Value Management (VM) incorporating Value Engineering (VE), are used in the local scenario and, if not, what benefits can be achieved by implementing a Value Management Framework in the local public service sector environment.

To address this aim, this research focuses on overall value, improving the social, psychological and environmental aspects of a project instead of one based on monetary value alone. The purpose of this research is twofold.

1. To acquire a comprehensive understanding of the usage of Value Management in Malta and to analyse the understanding of Value Management applications in Malta through a case study: Ambjent Malta;
2. The second purpose builds on this as it tests out Value Management by implementing it through a quasi-experiment methodology using a pre-test, post-test method (which will be explained in depth throughout chapter 3).

The data gathered and analysed in this research elucidates the current circumstances, the motivations for implementing Value Management, and the significance of using Value Management Methodology in moving forward.

Research Objectives (a) to (f);

- a. To analyse and determine the use of value management in the public sector through a review of international literature.
- b. To determine the extent to which value management can support Best Value Practice in local public sector scenarios, based on the analysis of international literature.
- c. To identify the types of local government projects typically benefitting from the application of value management methodologies.
- d. To determine where intervention possibilities exist in the public service management processes in order to construct a project model that supports value engineering that enhances project success.
- e. To examine the correlation between the implementation of VM in public sector major projects and project success outcome.
- f. To set up the pillars for a value management framework.

1.5 Research Questions and Hypotheses

The two research questions were identified as follows:

- I. Can value management techniques be used to achieve best value in the local public service sector and improve the quality of the public service?***
- II. Do value management methods improve project efficiency and quality in the public sector? If so, how?***

These questions were developed further to answer the hereunder identified objectives and hypotheses, each designed to explore critical aspects of Value Management (VM) in the

context of project management and public procurement. The hypotheses for this study were identified to be as follows:

- Experiencing a Value Management approach positively influences the belief that structured tools/frameworks ensure a cost-benefit approach.
- The original intent/need of the project is tested sufficiently to ensure alignment with the Client's requirements.
- The technical solution to the project need is tested using appropriate tools or techniques.
- The project's objectives in relation to the project need (scope) are achieved.
- The level of communication within the project team and between stakeholders improves.
- There is a correlation between respondents' knowledge or experience of Value Management and project success outcomes.
- The implementation of a structured tool or framework enhances the cost-benefit approach in awarding public contracts, as recommended in Public Procurement Regulations, compared to current methods.
- Inadequate alignment and verification processes during project planning and execution phases result in inconsistent achievement of project objectives.

1.6 Research Methodology

The research commences with a contextual background and literature review. This was required to construct a background understanding of VM and its characteristics, best value, current legal acts and procedures, the nature and function of public service sector services and other applications of VM globally.

The thesis methodology is based on the following steps:

1. A mixed method design of quantitative and qualitative approaches for data gathering within the context of Ambjent Malta.
2. Data gathering related to the current perceptions of VM in Malta and its current use, with research sample consisting of project sponsors, project clients, project leaders and financial stakeholders, contributors or investors with a focus on the local environment department – Case study: Ambjent Malta.
3. Multiple case studies (same contextual environment).
4. Participant observation, and qualitative/quantitative analysis.
5. Quasi-experimental research design using the Value Management Approach and Value Management Workshops methodology.

1.7 Significance of the Study

Currently, industry and commerce are undergoing significant market transformations due to intense rivalry, unstable marketplaces, precarious economies, and a swiftly advancing array

of technology. The expectations placed on management in this environment are substantial. The sector consistently requires people with technical skills, adaptability to change and innovation, and the ability to engage and collaborate effectively as team members. The significance of this study is to demonstrate how public sector services may prioritise project value and cost efficiency, with resulting outcomes.

Value management may serve as one of the strategies to ascertain the best value for money, considering the requirements of both customers and users of the product/service, alongside environmental and social advantages, mandated by the Public Procurement Regulations. This fits within the broader context of the core value articulated in the Public Service Management Code. Such investments may benefit Malta, as a crucial element of the EU structure and key players in a broader EU framework. Additionally, frameworks incorporating global best practices, adaptable to the Maltese context, can guarantee the integration of established standards for achieving environmental objectives, especially in projects overseen by Ambient Malta Department. Additionally essential criteria, including the improvement of public user feedback and quality assurance, constitute a fundamental aspect of the research gaps identified earlier in this study.

The impact of the study on the research field, includes areas related to public sector capacity and procurement processes. Enhancing the knowledge base and competencies of public sector personnel and relevant stakeholders in practice requires that working programs are developed to strengthen current professional development in both theoretical knowledge and practical implementation techniques. The possibility of incorporating VM methods into public procurement regulations is being looked at to assure consistency and optimise value obtained from public projects (Green & Popper, 1990). The iterative approaches for enhancing VM procedures could make such processes more responsive to the changing demands of the public sector and assure conformity with advancing best practices (Olawale & Sun, 2010). Literature indicates that value management may enhance project management enabling project managers to make better informed choices via the use of value management's innovative tools and processes.

This inquiry is significant to the research aim since value management is regarded in the literature as a proactive, innovative, distinctive, and strategic method. Therefore, it may be used to enhance project management processes that tend to support major projects given a substantial investment. Value management defines a project's roles and the most effective strategies to meet its requirements, hence optimising value for the principal customer and end user. Thus, in conclusion, the advantages of using a value management strategy are many and significant, enabling the client, society, community, and consumer to reap benefits from the execution of a value management plan in any particular public management route.

1.8 Organisation of the Study: Key Phases

The study consists of a total of four phases with the scope of: -

- Reviewing current knowledge through literature critique.
- Building the conceptual design of the model through emergent themes.
- Use of a Pre-test, Post-test method development.
- Producing a final framework for implementation.

Phase 1: Reviewing current knowledge – focused on reviewing present knowledge from literature in the area of intended study, therefore the use, benefits and current frameworks of Value Management. This phase also identified problems within the subject area and established the need for the study.

Phase 2: Building the Conceptual Model – this phase focused on conceptualising the idea of integration forwarded in this research and to support the overarching idea. An initial pre-test questionnaire was developed in order to investigate and form the concept based on the perception of Value Management and the key drivers for applying Value Management in the public service sector.

Phase 3: Use of a pre-test/post-test method development; This phase analysed the result of the initial pre-test questionnaire study in order to find the gaps present and map iterative stages to identify, support, or negate existing issues and barriers which were addressed through the study.

Phase 4: Producing a final framework for implementation - This phase focused on setting up and administering Value Management information Session/s and Workshops to test the level of engagement using Value Management principles in the public service, in the context of Ambjent Malta. Value Management Workshops were used to collect the data required and a post-test questionnaire constituted a second stage data collection. All stages lead to the final preparation of the framework and standards.

1.9 Research Ethics

This study adheres to the University of Malta's Research Ethics Policy. The researcher was fully cognisant that, for all components of this project apart from the literature review, ethical permission was a prerequisite. This permission had to be acquired from either the Faculty Research Ethics Committee (FREC) and/or the University Research Ethics Committee (UREC) and was identified by the submission code BEN-2023-00038. The researcher was also aware that an ethics research proposal form needed to be filed at various stages, and an application for data collection approval was submitted and subsequently approved. Moreover, confidentiality, data security, and other people's intellectual property rights have been thoroughly considered and addressed.

Chapter 2 - Literature Review

2.1 Introduction

Value management has been proven internationally to be applicable to all types of projects in different sectors, be it manufacturing, engineering, construction or even to improve public services such as transport and infrastructure (Male, 2016). In today's world, industry and commerce are experiencing tremendous changes in the marketplace, brought about by aggressive competition, volatile markets, shaky economies, and a very rapidly evolving array of technologies. In this situation, the demands on management for quality and efficiency are enormous.

Value management is a methodology aimed at optimising value for money while considering the requirements of the customer and consumers of the product or service, as well as the associated environmental and social advantages. A Value Study may be classified as either a Value Management Study, a Value Engineering Study, or a Hybrid Study. Value Management research examines the principle: What is the rationale behind my investment? What is the rationale for the investment? - What is its purpose? - What advantage do we want to attain? - The Value Management Study scrutinises the scope by revisiting foundational principles at the idea stage, perhaps leading to a significant transformation of that concept (Male, 2016). - It examines and evaluates the need of the project, clarifying the requirement and the rationale for its execution. Consequently, the Value Management Study may be characterised as a scope or business-oriented analysis (Male, 2016).

A Value Engineering Study, on the other hand, looks at the technical aspects of the project and asks whether the current solution is the right technical solution to meet the need. It considers the concept to be correct. Value Engineering considers that the scope and strategic mission phase of the project has been completed and makes changes to design phases and technical improvement phases. Therefore, the value engineering study can be summarised as a technically oriented study (Kelly, Male, & Graham, 2015).

2.2 Definition of Value Management

Value management, developed during the Second World War and formerly known as value engineering, has had numerous definitions and interpretations and has been expressed in different terminology. Over the years, no single definition has emerged that encompasses the various meanings associated with it worldwide. In this regard, Woodhead and Downs (2001) state that: "each definition of Value Management doesn't capture its complete meaning, together they provide a tapestry that does allow us a richer understanding" (Woodhead & Downs, 2001). Looking at the evolution of the definition, in the European Standard (EN12973), it is a fundamental concept applied within the framework of existing management systems

and approaches, based on value and function-oriented thinking, behaviour and methods, particularly focused on motivating people, developing skills, fostering synergies and innovation with the aim of maximising the overall performance of the organisation (European Committee for Standardisation (CEN), 2020). Furthermore, different definitions that have formulated direction through time, are outlined below:

- A systematic, multidisciplinary effort directed toward analysing the functions of projects for the purpose of achieving the best value at the lowest overall life cycle project cost (Norton & McElligott, 1995).
- A structured approach to defining what value means to a client in meeting a perceived need by establishing a clear consensus about the project objectives and how they can be achieved (Connaughton & Green, 1996).
- The integration of proven and structured problem-solving techniques . . . implemented by a multidisciplinary team under the guidance of a knowledgeable value practitioner to seek out the best functional balance between the cost, reliability and performance of a product or project (Thiry, 1997).
- Value Management (VM) as a philosophy, together with its associated tools and techniques, emphasises the need to consider function and cost in a structured and systematic way, as part of any strategic decision process (Hong Kong Institute of Value Management, 2019).
- Value Management's underlying principle is to achieve the required functions at the lowest possible life cycle cost without sacrificing quality. The purpose is to simulate the discovery and examination of high-cost areas and encourage creativity which result in generating better alternatives that maximise the value of the product or service (Fong, Shen, & Cheng, 2001).
- Value Management can be defined as a process in which the base needs/requirements of a project are made explicit and appraised as required and determined by the client, customer and other stakeholders (Kelly, Male, & Graham, Value Management of Construction Projects, 2004).

As defined by Kelly, *et al*, (2004) above, Value Management is thus a term used for a specific process at the project level. This process is determined by the explicit functional requirements of the client's own value system. The task of the Value Management process is to fulfil the client's needs/requirements with the required quality and the lowest possible life cycle cost. As a process, it aims to optimise the strategic, conceptual feasible technical and operational aspects of a project and its outcomes in terms of the same unique value system (Kelly, Male, & Graham, Value Management of Construction Projects, 2004).

What is Value?

Value as a concept is very subjective and changes depending on the perspective from which it is viewed. A customer might regard best value as the “best buy”; a designer might view value to be something that provides the highest degree of function, while a manufacturer will probably consider value as the lowest cost. A general concept more widely accepted is that value is a ratio of quality and cost. However, authors suggest differences depending on the individualistic approach and viewpoint (Thiry, 1997).

Tassinari (1985) reports that:

“Value increases when the satisfaction of the customer’s need augments, and the expenditure of resources diminishes.”

This definition has been agreed upon in the European Standard EN12973 which defines the concept of value to be similar to the effective and efficient use of resources in order to define, prioritise and deliver needs, therefore, achieving the best possible balance.

EN 12973 features the following ratio in order to define this particular concept: (European Committee for Standardisation (CEN), 2020).

$$Value \propto \frac{Satisfaction\ of\ needs}{Consumption\ of\ resources}$$

In the value discussion, the relationship between function and cost lies in the actual meaning of function and cost.

For this definition of value, one might consider function/value to be the capability to respond and therefore meet the customer’s needs, whilst resources are to be considered as the global overall resources required and necessary to fulfil that need completely (Thiry, 1997). Miles stated that a product or service is considered to have a good value when it has an appropriate performance and cost. Hence the term “best value” refers to the most cost-effective means to successfully accomplish a function that will meet the performance expectations of the customer (Stewart R. , 2005).

Recent perspectives further expand on these definitions, Orel *et al.* (2024) discuss value in terms of modern public management capabilities, emphasising the effective use of resources to address global challenges. They highlight how contemporary management strategies aim to enhance value by improving resource allocation and meeting public needs effectively (Orel, Kulinich, Smahliuk, Popov, & Rychka, 2024).

Roubtsova (2024) explores value within enterprise architecture, highlighting how the concepts of "value" and "capability" are defined and utilised in contemporary standards. This

approach focuses on integrating value management into the broader context of organisational capabilities and strategic objectives (Roubtsova, 2024).

Additionally, De Giovanni (2024) presents a modern, consumer-centric approach to defining quality and value, identifying twenty-one dimensions that contribute to the contemporary understanding of value in quality management. This perspective emphasises the importance of aligning value with consumer expectations and market dynamics (De Giovanni, 2024). Kryvoviazuk (2024) discusses value creation in the context of digital business transformation for international corporations, focusing on strategic management's role in leveraging opportunities and enhancing value. This approach underscores the dynamic nature of value in modern business environments, where digitalisation and strategic innovation play crucial roles (Kryvovazyuk, 2024). Khaleel and Ibrahim (2024) focus on shareholder wealth and value creation through market value-added and economic value-added metrics, highlighting modern performance measures that reflect the financial aspects of value in contemporary management practices (Khaleel & Ibrahim, 2024).

‘Function’ within the value management framework

Function is that specific purpose for any product or service, that characteristic which makes them work or sell; hence, it is closely related to value (Stewart R. , 2005). Function is a critical part of Value Management (Thiry, 1997). In the context of Value Management and Value Engineering, function is defined as an action for which something exists. Therefore, something is said to have served its function if it has met its requirements of use. There is, thus, a close link between function, specification and performance. If considering a service for example, a functional service would be when all the inputted energy into the service is focused 100% on the customer. Likewise, a project is functional when its outputs meet client’s requirements (Kelly, Male, & Graham, 2015).

In Value Management, function can be defined as a concept describing a need in terms of expected performance rather than its expected solution. Such a concept enables the value team to generate creative alternatives that are not based on paradigm (Thiry, 1997). One can also list a few basic characteristics of functions:

- Functions are use- or performance-orientated.
- A product can have several functions.
- Functions are totally independent of solutions.
- Each function of the same product is independent (Thiry, 1997).

Function is normally defined in Value Management as a verb and noun. Depending on the function, design methods and feasible options will be different. This is evident as a function of a same object/service can vary depending on the application and requirement. Taking the function of a window as an example, this could vary on the location. For example, whilst it is normal for a window to serve the function of ventilation and lighting, the main function of a

prison cell window would probably be to create a more humane environment (Zhang & Mu, 2013).

Understanding this functionality is critical in order to get the best value as it represents an important part of the design rationale. Function and value are related by the solution that yield such value and the functions such solutions perform. This also ensures that value increases when functions are optimally aligned with processes, outcomes and purposes (Utomo, Murti, & Idrus, 2015).

2.3 Function Analysis

Numerous projects especially those dealing with facilities and management processes involve multiple stakeholders. This is especially so within public organisations where one normally finds numerous regional and local government entities, regulatory agencies and special interests and public citizen groups involved in the project development process. This normally brings radically different views by the various stakeholders with respect to the importance of a project's objective.

Therefore, the application of Value Management within the context of a value study is a profound concentrated effort in which key stakeholders come together with a single goal –to improve the value of the project. Here, the application of Function Analysis provides the opportunity to identify and define incomplete or overlooked project issues, risks and objectives, while fostering direct communication between stakeholders through a consensus-driven process. For this reason, Function Analysis should be at the forefront of the Value Methodology. As Robert. B. Stewart (2005) states, understanding the problem is half the battle when it comes to finding solutions that add value to the project (Stewart R. , 2005).

This is a crucial factor in this research because anyone who states that they use some form of Value Methodology will be asked if they utilise Function Analysis and if so, how it is applied. This will be the most important test to determine whether Value Management is truly being applied. Indeed, this argument is also echoed and reinforced by the European Value Management Standard, whose local implementation is one of the main objectives of this study, which states that the Value Analysis/Value Engineering methodology is characterised by a function-based approach that requires the formal application of Function Analysis (European Committee for Standardisation (CEN), 2020).

According to the European Standard EN12973:2020, Function Analysis is a fundamental process at the core of the Value Management Approach and is an essential component in order to qualify value at any strategic or technical level. The type of function analysis and the functions that are worked on, change throughout the progress of the study. This ensures that the defined functional performance fulfils the necessary need and requirements are met. Function Analysis thus contributes to the evolution of the culture in an organisation which therefore helps it have effective Value Management (European Committee for

Standardisation (CEN), 2020). This is true as Value Management emphasises functions, as a significant underlying principle of Value Management is that of achieving the required project functions at the lowest possible cost without sacrificing quality. The purpose of function analysis is to stimulate discovery and examination of high-cost areas and to encourage creativity, which, in turn, should lead to the availability of better alternatives that can maximise the value of the product or service (Fong, Shen, & Cheng, 2001). The idea behind the term Function Analysis is to take the value team back to basics by challenging them to answer the key questions of Why, What, and How? (Kelly, Male, & Graham, 2015).

Function Analysis is considered to be at the core of value management (Spaulding, Bridge, & Skitmore, 2005). In fact, Miles back in 1972 emphasises that the one specific purpose of Value Management is in fact the identification and elimination of unnecessary cost. Therefore, Function Analysis is the systematic process in order to identify functions and the associated costs involved and assessing the necessity of those functions based on established criteria for the product or service. This makes function analysis extremely important in the Value Management process (Spaulding, Bridge, & Skitmore, 2005).

Function Analysis highlights technical solutions which place focus on the actual needs and wants of the customer. It helps guide the different stakeholders to a consensus on the objectives of a project. The technique/tool of function analysis requires that a function be described by a verb and noun. It is helpful to use active verbs instead of passive. The goal of such a tool is to identify, compare and classify the functions in order to build a virtual, function-oriented model of the project. A function analysis systems technique known as FAST diagram is highly versatile. It helps improve communication and motivation and can be used to cover a diverse range of complex problems in all sectors (Thiry, 1997).

Barton in 1991, described function analysis as that aspect which sets Value Management apart from other systems and processes (Barton R. , 1991). This is due to the fact that in function analysis one finds a close relationship between functional requirements and value capture. Therefore, when all functions are achieved at the lowest cost, good value is also achieved (Zhang & Mu, 2013).

One of the objectives for using function analysis during the early stages is in order to establish solutions to project problems that offer the best value for money. The function analysis technique requires all relevant information to be discovered through the issue analysis and then structures that information to establish the primary objectives of the project (Yu, Shen, Kelly, & Lin, 2007).

According to a study carried out by Skitmore in 2005, it was found that the most important elements in Value Management were considered to be brainstorming, function analysis and teamwork (Skitmore M. , 2005).

2.4 Background on Value Management

The origins of Value Management go back to the era of the Second World War in the United States. The phrase Value Analysis was created by a Purchase Engineer of General Electric Company. Miles had questioned the possibility of using alternative materials due to the lack of materials available stating: 'If I cannot obtain the product, I must obtain an alternative which performs the same function.' (Kelly & Male, 1993).

Value Analysis, conceptualised by Miles, emerged as a technique in 1947. It emerged from a problem-solving approach developed to identify alternatives for current designs. The value technique was first designed to address constraints in material supply. This occurred when a product, initially manufactured without issues, required redevelopment using alternative components (Jay & Bowen, 2015). This meant, then, that while it was essential to keep the function the same, the method of providing that function had to be changed. This later became a means of identifying lower cost materials, simplifying lower cost designs and lowering manufacturing costs (Thiry, 1997) (Spaulding, Bridge, & Skitmore, 2005).

Many of the techniques used were applied elsewhere, but a specific centralised focus on "function" made the value engineering methodology, as it was known at the time, unique (Jay & Bowen, 2015).

Central to the group process was the use of function analysis, a method that describes an item or product with a two-word couplet consisting of a verb and noun that identify its function (Shillito & De Marle, 1992). It is the analysis of function in these terms that is the key to the entire methodology and differentiates it from other problem-solving approaches (Thiry, 1997).

Key to the methodology was a questioning logic that allowed people to determine the function of the components in a design, which were laid out by Miles in a sequence of five steps called "The Job Plan". This plan was seen as a structured organised approach to conducting a value study. This Job Plan formed the basic structure of Value Analysis and has been successfully applied in all sectors: manufacturing, systems processes, health care, construction, software development and others making it a universal approach (Thiry, 1997). The five phases set-up by Miles were: Information, Analysis, Creativity, Judgement and Development Planning (Thiry, 1997).

This was later re-defined and improved upon and can be summarised as per the following (Kelly, Male, & Graham, 2015):

- Phase 1: Orientation.
- Phase 2: Information.
- Phase 3: Speculation.
- Phase 4: Analysis.
- Phase 5: Development and Planning.
- Phase 6: Schedule Execution.

- Phase 7: Status Summary and Implementation.

Value Engineering followed Value Analysis and is still currently in use in the United States especially in the manufacturing industry. In the UK this became popular in the construction industry especially in the 1990's and was renamed Value Management (McGeorge & Palmer, 1997). In fact, Value Management is the term widely used nowadays in the UK as the encompassing term for value engineering, value analysis, value planning, value review, value methodology and value management reviews (Kelly, Male, & Graham, 2004).

Recent literature has continued to emphasise the evolution and relevance of Value Management in modern contexts. For instance, Orel *et al.* (2024) highlight how contemporary governance strategies incorporate Value Management to address current challenges in public management, thereby enhancing resource allocation and community resilience (Orel, Kulinich, Smahliuk, Popov, & Rychka, 2024). Moreover, Roubtsova (2024) discusses the integration of value streams and capability maps in enterprise architecture, demonstrating the evolving application of Value Management principles in strategic planning and organisational development (Roubtsova, 2024). These modern perspectives show that Value Management continues to be an essential methodology, adapting to new challenges and sectors while maintaining its core principles of function analysis and resource optimisation.

2.5 Value Management in Other Countries

Value Management is being used internationally by governments, especially in the UK, USA, Australia, Europe, Japan, Korea, Hong Kong and India. This was amongst various factors attributed by Fong (1999) to have been helped through the introduction of professional bodies such as The Society of American Value Engineers (SAVE), the Institute of Value Management in the UK, the Associazione Italiana per la Gestione e l'Analisi del Valore (AIAV) in Italy, l'Association Française pour l'Analyse de la Valeur (AFAV) in France, VDI and DACE in Germany and the Netherlands respectively, the Hong Kong Institute of Value Management (HKIVM), the Canadian Society of Value Analysis (CSVA), Indian Value Engineering Society (INVEST) and the Society of Japanese Value Engineering (SJVE) amongst others (Fong P. , 1999).

Palmer in 1996 reports numerous differences between the UK, USA and Japan. The Value Management system in the UK takes place earlier when compared to the US with more emphasis placed on all the project objectives and user needs with more focus on use of the building than cost when it comes to construction. The American System is also based on a forty-hour workshop structured around a modern interpretation of the Job Plan carried out by an external team at the design stage normally at 35% of the Project Life Cycle. This study broadly consists of selecting high-cost areas of the project and generating alternatives to them. On the other hand, the British system of a Value Management Study takes place at a usually earlier stage of the Project Life Cycle and carried out by the Project Design Team but

led by an external VM facilitator. Palmer also highlighted that the Japanese Value Management system is drastically different than the UK and US system as the Japanese Value Management Study is a continuous process in all stages of the Project (construction). The major differences between the Japanese compared to the UK and USA systems are mainly due to key different business cultures and practices and it is, in fact, advised that there should be a clear understanding of these when applying Value Management (Palmer, 1996).

A fundamental difference between the UK and US in terms of the Value Management Study lies especially with regards to the duration spent during the Workshop. Whilst in the UK it is normal to have only one day workshops, which are sometimes reduced to half-day due to commercial pressures, this is not the case in the US with more time spent on workshops ranging between three to five days. This helps provide opportunity for a more in-depth study (Ellis, Wood, & Keel, 2005).

One other major difference between UK and US practice is how the workshop time is utilised during the study. UK practices generally have everyone working together as a team throughout the study and any individual work is done outside the workshop, whereas in the US, a certain period of time is devoted to individual working during the development stage of the job plan, Table 2.1 outlines four inconsistencies of workshop practice between the UK and the US (Hunter K. M., 2006).

Table 2.1: Characteristics of Workshop Practices in the UK and US (Hunter and Kelly, 2004).

Workshop Characteristics	UK	US
<i>Workshop Duration</i>	1 day	3-5 days
<i>Project Team/ Independent Team</i>	Project Team	Project Team/ Independent Team
<i>Working Practices During Study</i>	Teamwork	Teamwork and Individual
<i>Inclusion of Job Plan Presentation Phase</i>	N/A	YES

In terms of similarities, Pasquire and Maruo, 2001, reveal that the Value Management approach is similar between the countries regardless of the different terminology, team structures, techniques and Value Management intervention points. Pasquire and Maruo argue that the approach is similar due to the way of thinking and experience in these countries namely, UK, USA and Japan (Pasquire & Maruo, 2001).

Other similarities found between the UK and the US in both VM / VE Workshop studies include that they both start with a pre-workshop investigation, which might involve interviews with the client and design team, site visits, document reviews and the compilation of the workshop agenda. The output of both workshop studies is also similar and will be a workshop report describing the proceedings of the workshop which is an auditable document (Hunter K. M.,

2006). Value Engineering has been used by US Government agencies since the early 1950s and has been compulsory by law for projects since 1996. Since 1993, the Federal Office of Management and Budget has required government departments in the US to use Value Engineering to reduce costs, maintain quality and achieve best value. The Circular OMB A-131 was revised in 2013, again supporting the sustained use of value engineering by Federal Departments and Agencies in order to reduce programme and acquisition costs, improve performance, enhance quality and foster use of innovation. It also states that agencies should maintain policies and procedures in order to ensure that Value Engineering is considered and integrated, as appropriate, into the planning and development of agency programmes, projects, activities, as well as contracts for services and supplies. The Circular continues to state that Value Engineering shall be required for all new agency projects and programmes when the project cost estimate is at least \$5million, whilst agencies should establish criteria to help agency officials determine when Value Engineering may be suitable for ongoing projects and programmes (Office of Management and Budget, 2013).

In the UK, Value Management has been used significantly in the various sectors especially in the construction industry since the 1990s. The UK Cabinet Office has also issued guidance on the Management of Value (MoV) supporting a training programme in best value practice overseen by the UK Cabinet office. MoV supports the principles of Value Management in a comprehensive programme of improving benefit and reducing expenditure, when possible, without impacting essential project scope or service quality (Kelly, Male, & Graham, 2015).

Various organisations within the UK use Value management in Capital Projects including; The HM Treasury, Ministry of Defence (MoD), London Underground Ltd, Lord Chancellor's Department, the Department of Trade and Industry (DTI) and the British Airports Authority Plc (Fong P. , 1999). Furthermore, in Italy, the Public Procurement Legislation No. 207 of 2010 states that the drafting of complex works should preferably be carried out using the Value Analysis technique in order to ensure optimisation of the overall cost of the intervention (DECRETO DEL PRESIDENTE DELLA REPUBBLICA n.207, 2010).

In Australia, the Government implemented Value Management for its Federal Projects Costs of at least 5 million Australian dollars equivalent to 4.5m US Dollars (Karim, Rahmin, Danuri, & Mohamed, 2013). In Japan a similar requirement is mandated for Projects costs in excess of 175 million Japanese Yen equivalent to 2 million US Dollars (Karim, Rahmin, Danuri, & Mohamed, 2013). Examining the utilisation and effects of Value Management across various countries, along with its adherence to distinct legal stipulations, fosters comprehension of its prospective benefits and advantages. This analysis elucidates how it can be locally employed to optimise the introduction and implementation of an implementation framework for Value Management, underscoring the necessity of establishing such a framework within the local public sector.

2.6a Benefits of Value Management

The Value Management European Standard (2020) states that Value Management offers the following visible benefits:

- Better business decisions, which can be supported by customers and users by providing decision-makers with a sound basis for their choices.
- Increased effectiveness by organising and using limited time and resources to best effect; delivering better environmental, social, economic, and financial outcomes.
- Improved products for users and customers by clearly understanding, prioritising and satisfying their real needs.
- Enhanced competitiveness by facilitating technical and organisational innovation and resource efficiency.
- Aligning members of the organisation to its goals, critical success factors and values through improved internal communication and knowledge; and
- Enhancing communication and efficiency through multi-disciplinary and multi-task teamwork.

It also states that these benefits are available to all and applicable to all providers and consumers in all sectors of society, individuals, organisations, networks and governments (European Committee for Standardisation (CEN), 2020). The Institute of Value Management UK (IVM) lists among the benefits of Value Management the fact that it delivers returns on investment of between 20 to 40 times the cost of delivering the Value Management Process, plus significant soft benefits with low risk. The IVM Report specifically mentions that Value Management demonstrably delivers: (Institute of Value Management, 2014).

- Value Improvements in excess of 20% which includes savings of between 10% and 25%.
- Tangible returns on investment of between 20 and 40 times the resource costs.
- Significant benefits in terms of improved working relationships and organisational learning.

Specifically, Value Management delivers:

- Recognisably better decisions based on relevant and balanced information on a whole life value basis.
- Improved performance of products, services and programmes together with a project delivery that better reflects the needs of the stakeholders.
- Increased efficiency through team-based activity with a common focus.
- Enhanced competitiveness, by facilitating and realising latent creativity and benefits.
- A common value culture.
- Organisational learning and improved capability to embed change.
- Appropriate challenge to outdated solutions and standards, therefore encouraging innovation and utilisation of new technology (Institute of Value Management, 2014).

Jay and Bowen, (2015) conclude that case-studies of the results of traditional forms of value studies indicate that Value Management is still a powerful approach today for finding

innovative solutions to problems in the design of products, processes and services, and for addressing design issues that affect the whole organisation and its value chain. In a later study, they describe VM as a powerful tool for entrepreneurial development (Jay & Bowen, 2015).

According to the Value Management Handbook, 1995, Value Management enables better focused and more efficient management actions, a clearer understanding of the real needs of the customers and users of the products and systems, higher quality business decisions at both strategic and operational levels, lower operating costs, teams focused in contributing to the objectives of the business and greater project control.

Similar to the European Standard, it states that Value Management concerns all kinds of organisations in:

- The government, health and public service sectors.
- The industrial sector including manufacturing, construction and process plant.
- The services sector (European Commission, 1995).

In the US, the Ministry of Transportation of Ontario has conducted Value Engineering studies since 1995 and reports savings from the ministry's Value Engineering programme to exceed \$150 million since 1998, whilst also listing benefits in business process improvements, innovative ideas, better collaboration with partners, better project performance, improved safety and maximising value for taxpayers (Ontario Ministry of Transportation, 2015). Hiley and Paliokostas (2001) emphasise that the primary benefit identified from their literature review and interviews was that Value Management facilitated the establishment of clear objectives, enhanced communication, improved team cohesion, and fostered a better understanding among project members and stakeholders.

The above-mentioned items are classified in the study as 'soft benefits' and are distinguished from the traditional benefits of enhancing quality and elimination of unnecessary cost (Hiley & Paliokostas, 2001). These 'soft benefits' especially team building, better communication amongst project team due to the present workshop structure and the airing of any potential disagreements and resolutions are also outlined by Green and Moss (1998). Another significant contribution to Value Management highlighted by Green and Moss is the consensual decision making. Ensuring that decisions are rational, explicit and countable (Green & Moss, 1998). Bone and Law (2000), on the other hand, focus more on the traditional benefits in terms of increased productivity, enhanced competitiveness and profitability, and improved performance (Bone & Law, 2000).

As a decision-making tool in the design and realisation of projects, Value Management offers a structured framework service, which enhances the value of a project in many ways. It involves a systematic multidisciplinary effort led by an experienced facilitator that maximises the functional development of a project from concept to completion, focusing on the better optimisation of project cost, as well as promoting more efficient and effective constructability (Rangelova & Traykova, 2014). The Institute of Value Management (IVM) argues that VM can

be applied incrementally, generating a return on investment that is 20 to 40 times higher than the costs required to implement the VM process. In fact, the IVM argues that VM demonstrably delivers improvements in excess of 20%, including cost savings of between 10%-25% together with improved performance of products, services and a project delivery that better reflects the needs of the stakeholders (Institute of Value Management, 2014). Another reference would be the practice in the USA, for example by the Department of Transportation Highway Administration, which achieved an average 5% cost saved across all States totalling \$1,086,629,295 in aggregate savings achieved by applying Value Engineering (Department of Transportation - Highway Federal Administration, 2018).

The application of Value management results in many benefits to a project as outlined by Smith (2007) hereunder:

- Provides a forum for all concerned parties in a project development.
- Provides an authoritative view of the entire project, not just a few elements.
- Develops a shared understanding among key participants.
- Identifies project constraints, issues and problems which would not have been identified otherwise.
- Improves the quality of the definition.
- Identifies the priorities and objectives of a project.
- Identifies and evaluates the means of meeting needs and objectives.
- Deals with the life cycle not just initial costs.
- Usually results in remedying project deficiencies and omissions and superfluous items.
- Ensures all aspects of the design are cost effective for their required purpose.
- Identifies and eliminates unnecessary costs.
- Provides a means to identify and incorporate project enhancements.
- Provides a priority framework against which future potential changes can be judged.
- Crystallises an organisation's brief priorities.
- Maintains a strategic focus on the organisation's needs during the development and implementation of a project.
- Provides management with the information it needs to make informed decisions.
- Permits a large return on a minimal investment.
- Promotes innovation (Smith, 2007).

These are similar to the benefits highlighted in the OGC Risk and Value Management Guide listed hereunder:

- Establish what value means to the client in terms of business benefits and priorities.
- Identifying and agreeing business needs.
- Identifying and evaluating options for meeting business needs.
- Selecting and agreeing the best option to meet these needs.
- Defining and agreeing on the project objectives.

- Refining the design to maximise value and eliminate waste not directly related to the project objectives (Office of Government Commerce, 2007).

Recent studies continue to confirm these benefits. For instance, Wang, Dulaimi, and Aguiar (2021) discuss how Value Management enhances decision-making processes and leads to significant cost savings and improved project outcomes in the construction industry. Their research emphasises the importance of stakeholder engagement and functional analysis in achieving these benefits (Wang, Dulaimi, & Aguiar, 2021).

The use of Value Management in contemporary projects has shown the ability to enhance creativity and facilitate cooperation among project teams. Li, Love, and Matthews (2022) assert that the use of Value Management principles in project planning and execution improves the alignment of project goals with stakeholder requirements, hence boosting project performance and sustainability (Li, Love, & Matthews, 2022). Value management and value-based thinking prioritise the needs of clients, customers, end-users, and other important stakeholders. It underscores their needs and, as a management approach, pursues new solutions to fulfil the same criteria and duties (Kelly, Male, & Graham, 2015).

2.6b Value Management: Costings for its Operations

The expenses associated with value management mostly include the costs expended by the Value Management team, the facilitator of the Value Management Workshop, and any expenditures necessary before, during, and after the workshop to achieve the desired outcomes. This encompasses the resource expenses associated with the Value Management process, in addition to the venue expenses for the necessary workshop(s). Another significant economic effect is the time invested by all participants, which detracts from their everyday job tasks. Nonetheless, the advantages far surpass these expenses, as shown in the preceding section. The Institute of Value Management (IVM) argues that VM can be applied incrementally, with the possibility of delivering returns on investment of between 20 to 40 times the costs required in order to deliver the Value Management process (Hunter K. M., 2006).

Regrettably, a significant obstacle to the global implementation of value management, particularly within the construction sector, has been the financial resources necessary to support the value management process. The perception is that the supplementary expenses associated with establishing a specialised Value Management team and the requisite personnel elevate costs needlessly, yielding little benefit to the clients. However, even after considering all the cost and the barriers to Value Management, the advantages far outweigh the cost incurred (Olawumi, Akinrata, & Arijeloye, 2016).

Skitmore (2005) notes that the cost of the Value Management Workshop, estimated at around 0.3-0.5% of the value of the project value including briefing, workshop, and debriefing, is unfortunately a major problem. As a result, various interlocutors in his study including the

government of New South Wales, Australia, did not consider Value Management necessary for small projects. However, a reasonable ratio of savings to costs to justify a workshop was given as 10:1 (Skitmore M. , 2005).

Value Management is, therefore, seen as a very low-cost but highly beneficial exercise, especially when integrated as early as possible in the project life cycle. The costs incurred can become essentially negligible, especially when one takes into account the reduced need for subsequent reports and reviews when value management is replaced by routine appraisals and audits, which are always required (Olawumi, Akinrata, & Arijeloye, 2016). The cost associated with Value Management compared to the benefits are almost dismissible (Jaapar, 2011). Another study found that the costs of conducting a Value Management workshop rarely exceeds 1% of the total project costs, whilst it can potentially save between 10% to 15% of total project costs (Olawumi, Akinrata, & Arijeloye, 2016).

The Hong Kong Environment, Transport and Works Bureau (Technical Circular Works No. 35), 2002, states that whilst initially the cost of a Value Management Workshop might appear high and time consuming, costing approximately 20-50 professional days on top of around \$100,000 in professional facilitator fees for a two-day workshop, in the long run, these costs have proven to be well spent with gains in:

- Updating standards, criteria and objectives.
- Promoting innovation.
- Eliminating unnecessary items and costs.
- Optimising resources.
- Finding solutions that best fit the specific project objectives.
- Saving time.
- Breaking dead lock situations.
- Ensuring ownership and commitment by all stakeholders (Environment, Transport and Works Bureau Government Secretariat Hong Kong, 2002).

2.7 Value Management in the Project Life Cycle

2.7.1 The Project Life Cycle (Definition)

In the analysis of project management, projects often go through many stages known as the project life cycle (Gardiner, 2005). Each phase is often defined by one or more deliverables, and the phases commonly overlap due to a strategic approach. Each phase has a defined objective and scope of activity, along with a crucial decision point, sometimes termed 'gateways', to assess progress achieved and necessary next actions. This enables enhanced management oversight of the project and guarantees that challenging problems are not neglected while resources are used more effectively (Association of Project Management , 2019).

There are different views on how many phases form the Project Life Cycle and what should comprise the content of each (Graham, 2001). Considering first a four-phase project life cycle the following phases are worth noting; (Gardiner, 2005).

Phase 1: Initiation and Definition

The first phase signifies the commencement of the project. In the commencement and definition phase, the project justification is established according to the sponsor's needs. The requisite expenses and benefits are often examined via a feasibility study.

Phase 2: Planning and Development

At this juncture, significant choices have been made about the design of the project's final goods and the methods for their realisation. Consequently, planning and development include the establishment of scope management plans, work plans, timelines, and resource allocations.

Phase 3: Execution and Control

The execution and control phase is when project deliverables are expected to align with or surpass specifications and be delivered punctually. This period also exhibits the greatest spending rate.

Phase 4: Closure

Closure is considered to be the formal part of a project, representing the end of a project and characterised by the closing of the project, which involves completing the documentation and administration requirements, as well as arranging handover (Gardiner, 2005).

The afore mentioned phases can be further subdivided and extended. In the construction industry, the Royal Institute of British Architects, RIBA, has divided the Project Life Cycle for construction projects into seven phases as depicted below: (RIBA, 2020).

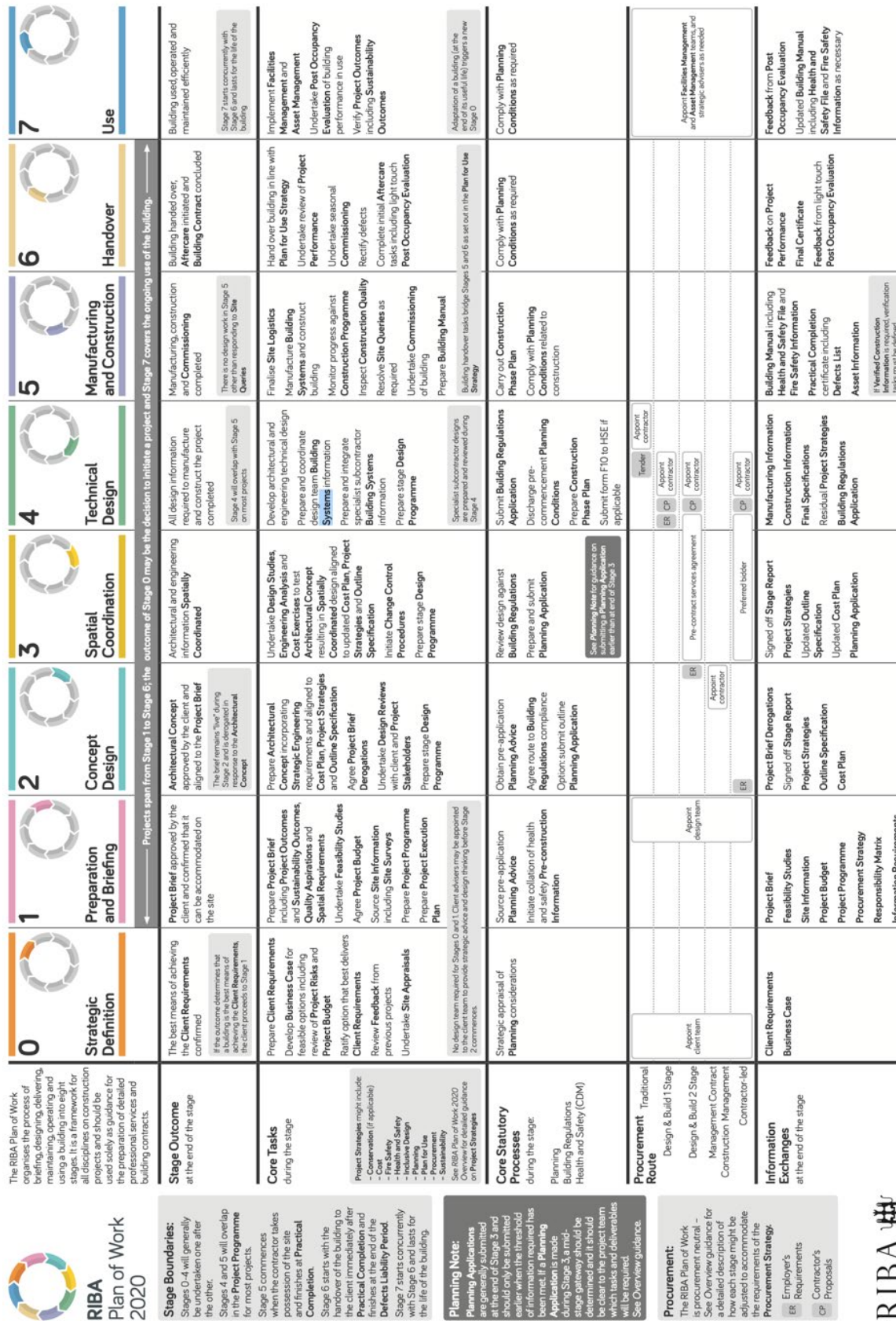


Figure 2.1: RIBA Project Life Cycle.

The RIBA project life cycle formed the development of the generic process protocol for the construction industry and maps the whole project process from the emergence of a client's need through to operations and maintenance (Kagioglou, Cooper, Aouad, & Sexton, 2000).

In a Value Management context, Male *et al.* (2015) make use of this RIBA project life cycle as it represents the most detailed life cycle provided by a professional institute for construction. As a consequence, Male *et al.* (2015) have linked it to common Value Management intervention points.

Thus, the generic Value Management Process can be broken into two parts:

- *Value opportunities during the entire project life cycle with possible intervention points.*
- *The inputs and outputs from the Workshop Process carried out.*

The different bodies and standards cite different starting points for value management. However, there are some commonalities between them. All approaches cover the part of the project life cycle that deals with project concept, project briefing and design development. Another commonality is that most approaches consider it beneficial to implement value management as early as possible in the project life cycle.

Figure 2.2 shows how from these approaches Male *et al.* (1998) derive five intervention points of convergence for Value Management opportunities in the project life cycle.

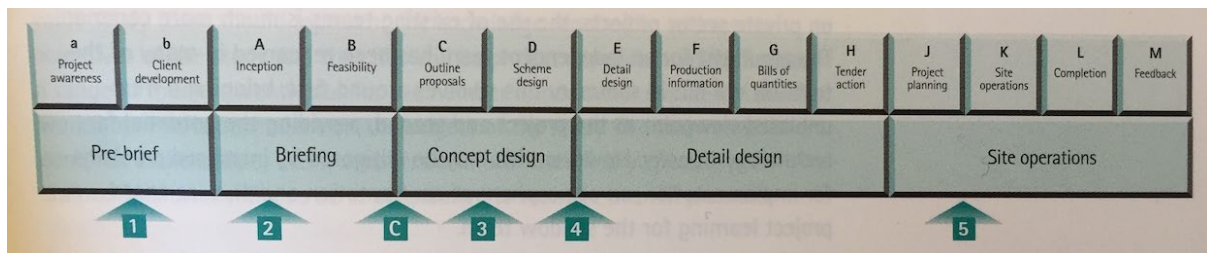


Figure 2.2: Value Opportunity Points identified (Male, Kelly, Fernie, Gronqvist, & Bowles, 1998).

These are: *The briefing workshop, The concept design workshop, The detail design workshop, The Charette, The operational study* (Male, Kelly, Fernie, Gronqvist, & Bowles, 1998).

2.7.2 Incorporating Value Management (into the Project Life Cycle)

In 2006, Hunter devised a Three Stage Project Model to integrate Value Management Opportunity points into the project life cycle tailored to the needs of the Public Service Sector. This Project Model had three stages: Pre-Project, Project, and Post-Project, as seen in Figure 2.3 below. In this developed Project Model, four intervention areas for Value Management opportunities were discovered. These included two opportunity intervention areas in the Pre-Project Phase that could be addressed in the same Value Management session and, thus, may be considered as one. This phase is regarded as the one in which the majority of issues arise and necessitates more time. Opportunity Point Two was during the Project Stage during the tactical design phase of the project. Additionally, two more opportunity points, applicable in four distinct stages, were identified in the Post-Project Stage. The two Value Management

opportunity points included here were positioned to guarantee the effective integration of the project into the main company (Hunter K. M., 2006).

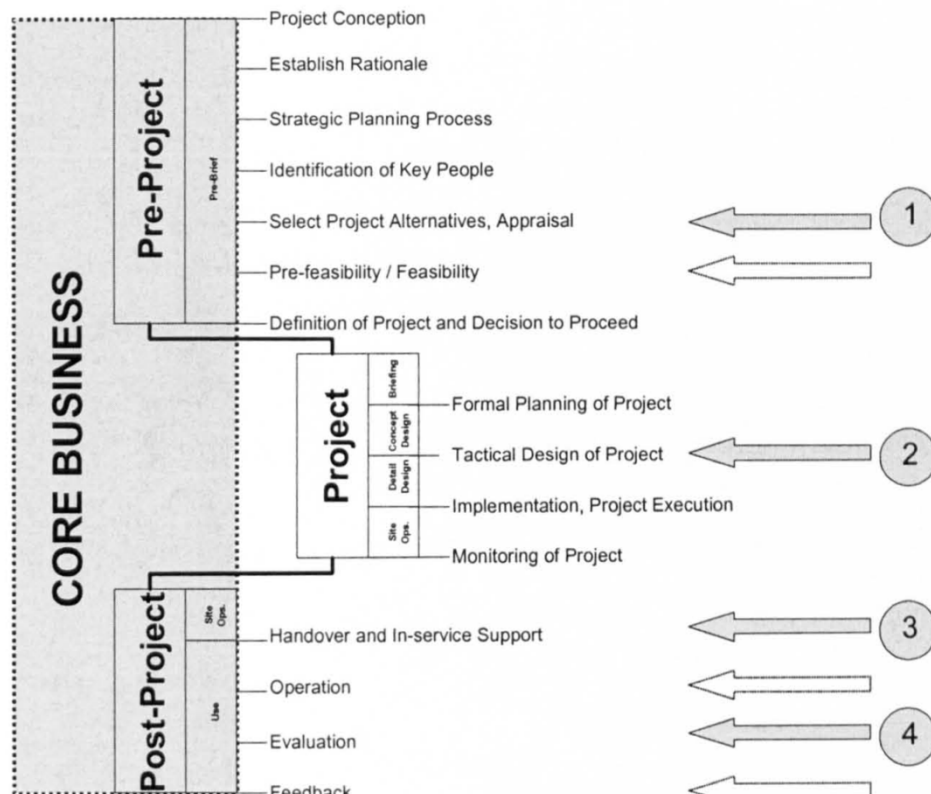


Figure 2.3: The Three-Stage Project Model Adapted for the Public Service Sector (Hunter, 2006).

In theory, when considering the construction industry, Value Management techniques can be applied at any stage of the building design process. In fact, Value Management has been used throughout the life cycle of a project; in practice, however, in order to get maximum return of Value Management input, it is usually applied to a project at early design stages e.g., the Conceptual Design and Sketch Design. In order to obtain overall optimisation of a building system, Value Management techniques should be included in the design process (Shen, 1993) as depicted in Figure 2.4 below. This view corresponds to those expressed by Dell'Isola and Kirk *et al*, in 1982 and 1988, respectively, who agree that the earlier it is possible to apply Value Management techniques to a project, the better the results that can be expected (Dell'Isola, 1982) (Kirk & Spreckelmeyer, 1988).

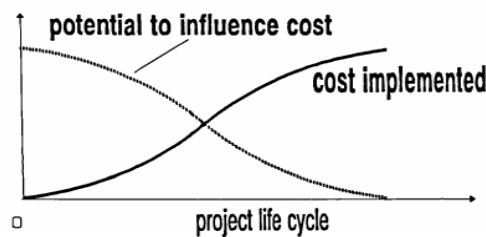


Figure 2.4: The Potential to Influence cost over Project Life Cycle (Shen, 1993).

Smith, in 2007, highlighted seven potential opportunity application points for the insertion of Value Management, these were: (i) Concept stage; (ii) Pre-feasibility stage; (iii) Scheme Design/feasibility stage; (iv) Detailed design/appraisal stage; (v) Implementation/construction phase; (vi) Commissioning/operation; (vii) Decommissioning/end of assets (Smith, 2007).

When considering Value Management as applied in Government Projects, the OGC (Office of Government Commerce, UK) Procurement Guidance on Value & Risk Management in the UK states that Value Management is about enhancing value and not about cutting cost, although this may be a by-product of the result or process. As previously defined by Male *et al* (Male, Kelly, Fernie, Gronqvist, & Bowles, 1998) and the European standard, the OGC sustains that the principles and techniques of Value Management aim to achieve the required quality at an optimum whole-life cycle cost during the process of project development. The aim of Value Management is to maximise Project Value within time, cost and quality constraints.

The OGC lists the following as critical differences between value management and cost reduction:

- *Value Management is a positive element by focusing on value rather than cost, therefore seeking to achieve an optimum balance between quality whole life cost and time.*
- *Structured, auditable and accountable.*
- *Value Management is a multi-disciplinary approach, seeking to maximise the creative potential of all project participants including the client. It helps all stakeholders to work together as an integrated project team.*

The OGC, similar to Male *et al* (Male, Kelly, Fernie, Gronqvist, & Bowles, 1998), also considers Value Engineering as a part of Value Management which considers specific aspects of the design, construction, operation and management. It highlights that cost cutting without a proper analysis is likely to lessen value and only unnecessary cost should be eliminated without any loss of function or quality.

The OGC also links risk and value management together as it considers them both continuous processes throughout the procurement lifecycle and provides what it calls a Gateway Process. This is a process which highlights the main points in the procurement process where risk and value management activities take place and summarises these activities. A Gateway Process is also defined in the OGC in order to highlight the continuous involvement of value management throughout the procurement cycle with some key decision points highlighted.

This Gateway process helps to reduce overall project risk by examining the project at critical stages in the project's life cycle in order to provide assurance that it can progress successfully to the next stage. The project sponsor should ensure that a value management plan is drawn up and incorporated in the project execution plan.

The following Review Points, Table 2.2, are recommended by the Office of Government Commerce, UK, (Office of Government Commerce, 2007).

Table 2.2: Review Points.

Gateway	Phase Description
Before Gate 0	To identify Stakeholder needs, objectives and priorities.
Gate 0	Strategic Assessment
Before Gate 1	Study to evaluate options that could meet user needs
Gate 1	Business Justification
Before Gate 2	To develop output-based specification, to refine and evaluate options that satisfy project brief and objectives.
Gate 2	Procurement Strategy
Before Gate 3	To Apply Selection and award criteria
Gate 3	Investment Decision
Before Decision Point 1 (Outline Design)	Study to Optimise Whole: life cycle design quality and cost.
Decision Point 1	Outline Design
Before Decision Point 2 (Detailed design)	Study to optimise whole-life cycle design quality and cost. Integrated project team to asses buildability of design.
Before Gate 4	Finalise design and start implementation
Gate 4	Readiness for service
Before Gate 5	Review and Feedback of lessons learned (post-Mortem)
Gate 5	Benefits Evaluation

Understanding the project life cycle, its many stages, and the possible inputs for Value Management implementation is essential, as this will constitute a vital component of the local framework for implementing Value Management in public sector projects.

This research will concentrate on analysing the existing Project Life Cycle and framework used in local Public Sector projects prior to proposing an enhanced project life cycle framework that incorporates Value Management within this new structure.

2.8 Value Management and the Public Sector

In today's economic climate, most developed economies are concerned about the impact of public spending and the impact of government borrowing requirements on the economy. Therefore, efficiency in the delivery of public services and greater attention to the way in which public institutions must use the financial and human resources at their disposal, while reducing costs and improving quality, has become increasingly important over the span of the last 30 years (Dalli Gonzi, 2019).

As a result, the public sector is now under similar pressure as the private sector to deliver to stakeholders by demonstrating efficiency, accountability and transparency while implementing policy and adapting to change (Crawford & Helm, 2009).

The California Department of Transportation (Caltrans) Value Analysis Programme has been using the Performance Measures Process since the year 2000. This process has been applied to over 150 Value Analysis Studies. Stewart and Cilch, 2006, state that the facilities developed by public agencies are intended to serve the public which are therefore funded, in turn, through the levy of taxes upon the public. Hence, the definition of customer, varies significantly between public and private entities. Private customers make explicit and independent buying decisions based on fulfilment of a specific desired function. On the other hand, from the perspective of a public agency, users more than customers, do not make explicit buying decisions but rather are procuring implicitly through the act of paying taxes. Therefore, expectations may be very different, while some users may not use a particular public facility at all. Private bodies/businesses offer a particular product or service to appeal to a particular customer and market sector. Public authorities/agencies might implement projects that do not meet the wants and/or needs of a wide range of potential users. This is crucial for understanding the different determination of value, as it is the customer or user who must ultimately determine the value.

Public projects are usually driven by a sponsoring agency that is responsible for managing their development and construction. Since most projects today are very large, there are several additional stakeholders representing other public agencies as community groups, individuals and private organisations. In such scenarios, problems can arise as these agencies often do not all agree on the need and requirements of a project, let alone the performance requirements. Such problems usually result in projects that ultimately do not meet the needs of the majority, are delayed due to political squabbles and lead to cost overruns (Stewart & Cilch, 2006).

Public sector initiatives, particularly transportation projects, are intrinsically distinctive. Public undertakings, irrespective of governmental jurisdiction, must vie with other initiatives for diminishing public financial resources. Consequently, public initiatives are crucial in political discourse. The execution of public projects is a prominent and significant means by which the public may assess the efficacy of their political representatives.

This often leads to some projects being completed to support the political agenda rather than to serve the public interest. Two common examples of this are the so-called "pork barrel" projects, which usually involve spending large sums of money for an inappropriate benefit, and the "sunk cost" effect, which describes the tendency of politicians to pump more and more money into failing projects that should be discontinued. Unfortunately, in these situations, political expediency usually trumps logic and common sense. The benefits/value of Public Projects can often be difficult to quantify. This is so because while economic analysis methods, such as cost-benefit analysis, can be useful for planning purposes, it is exceedingly difficult to place monetary value on such things as the environment and human lives. While there may indeed be actuarial and scientific data to support such calculations, these calculations fail miserably in expressing the qualitative impacts of the loss of human life and the degradation of human health and the environment. In fact, no politician or ranked government official would dare to publicise that such calculations or analysis formed the primary basis in their decision-making process (Stewart & Cilch, 2006).

"Value for Money" has become a keyword for evaluating the government's performance and achievement in recent years. Value for money is, nowadays, seen as a prerequisite in all public sector transactions around Europe, with public sector clients demanding that those designing and implementing projects provide them with best value. Public sector capital projects are increasingly subject to national economic pressures; hence, it becomes even more important for project teams that look beyond their projects for solutions (Fong P. , 1999).

This is where Value Management can serve as an indispensable tool even in the public sector. However, the link of value management with the public sector is not that well associated, thus there are very limited publications in this area (Hunter K. M., 2006).

According to an IVM UK report titled Two Thousand Pounds a Second that focuses on reducing unnecessary cost in the public sector, a well-managed value programme will frequently deliver in excess of ten times the benefits in cash or kind in relation to costs. This is better than most other performance improvement techniques claim. It must also be considered that in adopting a value approach, other useful approaches do not have to be rejected. This is so because the Value Management technique provides a framework including other approaches which can be integrated. The Employer's Organisation in the UK has since recommended Value Management as the most appropriate approach to improvement and good Human Resource Management (HRM). All in all, value management is the best buy for Public Services. As a conclusion to this report, the Institute believes that, as a matter of policy, all public services should be required to operate an auditable value programme covering every aspect of their activities. The overall result would be a public sector that is continually improving (Institute of Value Management).

A UK government White Paper in 1995 entitled "Setting new standards: a strategy for Government procurement" suggested new strategies for better value for money in government procurement. As the report highlighted, the cheapest initial cost is rarely the

same as best value for money (Chancellor of the Exchequer, 1995). This was an interesting development in the UK, which was followed by the Best Value Act of 1999.

2.8.1. The 'Best Value' Concept, UK

The concept of Best Value as a procurement philosophy was introduced in the UK by the Labour Government in 1999. The main goal of the new concept was to improve service quality (Higgins, James, & Roper, 2004).

The aim of the new concept was to repeal the Compulsory Competitive Tendering (CCT) which was used in the UK before 1999. This, however, required a culture change in the thinking and behaviour due to the different technical requirements of Best Value. The HM Treasury in its document Value for Money highlights that the UK Government provide and procure services on the basis of value for money rather than lowest cost (Hunter K. M., 2006).

Amongst various benefits resulting from the applying of Best Value as mentioned by Higgins et al. (2004) are responsiveness to users, staff morale, allocation of resources, service quality, service efficiency, service effectiveness and accountability to the public. These are aligned to the objectives aimed for when using Value Management (Higgins, James, & Roper, 2004).

The idea of achieving value for money should be a key requirement of any government project (Audit Commission, 1996). This idea is supported by Fong (1999) who states that; 'value for money has become a keyword for evaluating the government's achievements in recent years, ' and that public sector clients expect projects that add value (Fong P. , 1999). The Best Value Act requires authorities to secure continuous improvement in exercising all their functions with due regard to economy, efficiency and effectiveness" therefore ensuring that value for money is achieved (UK Government Act, 1999).

Sanderson (1996) suggests that the purpose of public services is to meet the social requirements and needs and not to satisfy public preferences (Sanderson, 1996). Thus, the private sector is more likely to achieve customer satisfaction by taking into account individual needs and desires. Stewart and Walsh (1992) highlight that; 'The mistake is to assume that there is one approach to management applicable to public services based on an over-simplified model of the private sector.' Thus, there is uncertainty as to whether private sector methods in terms of researching society's needs to ensure widespread customer satisfaction will reshape public sector practice (Stewart & Walsh, 1992).

One particular issue that effects a public organisation which is not normally present in the private sector is political consideration and the fact that politics has a tendency to get in the way of successful provision of services. Another issue highlighted is that public entities at times do not have the necessary resources, including funds, in order to carry out market research to examine trends and improving service delivery (Nutt, 2000).

Mismanaged resources keep the public sector inefficient and underutilised. When the quality of resources is jeopardised due to short-time frames or unrealistic ministerial demands, the

impact on organisations, citizens and the environment is taxing. The important question for the proactive public manager is what one achieves with the resources available. An important desire for governments is to deliver better public service at less cost to the public purse. It is critically important for governments to understand that the public citizens are the customers whose requirements they need to meet, as citizens know when they are being provided with the service and security they need or not (Dalli Gonzi, 2019).

On the other hand, due to the public sector having more limitations and constraints than the private sector, it is also subject to a higher degree of scrutiny by the public when compared to the private sector. One advantage identified, which could also be viewed as a disadvantage, is that the public sector does not have the pressure the private sector has to make profits. While the private sector with its focus on increasing profits clearly has to be more competitive, the public sector must take note of its strategic needs and wants as outlined by Hunter, 2006, and depicted in Table 2.3 below (Hunter K. M., 2006).

Table 2.3: Strategic Needs and Wants of a Public Service (Hunter K. M., 2006).

Strategic Needs	Strategic Wants
Satisfy service needs	Fill a service gap
Satisfy a broad social need	Respond to private sector failure
Ensure the well-being of society	Satisfy public preferences
Maximise citizens utility	Meet best interests of general public
Achieve customer satisfaction	Ensure equality
Improve core services	Promote differentiation
	Satisfy individual needs and desires

Thus, Male *et al*, in their report study, highlight that, in order to implement Value Management within the UK Public Sector, the following should be the foundations of such a system:

- A capital procurement procedure to allow expenditure through a Value Management department.
- This same Value Management Department should have an allocated budget which forms part of the capital spend of the project in order to undertake value management activity.
- This Value Management department should also have qualified staff skilled in Value Management. This would enable the department to recognise and track potential offered by Value management on projects.
- Ensure that the intention is to ensure value for money and not cost cutting.
- Agreements with procuring agency for meetings with project design team should be the focus.
- The Value Management department should follow the project until completion and ensure the effectiveness of the Value Management actions.
- Such a policy should draw together the best of the public sector (Male, Kelly, Fernie, Gronqvist, & Bowles, 1998).

From the study regarding Value Management and Best Value in the Public Sector carried out in Scotland by Hunter in 2006, the following propositions were recommended in the result:

- I. Value management is a service which can maximise the value of government services to achieve Best Value.*
- II. The Value Management methodology can identify opportunities to add value to any type of project by making the best use of resources, identifying the project objectives, and determining the clients' values and requirements of the end user.*
- III. Innovative and 'out of the box' thinking is encouraged by using and during the Value Workshops and therefore help drive a change of attitude from the standard risk free, 'closed box' thinking normally encountered with.*
- IV. All projects regardless of the industry sector undergo similar stages throughout the life of a project or programme. Likewise, pre and post project stages are also comparable in terms of activities undertaken to prepare and acknowledge the project in core business. Therefore, similar issues appear at similar project stages, and these are generic in nature.*
- V. The audit of Best Value can be facilitated by the methodical process of value management which can also illustrate the route taken by local authorities achieve Best Value (Hunter K. M., 2006).*

Corrigan and Joyce in 1997 describe the role of the government both central and local as being:

"Conceived of as an organisation under the direct control of elected representatives of the public, with a mandate to deliver services (and take other initiatives) which are needed by the public in a defined geographical area, whether a locality or a nation State. The representative system is defined as concerned with meeting the needs of the people."

(Corrigan & Joyce, 1997).

In this context, it should be noted that the thinking hat of 'strategic government' could be used to understand the importance of considering citizens as our customers (Dalli Gonzi, 2019). Maddock in 2002, quoting Charles Falconer, states that "Public service must reflect real lives and deliver what people really want" (Maddock, 2002). A publication by Bone (1994) was initiated to introduce what Bone calls a 'missing element' in the public sector that could be filled by Value Management. It is stated that the public sector will benefit by reducing public expenditure and that the introduction of this method represents an 'opportunity' and is an example of the importance of public sector management knowing what methods are available to increase the value of public services. Value Management is described as another tool for managers; 'an extremely powerful tool; arguably one of the most effective management methods, which has proved its worth in many countries around the world since the 1950s' (Bone C. , 1994).

2.9 Summarising the Case Studies of Value Management

As mentioned by the IVM in 2014, Value Management has proven to be beneficial internationally and demonstrably delivers improvement in excess of 10%. Some examples of application of Value Management which gathered improvements include:

Saving of £350million (£419 million) for major UK Airport Operator with the application of Value Management.

A major airport operator in the UK underwent significant changes in internal and external structures in order to improve in their delivery of value for money. The implementation of a Total Value Management Programme by the company enabled the company to save £350 million (£419 million) whilst also improving quality and performance (Institute of Value Management, 2014).

Major Pharmaceutical Development Gained Funding with the Help of Value Management

The Value Management studies carried out helped the company achieve their objectives with a 15% saving over the whole development (Institute of Value Management, 2014).

Value Management in London Underground

The South Wimbledon Refurbishment Project, which was part of the major improvement of stations on the Northern Line, developed an implementation plan that achieved a considerable number of the original required key benefits. The aim of the project was to enhance the passenger environment whilst improving operational functionality. These aims with the help of applied Value Management were achieved whilst also reducing the funds required by half (Constructing Excellence, 2005).

Pizza Hut UK

Pizza Hut was anticipating a programme of 25 refit projects in 1997 at an estimated/budget value of £145,000 each, amounting to a programme value of over £3.5 million. In order to review the projects before going on site, a series of three half-day value management workshops was convened comprising the client representatives, i.e., the Area Manager and Property Manager and the consultants, including the Architect designer, Quantity Surveyor and Services Engineer. The workshops were facilitated by an experience value management facilitator from outside the project team.

All three workshops carried out used a traditional format of information exchange, functional analysis, brainstorming of different solutions, evaluation of preferred alternatives, acceptance and implementation. As a result of nine hours of workshop and a similar amount of work outside the workshops by members of the team a total of £14,000 (£16,768) per project was saved, equivalent to £350,000 (£419,000) capital cost on the whole programme. As a result of the workshops, quality standards in particular areas were actually raised, and longer-term maintenance was reduced. A shorter contract period was also established, and shorter delivery times were achieved for certain long lead time items.

The total cost of the value management exercise was estimated at less than £10,000, (£11,977) giving a return of 35:1 on the investment (Constructing Excellence, 2005).

Light Rail Infrastructure Europe

A pilot study was carried out in order to include Value Management approach on a multi-billion-euro light rail project. With the aim that if the pilot study was successful, the developed Value Management Procedure would be embedded within the Client's organisation and to the roll-out of other projects. The project involved a 26km two-directional light rail in the Republic of Ireland. The Value Management approach applied, included a Work Plan, a Value Management Procedure veering the whole project lifecycle and a Value Management Pilot Workshop.

This Pilot study carried out proved to be a great success and the use of Value Management on the 26km designed scheme managed to achieve 65-million-euro worth of value improvements. This resulted in the Value Management Procedure to be implemented in the Client's overall organisation and will continue to be used for all of their projects (Institute of Value Management, 2014).

Value Management Applications in Hungary

Hungary has carried out 76 value engineering studies on various transport projects over seven years, resulting in total savings of £105 million (£125.76 million) on £1.1 billion (£1.32 billion) of expenditure, a saving of 10%. Value enhancement opportunities worth a further £24 million were also identified. Various projects included a value engineering study to draught a law to "Regulate sign language Translator services", which was eventually passed by the Hungarian Parliament, and a unique value engineering study commissioned by the National Bank of Hungary to develop cash flow system computer software. This involved a two-month effort with 25 eight-hour workshops. The Value Engineering team managed to identify over 600 functions for the developers of the system. Another notable project is the value engineering study carried out for the development of new safety requirements related to the technical changes at the nuclear power plant in Paks. Following the workshop, a 2-day value engineering seminar was successfully conducted for another 15 staff members at the power plant to improve their plan review skills. The project resulted in significant and unexpected cost savings, so the Paks Nuclear Power Plant decided to apply the Value Management/Engineering method also to the 20-year life extension project (Fodor & Kmetty).

Value Engineering in the U.S. Department of Defence

Value Engineering has been heavily used and applied in U.S. Department of Defence projects with very positive results. From the year 2000 through to 2005, the average return on investment within the U.S. Defence Department was 7.6 to 1. With Department of Defence Value Engineering considerable savings and cost avoidance since fiscal year 1981, cumulatively, more than \$30 billion (£26.46 billion) has been saved, with an average savings of about \$1 billion (£0.88 billion) annually. From a qualitative perspective, Value Engineering

in the United States creates opportunities for the Defence Department to achieve long-term benefits in cost reduction, communications, procedures, waste reduction, performance, efficiency, reliability, producibility, quality, effectiveness, readiness and warfighting capability (Mandelbaum, 2006).

The above-described examples illustrate several instances of the applied Value Management technique used in diverse ways across many nations globally. This presents a case that the proper use of Value Management may provide several advantages beyond cost reduction, with significant benefits across multiple industries.

2.10 Legal Acts Regarding Value Management or Equivalent Regulations

Value Management is being used internationally by governments, especially in the UK, USA, Australia, Europe, Japan, Korea, Hong Kong and India. According to Fong (1999), the introduction of professional bodies, such as The Society of American Value Engineers (SAVE), the Institute of Value Management in the UK, the Associazione Italiana per la Gestione e l'Analisi del Valore (AIAV) in Italy, l'Association Française pour l'Analyse de la Valeur (AFAV) in France, VDI and DACE in Germany and the Netherlands respectively, the Hong Kong Institute of Value Management (HKIVM), the Canadian Society of Value Analysis (CSVA), Indian Value Engineering Society (INVEST) and the Society of Japanese Value Engineering (SJVE) amongst others helped Value Management to be more widely used by the various governments (Fong P. , 1999).

In the United States of America, the Value Management Approach, mostly referred to as Value Engineering, has been used by US Government agencies since the early 1950s and has been compulsory by law for projects since 1996. It can be found in the U.S Code Title 41 Chapter 1711 titled: Value Engineering of 2011 and in Public Law 111-350, Title 41 of the United States Code deals with Public Contracts with the purpose of the Act being to enact certain laws relating to Public Contracts. Section 1711 is found in Division B Chapter 17, which is the Section for the Office of Federal Procurement Policy, the purpose of which is to provide government with overall direction of procurement policies and in order to promote economy and efficiency in the procurement of property and services by Federal Agencies (Office of the Law Revision Counsel , 2011).

Since 1993, the Federal Office of Management and Budget has required government departments in the US to use Value Engineering to reduce costs, maintain quality and achieve best value. This Circular OMB A-131 has been revised in 2013, again supporting the sustained use of value engineering by Federal Departments and Agencies in order to reduce programme and acquisition costs, improve performance, enhance quality and foster use of innovation. It also states that agencies should maintain policies and procedures in order to ensure that Value Engineering is considered and integrated, as appropriate, into the planning and development of agency programmes, projects, activities, as well as contracts for services and supplies. The

Circular states that Value Engineering shall be required for all new agency projects and programmes when the project cost estimate is at least \$5 million, whilst agencies should establish criteria to help agency officials determine when Value Engineering may be suitable for ongoing projects and programmes (Office of Management and Budget, 2013).

Value Engineering has been extensively utilised and implemented in projects by the U.S. Department of Defense, yielding highly positive outcomes. Between 2000 and 2005, the average return on investment within the U.S. Defense Department was 7.6 to 1. Since the fiscal year 1981, the Department of Defense Value Engineering programme has achieved substantial savings and cost avoidance, cumulatively exceeding \$30 billion, with average annual savings of approximately \$1 billion. From a qualitative standpoint, Value Engineering in the United States provides the Defense Department with opportunities to realise long-term benefits in cost reduction, communication, procedures, waste reduction, performance, efficiency, reliability, producibility, quality, effectiveness, readiness, and warfighting capability (Mandelbaum, 2006).

Italy

In Italy, the Code of Public Contracts relating to works, services and supplies, residential Decree 2010, no.207, recommends that the drafting of projects of works and complex works are preferably carried out using the “Value Analysis” approach for the optimisation of the overall cost. It also states that if several solutions are possible, the choice must be made through a qualitative and quantitative evaluation method. This substantiates the Ministry of Public Works Decree of 2000, which stated that the suitability of these aforementioned proposals is to be tested by using valuation techniques such as value analysis. This is specifically mentioned in the decree (DECRETO DEL PRESIDENTE DELLA REPUBBLICA n.207, 2010).

The European Commission issued a Guidance document in February 2018 entitled Public Procurement Guidance for Practitioners, which is primarily aimed at procurement practitioners within contracting authorities in the European Union. The goal of the document is to serve as a guidance for practitioners in order to plan and deliver public works in an efficient and value-for-money way (European Commision, 2018).

Japan

In Japan, Value Engineering has been introduced in civil engineering design by the Ministry of Land, Infrastructure, Transport and Tourism since 1997. The design Value Engineering Guideline was, in fact, published by the aforementioned ministry.

Ontario, Canada

The Ontario Ministry of Transportation completed its first Value Engineering study in 1995 and, since then, it has implemented the Value Engineering approach on highway standards, business processes and highway projects with monetary benefits exceeding \$150 million. It is

interesting that the Value Engineering programme was developed and grown in Ontario without the aid of government legislation. The Ontario Ministry of Transportation (MTO) managed to successfully implement an award-winning Value Engineering program where Value Engineering is not a statutory requirement. The MTO, thus, developed a document policy which encourages Value Engineering by stating: (Lane & Holmes , 2001).

“Value Engineering is to be applied to suitable projects to the maximum extent that time and resources will allow. Regions should provide an annual plan that outlines which projects are suitable for VE studies in their Region based on the above selection criteria and their project specific knowledge.”

(Lane & Holmes , 2001).

Abu Dhabi

The Municipality of Abu Dhabi City issued a Consultant Procedure Manual in 2001 that emphasises the use of Value Engineering as part of ongoing analysis of cost effectiveness. A written statement or memorandum describing the potential saving and advantages is to be submitted to the Department which in turn is to determine whether an in-depth value engineering study should be undertaken (Department of Urban Planning and Municipalities, 2019).

United Kingdom

In the United Kingdom, Value Management has been used and applied in various forms in various sectors. In the Public Procurement Policy, Value Management has been included in the Best Value Process. The UK Policy document for Public Procurement and the Delivery of Public Value, (Erridge, 2005), considers a framework of public procurement values that are outlined hereunder in Table 2.4:

Table 2.4: Framework of Public Procurement Values (Erridge, 2005).

Goals	Values
Regulatory Goals	
Propriety	Conduct, behaviour and corporate governance
Transparency	Requirements and procedures are open
Commercial Goals	
Economy	Cost reduction
Efficiency	More for the same price; same for less
Socio-economic Goals (bundles of values)	
Social welfare	Equality, protection of minorities, sustainability
Public value	Trust, legitimacy, equity, ethos and accountability

Such a Framework led and encouraged the requirement of a new Public Procurement in the UK. This was to be Best Value (Erridge, 2005).

As stated above, the concept of Best Value as a procurement philosophy was introduced in the UK by the Labour Government in 1999. The primary objective of this new concept was to enhance service quality (Higgins, James, & Roper, 2004).

The aim was to replace the Compulsory Competitive Tendering (CCT) system that was in use prior to 1999. This transition necessitated a cultural shift in thinking and behaviour due to the

different technical requirements of Best Value. As highlighted in the foregoing sections, the HM Treasury's document on Value for Money underscores that the UK Government provides and procures services based on value for money rather than the lowest cost (Hunter K. M., 2006).

According to Higgins et al. (2004), the various benefits of implementing Best Value include responsiveness to users, improved staff morale, better resource allocation, enhanced service quality, increased service efficiency, greater service effectiveness, and heightened accountability to the public. These benefits align with the objectives sought through value management (Higgins, James, & Roper, 2004).

In this context, the Best Value Act mandates that authorities ensure continuous improvement in all their functions, with due regard to economy, efficiency, and effectiveness, thereby ensuring that value for money is achieved (UK Government Act, 1999). The Office of Government Commerce in the UK also emphasises that government procurement should be based on value for money rather than the lowest cost. This principle, known as Best Value in the UK, is supported by guidance documents that recommend the use of value management and risk management to achieve value for money (Hunter & Kelly).

Singapore

The Ministry of Finance of Singapore states that suppliers' bids are evaluated holistically, according to the principle of value for money. As explained by the Ministry document itself, this means that the offers are not evaluated just on price and the lowest bid accepted but on various different factors which create value such as the quality of the goods and/or services, timeliness of delivery, reliability and after sales support, etc. (Ministry of Finance, Singapore, 2019).

Ghana

Value for money is derived from the optimal balance of benefits and costs on the basis of total cost of ownership. As such, value for money does not necessarily mean that a tender must be awarded to the lowest tenderer but, on the contrary, to one which uses a judicious, economic and efficient use of state resources at a reasonable cost. Value for money is not about achieving the lowest initial price: it is defined as the optimum combination of whole life costs and quality. (Nsiah-Asare & Boateng Prempeh, 2016) Hence, one realises that a link between the concept of Value for Money and Value Management exists.

Jakarta

In Indonesia, the concept was introduced in 1986. However, regulation only came into force in 2003 with the implementation of Decree No.108/2003 and later enforced in 2007 with the Public Work Minister Regulation No.45/2007 regarding Technical Guideline for State Building Construction. Both these respective documents support and regulate the implementation of VE in state projects. In another regulation, No. 40/2014, regarding the Jakarta Housing Office

Article 3, paragraph 2(j), it is stated that the Jakarta Housing Office should organise housing, settlements and technical guidance for building regional government with the function of supervision and Value Engineering to building regional government. The authors, however, recommended the requirement of having more assertive state regulation on Value Engineering implementation by either composing a new regulation or strengthening the existing regulation by equipping them with more detailed guidelines, such as ways to implement Value Engineering in the planning phase (Rachmi & Krishna, 2018).

Hong Kong

In Hong Kong, the Implementation of Value Management in Public Works Projects Circular, issued in 2002, sets out the requirements and guidelines on the application of Value Management to the Public Works Programme and it has the support of the Secretary of Housing, Planning and Lands. This circular followed the introduction of Value Management in the Public Works Programme in September 1998 with WBTC No. 16/98. It recommended departments to conduct Value Management studies for projects costing more than one hundred million US dollars (€88 million). This was revised in the new Circular with the Steering Committee stating that, in general, Value Management Studies shall be conducted whenever it is perceived that there are likely to be net benefits and that Value Management studies should be considered for every major project, whatever the cost.

The Circular also mentions that two lists of Value Management Facilitators are to be held by the Environment, Transport and Works Bureau. In the Appendix Section of the same Circular, the Guidelines on the implementation of Value Management are listed. It describes the main elements of Value Management and of the Value Management workshop including its form and duration. It also maintains that Value Management should be considered as a tool and be used to supplement other management tools like cost cutting, cost engineering and quality assurance (Environment, Transport and Works Bureau Government Secretariat Hong Kong, 2002).

2.11 Public Procurement Issues

Under the current public procurement rules in the UK, which are similar to those in Malta, preference is given to the lowest price rather than the best price. So, if the initial brief is unclear, problems are bound to arise as the design team works on the basis of that brief. It then goes into the tender with inadequately prepared documents (Lang, 2016). According to the National Audit Office UK, only one in four UK government projects completed in the late 1990s was completed on time, and only one in three was completed on budget. Such rates should not have been found acceptable for all these years, justifying the measure of taking the risk to change to a different path. In support of this strategy, the Constructing Excellence Report, (2011), in the built environment states that lowest price should not be used in tenders because:

- It forces contractors to price work at unrealistically low levels. As it is impossible to maintain standards and make profits, quality of work falls and contractors become more eager to engage in legal battles to recover their 'losses'.
- It does not deliver cost savings but, in fact, is more likely to result in cost and time overruns, leading ultimately to poor value for money and greater whole life costs in the maintenance and operation of assets.
- It attracts a high risk of abnormally low tenders which should be rejected under the provisions of the EU Procurement Regulations, or the procuring authority faces a risk of challenge (Constructing Excellence, 2011).

Misuse of Funds and Corruption in Public and Mega Projects

Beyond mere inefficiency, the misuse of public funds and corruption are identified as central issues significantly affecting public procurement and public policies. Corruption has been described as the "elephant in the room" in project management, demanding urgent discussion, acknowledgement, and analysis, particularly given its pervasive relevance in mega projects due to their intrinsic characteristics (Locatelli, Mariani, Sainati, & Greco, 2017). Corruption distorts markets and, critically, deprives the general public of the intended benefits due to an unfavourable cost-benefit ratio (Locatelli, Mariani, Sainati, & Greco, 2017). This can manifest in manipulated project locations or the use of complex, non-standard technologies that bypass transparent procurement processes, often facilitated by bribes to politicians and large corporations. Such illicit practices lead to projects with limited social benefits, low financial returns, and inflated costs (Locatelli, Mariani, Sainati, & Greco, 2017). Corruption flourishes in environments with weak governance, highlighting that strengthening governance throughout the project life cycle is crucial to mitigating opportunities for such malfeasance (Wells, 2015).

To illustrate these procurement failures, mismanagement, and corruption, several international cases provide valuable insights into problems that could be addressed through a Value Management (VM) approach applied at an early stage:

Spanish Mega Construction Projects: The case of the Candi Ravine Bridge, which incurred an additional €43.5 million to fix its ascending structure due to foundations of anhydrite and gypsum expanding upon contact with water, exemplifies inadequate planning and evaluation before construction (Mendez, 2014). This highlights the necessity of investing sufficient time in the planning stage to ensure complete definitions and reduce costly changes later (Fraser of Carmyllie QC, 2004).

The Volkswagen Scandal: Although primarily a private sector case, it starkly demonstrates how poor management decisions, fraud, and a focus on financial incentives can lead to devastating consequences for the company, the public, and the wider industry (Mansouri, 2016). The scandal, including the use of "defeat devices" to falsify emission tests, resulted in significant environmental pollution and health costs (Mansouri, 2016). It also exposed

regulatory failures, prompting the EU to introduce stricter vehicle testing procedures (House of Commons Transport Committee, 2016). This case underscores the importance of ethical conduct and robust regulatory oversight across all sectors that impact the public.

Tangentopoli (Italy): This period in the early 1990s revealed a public works contracting system that had degenerated into a machine driven by corruption and favouritism, excluding fair competition, falsifying costs, ignoring best value, and lacking transparency (Bologna & Del Nord, 2000). This systemic crisis prompted a major reform in Italy (Merloni Law, 1994, 1998) (Bologna & Del Nord, 2000). The reform aimed for transparency, competition, separation of design from construction, prioritisation of quality, introduction of Project Management principles, and effective programming (Bologna & Del Nord, 2000). Crucially, this cultural shift led to tangible positive results, such as the dramatic reduction in the cost of major public construction projects, with the Milan subway cost falling from \$227 million/km in 1991 to \$97 million/km in 1995 (Rose-Ackerman, 1996). Notably, the reform explicitly recommended the use of Value Management (Analisi di Valore) in the drafting and optimisation phases of complex public works (Bologna & Del Nord, 2000; CONSULENZA GLOBALE Organization, 2001).

The TAV Case (Italy): This mega project, the Treno ad Alta Velocita, demonstrates how its initial setup as a private project circumvented public procurement safeguards like transparency and fair competition (Locatelli, Mariani, Sainati, & Greco, 2017). This bypassing of regulations enabled the pre-selection of contractors and technology without open tendering, leading to massive cost overruns (approximately 250%) and significant delays. Furthermore, the project suffered from underutilisation (averaging 32% in 2015), illustrating the dangers of non-standard procurement and insufficient oversight (Locatelli, Mariani, Sainati, & Greco, 2017).

Scottish Parliament Building: This project generated controversy primarily due to spiralling costs, which soared from an estimated £40 million to over £400 million, a tenfold increase (BBC, 2007). The Auditor General's report cited procurement issues as the "biggest" cause of systematic failure, alongside inadequate planning, late provision of information, poor communication, and a demanding, unrealistic timetable (Audit Committee, 2004) (Fraser of Carmyllie QC, 2004). The "golden triangle of quality, time and cost was ignored," with quality and time being prioritised over cost, leading to escalated expenses (Audit Committee, 2004). The report recommended ensuring adequate time for the planning stage, proper procurement route selection, and the use of Value Management to evaluate construction processes (Audit Committee, 2004); (Fraser of Carmyllie QC, 2004). A Value Engineering exercise for this project could have saved at least £25 million (Mufeez, 2011).

Operation Car Wash (Brazil): This corruption scandal, centring on the state-owned company Petrobras, involved executives accepting bribes from construction firms for inflated contracts, with funds diverted for personal gain and political campaigns (BBC, 2018). This highlights systematic fraud within public contracts and its impact on national governance (BBC, 2018); (Encyclopaedia Britannica, 2018).

Misuse of Public Funds in Other Sectors: Corruption is not limited to construction. In healthcare, pharmaceutical companies, such as GSK, have been fined for bribery payments to doctors and hospitals to promote their products, with these costs often passed directly to consumers (BBC, 2014). The Sopharma case in Bulgaria illustrated how private interests within regulatory bodies can lead to monopolisation and inflated medicine prices for public hospitals (Hall, 2012). In the electricity and water sectors, cases like the 'Gorilla' file in Slovakia and convictions in France and Italy expose widespread bribes and systematically flawed "delegated management", leading to abuses and fraudulent accounting ((Hall, 2012); (Skolkaj, 2018)).

In response to such pervasive issues, the Project Management Institute of Montreal has identified six key lessons and proposed eight recommendations to combat corruption (Paquette, 2014). The lessons highlight problems such as siloed management, the lowest bidder practice encouraging cost overruns, weak amendment management, conflicts of interest, secret project portfolios, and a lack of data on project performance (Paquette, 2014). Their recommendations include:

- Interdisciplinary working methods.
- Trade-based methodologies.
- Risk management.
- Reviewing contract awarding practices.
- Abolishing lowest bidder practices.
- Developing a centralised database.
- Including Project Management experts in infrastructure projects.
- Implementing more rigorous and transparent project portfolio management (Paquette, 2014).

These recommendations demonstrate that good project management "can only help to fight against corruption and collusion" (Paquette, 2014).

This is precisely where Value Management (VM) serves as a crucial, proactive strategy to resolve or mitigate these identified problems. VM offers a structured framework that focuses on optimising value by balancing cost, quality, and stakeholder satisfaction (Connaughton & Green, 1996); (Hong Kong Institute of Value Management, 2019); (Rangelova & Traykova, 2014)). By systematically applying function analysis (European Committee for Standardisation (CEN), 2020); (Stewart R. , 2005)) and promoting early intervention in the project life cycle (Shen, 1993), VM directly addresses the shortcomings seen in the international cases, such as poor planning, lowest price bias, lack of transparency, and communication failures. VM's emphasis on consensual decision-making (Green & Moss, 1998) and a systematic approach to considering function and cost (Hong Kong Institute of Value Management, 2019) helps counter political squabbles and the absence of objective criteria (Stewart & Cilch, 2006).

In the Maltese context, public procurement rules also generally favour the lowest price, creating similar challenges to those observed internationally (Lang, 2016). However, Malta's Public Procurement Regulations acknowledge the "Most Economically Advantageous Tender (MEAT)" or as per recently the Best Price Quality Ratio (BPQR) criterion, which includes considerations beyond just the lowest price, such as quality, aesthetic, functional, environmental, and social aspects, and allows for life-cycle costing (Government of Malta, 2016). This indicates a move towards principles that VM can strongly support and formalise.

2.12 Public Procurement in Malta

Getting best 'value for money' is important to everyone, no matter whether it is a purchase at the supermarket, procurement of submarines for defence or a mega billion-euro construction or infrastructure project (Barton R. , 2022).

The public procurement system in Malta is in a state of active change. Over time, as part of the reform programme, an institutional framework for public procurement has been built. Even though there has been a strong impetus for reform and a high rate of change, there is still room for improvement, and this is recognised both by internal and external stakeholders. There is a recognition and commitment to improve the current state and that the public procurement workforce capability will play a key role in the future success of public procurement in Malta (OECD, 2019).

When comparing this to the public sector in Malta, the National Audit Office (National Audit Office (NAO), 2014) notes that public administration is constantly faced with challenges and opportunities due to changing developments and trends in modern society. Such challenges arise from the internal and external factors of a dynamic world. They impact on the achievement of public sector goals and objectives. These include value for money; a culture of customer care; increased decentralisation and flattened hierarchical systems; increased diversity and demands for work-life balance and the quality of work (Zammit, 2019).

Every sector faces risks, especially those that work with many employees, such as the public sector. Risk management in the public sector is even more complex and has wider societal implications because of the multiple interests and stakeholders involved. McConnell and Drennan (2007) mentioned that public risks can have an impact on public values. Public risk management is about public value management (Drennan & McConnell, 2007).

To ensure efficient use of resources and finances, an effective and functioning governance system is essential in the public sector. This enables better public sector performance that can withstand rigorous scrutiny. With such an approach, better services, better management, better service delivery and thus better outcomes can be achieved, which ultimately improve the quality of life in the community (Zammit, 2019). The Maltese Code of Public Service Management states that "the Public Service strives to provide all its customers, both external and internal, with an excellent service characterised by professionalism, quality and courtesy

(Office of the Principal Permanent Secretary, 2020). In this regard, in a 2019 thesis, Zammit discusses the need to improve awareness and communication of risks, opportunities and threats in the public sector. It was also highlighted that there are few workshops, in this case for risk management, and they are very limited (Zammit, 2019). Making a case for risk management in the public sector forms part of the resilience building process that adds value to the sector in terms of foresight and proactivity, as economic changes battle its stability, as has been experienced through periods in history. Value management has been used as a risk management tool and the workshops themselves have indeed been found useful in handling risks and uncertainties that may come up during a project (Nnadi & Ezemerihe, 2018).

Public Procurement Regulations in Malta: Governance System

The Maltese Public Procurement regulations clearly state that the award criteria of contracting authorities should be the award of public contracts on the basis of the most economically advantageous tender. The Public Procurement Act considers the most economically advantageous tender, as a tender to be determined on the basis of price and cost. The Act mentions the use of a cost-benefit approach, such as life-cycle costing, which can include best price-quality ratio. However, this must also be assessed in terms of the qualitative, environmental and social aspects brought about by the public contract and not only in terms of quality and cost. Criteria to be considered include quality, aesthetic and functional characteristics, technical merit, design for users, social and environmental aspects (Government of Malta, 2016).

The Public Procurement regulations consider life cycle cost to be part or all of the costs of the entire life cycle of any product, service or works:

- Costs relating to acquisition.
- Costs of use, such as consumption of energy and other resources.
- Maintenance costs.
- Costs imputed to environmental externalities such as emissions and climate change mitigation costs.
- End of life costs, such as collection and recycling costs; (Government of Malta, 2016).

Dalli Gonzi (2019) suggests that cost-cutting and downsizing should not be the only solutions considered but other measures, such as, resource management and the use of tools developed for planning and analysis, should be considered (Dalli Gonzi, 2019). At this point, the introduction of a value management framework could enhance and standardise a best practice approach to ensure that all these aspects are met, as value management has proven internationally. Value Management could be the ideal mechanism/approach to ensure that the best value for money is found, while at the same time taking into account the needs of the customer(s) and the users of the product/service, including all environmental and social benefits as required by public procurement regulations, within the wider dimension of the core value of the Public Service Management Code.

In October 2016, the Government of Malta published the following new public procurement regulations:

- LN. 352/2016 – Public Procurement Regulations.
- LN. 353/2016 – Concession Contracts Regulations 2016.
- LN. 351/2016 – Public Procurement of Entities operating in the Water, Energy, Transport and Postal Services Sectors Regulations.
- LN. 350/2016 – Emergency Procurement Regulations 2016.

Within this context, considerable progress has been made in recent years on improving the process of public procurement in order to respond to European Union Directives. It should be noted that the “Most economically advantageous tender”, MEAT, has been established as the sole award criterion. Directive 2014/24/EU on public procurement introduced the concept of most economically advantageous tender (MEAT) criteria, which takes into consideration aspects other than the lowest price, such as security of supply, environmental investments and long-term sustainability. However, for pharmaceuticals, this provision is not implemented at national level where tenders are used, and the lowest price offers always win.

This idea should ensure, that] procuring with Lowest Price is the concept where acquisition price is the only aspect considered and quality only marked in the technical specifications, whether the offer complies or not. On the other hand, MEAT should consist of cost-effectiveness/best price quality ratio (BPQR), where a combination of price, costs and various non-economic factors are used. This requires the use of a cost-effectiveness approach such as Life-Cycle Costing or indeed a Value Management approach (Lupi, 2017). The categories for Public Tenders in Malta are set out in the Public Procurement Regulations. If the procurement procedure is €10,000 or above, then a full tender process is carried out. For procurement below €10,000, the process to administer is covered by official quotations. When the estimated value, on the other hand, does not exceed €5000, public contracts are awarded by either obtaining hand quotations or by a direct contract award, which is at the discretion of the head of the contracting authority. Main actors in the public procurement process are the Office of the Prime Minister (OPM), the Department of Contracts (DOC), Directorate of Operations, Directorate of Policy Development and Programme Implementation and Directorate of Administration. The DOC is responsible for the administration of the procurement procedures. It oversees the procurement procedures, with responsibilities including vetting and approving procurement methodologies, administering the blacklist, and supervising and reporting any breaches to the regulations.

The DOC serves as a central purchasing body, and it even administers the framework agreements and is responsible for administering the framework agreements which are published by the same DOC. The DOC introduced the e-procurement Platform (e-PPS) in 2011. This has been used for all the procurement procedures with a value of or above €5000 since 2016. The following information is available in the e-PPS with the goal of ensuring the efficiency and transparency of the procurement documents:

- Tender notices and bidding documents.
- Tender clarifications issued by contracting authorities.
- Minutes of clarification meetings/site visits.
- Record of bids.
- Successful bidders and awarded price.

There are currently about 170 contracting authorities in Malta. Most of these fall under the jurisdiction of the DOC. To decentralise procurement functions at ministry level, the establishment of Ministerial Procurement Units (MPUs) began in 2016. The MPUs are tasked with processing, publishing, managing and recommending the award or cancellation of tenders. Regulation 79 of the Public Procurement Regulations lists the following as the main duties of the MPUs:

- Observe and abide by Public Procurement regulations.
- Administer calls for tenders published under the open procedure, as long as the value exceeds €10,000 but does not exceed €250,000.
- Publishes all tenders, through the government's e-Procurement platform.
- Monitor the implementation of the procurement process.
- Take appropriate measures to prevent and remedy any potential conflicts of interest.
- Publish in the Government Gazette.
- Make recommendations.

In the aforementioned OECD report, Malta rated as average compared to other EU countries, according to the EU Single Market Scoreboard 2017. However, seven areas out of 12 areas were highlighted as unsatisfactory. These were:

- Cooperative procurement.
- Award criteria.
- Decision speed.
- Procedures divided into lots.
- Missing calls for bids.
- Missing seller registration numbers.
- Missing buyer registration numbers.

Whilst Malta has progressed via many initiatives and made significant process since 2017, it was still acknowledged that further improvement needs to be done particularly in areas that would enhance effectiveness and efficiency. This could be a key factor for the push to insert a recommendation for a Value Management Approach in the Public Procurement process (OECD, 2019).

The public procurement cycle refers to a sequence of related activities, from needs assessment, through competition and award, to payment and contract management, as well as any subsequent monitoring or auditing. These activities can be divided into the three stages

below: Pre-tendering - includes the planning stage; Tendering - including invitation and award of tender; Post award - including contract and implementation.

An analysis was carried out in 2019, in order to identify the challenges arising across these three broad stages of procurement.

Stage 1: Pre-tendering

Procurement planning includes both what contracting authorities do in terms of purchasing activity over a certain period and what they do for the acquisition of a given necessity. Time spent analysing the market before issuing a tender will almost always result in a superior work output in the end. The lack of direction on how to incorporate market information into procurement strategy is a key criticism raised in the report. This is an opportunity area where Value Management can help when incorporated in the pre-tendering public procurement process.

A significant part of the pre-tendering process deals with framework agreements. Some benefits of framework agreements include as listed in the report:

- Reduction of waste.
- Controlling of public debt.
- Value for money.
- Best product/price ratio.
- Increased quality of procured goods and services.
- Better management of products and services.
- Market competitiveness.
- Increased transparency.
- Environmental and social sustainability.

In Malta, unfortunately, evaluation is a stage in the procurement process that experiences time delays and during the study carried out in this report a number of areas requiring improvement were highlighted. These included:

- Requests for evaluator approvals of outcomes after the publication of tender.
- Evaluators lacking the necessary experience and knowledge of how to conduct an evaluation.
- Lack of knowledge concerning the carrying out of online evaluation in the e-PPS.
- Issues during the evaluation process sometimes not raised with the result that they are not dealt with.

As previously mentioned, there is potential for increased efficiency and effectiveness by improving contract and supplier relationship management in Malta. As stated in the OECD report, currently there are no defined frameworks or guidance on these methodologies. If these are introduced, then there could be improvements in the following problem areas identified in the same report.

Requirements drafting: creating quality requirements for inclusion in requests for proposals. Clear and up to date requirements for inclusion in requests for proposals.

Procurement planning: Assisting to define the most appropriate kind of approach to the market for the procurement process.

Risk management: Consideration of risk is much improved by the availability and analysis of market information. Defining improved risk treatments in areas such as financial viability.

Governance: ensuring clear responsibilities for the operational management of contracts including breaches, reporting, performance measurement and complaints.

A management framework containing clear governance and controls can support improved outcomes (OECD, 2019).

Increasing general effectiveness and efficiency of the procurement function.

The main areas for increasing efficiency in Malta currently are:

- Increased competition, reduced administrative burdens, shortened duration and increased compliance levels.
- Increased value from use of framework agreements.
- Decreased unsuccessful procurement processes.
- Improved public procurement planning as reflected in decreased time spent on certain parts of the procurement lifecycle.

The procurement processes are also examined through the perspective of efficiency and effectiveness in the study. According to the research, there is an understanding that there are several opportunities for improvement.

2.13 Value Management in the Maltese Context: A Local Perspective

Value Management (VM), also known as Value Engineering (VE) in some contexts, has been a subject of evolving discussion and limited application within Malta's construction and public service sectors. Local academic works on this topic are few and limited, but those that exist shed light on its historical reception, current challenges, and potential for future integration.

An early investigation by Damian Vella Lenicker (1997) explored the American practice of Value Engineering and its relevance to the Maltese construction industry, noting that in the UK, it was referred to as Value Management. Vella Lenicker's dissertation aimed to propose local implementation based on findings from a case study on the New Air Terminal project. He observed that in the preceding twenty years of frantic building development in Malta, clients, particularly government projects, frequently faced "financial disasters" due to factors often obscured. For instance, one particular building, initially estimated at Lm14 million, eventually cost well over Lm20 million. Vella Lenicker suggested that better administration

and a more structured approach might have averted such situations, leading to significant savings or more functional buildings (Vella Lenicker, 1997).

Vella Lenicker (1997) found significant disadvantages in applying North American practices directly to the local industry due to differing construction cultures. He noted that while the U.S. government was instrumental in furthering VE in construction, its acceptance in the U.S. private sector was less enthusiastic. In the UK, VM was a more recent development, practiced by a small group of firms. A critical observation for Malta was the prevailing practice of awarding tenders based on the lowest price, which often resulted in compromised quality and increased overall costs. The concept of life-cycle costing was largely an "alien concept" locally, with decisions often based passively on an architect's knowledge rather than comprehensive analysis. Vella Lenicker (1997) suggested that public projects, being larger and often carried out by the government, were prime targets for VM implementation locally, given the traditional procurement system emphasising accountability and open competitive bidding. He proposed the Charette, the 40-hour Value Engineering study, and the Contractor's Change Proposal as suitable for local implementation, acknowledging the need for legislative changes and a shift in building industry culture for successful adoption. His early work thus highlighted a foundational gap in structured cost and value control within the Maltese construction sector (Vella Lenicker, 1997).

More recently, Mary Anne Azzopardi (2022) conducted a preliminary exploration into how Value Management could be more widely introduced in the local construction industry, focusing on mitigating financial risks and cost overruns. Her research found that although VM is not widespread in Malta, local construction industry operators do apply the strategy, primarily as a cost-cutting technique, to avoid cost overruns linked to changes in project scope and design. This local perception of VM mainly as a cost-cutting tool aligns with observations from other countries like Nigeria and Sri Lanka. A significant finding in Azzopardi's study was the lack of Value Management guidelines available locally, which was identified as the most likely factor holding back VM implementation. Other barriers included a lack of training, a lack of qualified personnel, complex VM workshops, and certain cultural differences. Azzopardi (2022) emphasised the importance of communication between different entities as the most crucial factor within the local construction industry, alongside professional transparency and a set of recognised guidelines for VM to be more prevalent. Her study identified "ease of use of system" as the most important Critical Success Factor (CSF) and "time taken for project completion" as the most important Key Performance Indicator (KPI) (Azzopardi, 2022).

Adding to this understanding, Samuel Chircop (2022) specifically examined VM's role in controlling cost overruns within the Maltese construction sector. His research aimed to ascertain local construction professionals' perceptions of VM and its techniques. Chircop (2022) affirmed that there is a lack of knowledge among the local construction community regarding the concept of Value Management. Despite many respondents having significant experience (over 15 years), an "average" level of understanding of VM techniques was most

common across all work designations, and there were no respondents who claimed a "very high" level of understanding. This indicated a persistent gap in familiarity with VM's role in cost control, despite decades of VM presence in the construction industry internationally. When asked to rate the importance of various VM techniques, Target Costing was ranked as the most important by overall respondents and by most work designations. SMART Methodology and Function Analysis System Technique (FAST) followed in importance. Interestingly, Function Analysis, a foundational VM technique in literature, was ranked as the least important by local professionals, highlighting a disconnect between academic principles and local perception. Chircop (2022) recommended educating students and providing courses to construction professionals to broaden their knowledge and applicability of VM (Chircop, 2022).

Collectively, these studies (Vella Lenicker 1997, Azzopardi 2022, Chircop 2022) paint a picture of VM in Malta characterised by historical disinterest and persistent knowledge and awareness gaps, confirming the identified research gap in the overall literature review that VM application in Malta, particularly in the public sector, is limited and needs further investigation. They consistently highlight the need for formal guidelines, structured training, and a cultural shift to fully embrace VM principles for enhancing project outcomes and ensuring better value for public funds. The local context, therefore, presents significant opportunities for the integration of comprehensive VM frameworks into existing public procurement processes, moving beyond a narrow cost-cutting view towards a holistic value-adding process, as also emphasised in the broader literature of value management.

2.14 Chapter Summary

The literature review chapter aimed to start a response to the specified research questions that may be addressed using value management methodologies found in the literature. The primary purpose was to enhance understanding of the notion of value management and to explore the ideas and interpretations developed by scholars to facilitate comprehension of the approach. The primary aim of value management is to achieve the objectives and goals of the client and project stakeholders via a systematic decision-making process. The research indicates that value management may enhance project management by integrating into an organisation's decision-making process, enabling project managers to make better informed choices via the use of value management's innovative tools and processes. Value management is considered a proactive, inventive, unique, and strategic approach in the literature. Consequently, it may be used to improve project management. Value management delineates a project's functionalities and the optimal means to fulfil its objectives, so maximising value for the primary client and end user.

The advantages of using a value management approach are many and significant. The study results indicate that the client, society, community, and consumer all benefit from the

implementation of a value management plan. The traditional direct benefits of value management, including enhanced quality, reduced costs, and the elimination of unnecessary expenditures, were classified into two categories: tangible benefits and intangible ones, such as improved communication, superior decision-making, and team cohesion. The need of these advantages was emphasised in the situations examined in the literature chapter. The absence of communication, poor decision-making, time delays, misallocation of cash, and extraneous expenses have culminated in a diminished value for the client and/or end user, particularly in the public sector, adversely affecting the general public. The study indicated that the implementation of value management was effective and advantageous across several corporate sectors, including construction, manufacturing, automotive, local and central government, and the service sector.

We have observed a growth in the demand for greatest value in society over the last 20 years, involving a long-term drive for greater quality and lower prices while maintaining an acceptable balance between quality and cost. However, in order to obtain this optimum value, a number of guidelines have been set that must be followed. These include assuring responsibility, transparency, continual improvement, and ownership, as well as considering economy, efficiency, and equal opportunity standards. Most public services are there to satisfy the needs and welfare of society. Achieving value for money should be one of the most important requirements for any government project. However, in the literature and, especially in the case studies, the public sector is described as wasteful, inefficient, fragmented and, above all, unable to meet the needs of the public.

Another essential component of this research was the possibility of using the value management method across the project life cycle. Different forms of value management studies benefit different intervention points and necessitate a different method, which still delivers advantages, although it was discovered that the earlier the intervention, i.e., the application of value management, the larger the benefits and results.

Value management has sometimes been misconstrued as only a cost-reduction strategy, perhaps explaining its limited use in several projects. To get government support, a careful examination of value management is essential. Nonetheless, a scarcity of practical experience with value management was identified in the global literature, hindering its widespread implementation. The analysis revealed a scarcity of publications advocating the use of value management within the public service sector. The assessment underscores the need of adopting best use as a guiding philosophy, fostering a connection between users and providers, and using value management as an all-encompassing technique to get optimal value from a project. It advocates for the evaluation of intervention strategies over the project life cycle, delivering tangible advantages such as quality and efficiency, while guaranteeing that residents get the benefits promised to them.

Key conclusions assisting in the answering of the research questions and hypothesis, represented hereunder can be summarised as follows:

- Embedding the concept of 'best use' as a philosophy and not just another initiative.
- Maintaining a link between users and providers in the public sector.
- Value management as an exercise beyond cost-cutting but as a comprehensive method to achieve best value from a project.
- The consideration of intervention options in the project life cycle for a successful application of value management methods depending on the nature of the project and the scope of which benefits are being sought out.
- The use of value management as a provider for direct benefits – better quality and higher efficiency at lower cost.
- Use of value management as a provider for soft benefits; better communication and team building.
- Value management as a method to assist the public sector in ensuring citizens get what they were promised.

Chapter 3 - Methodology

3.1 Introduction and Overview

This chapter explains the research methodology which was adopted to achieve the aim and objectives of this research. The approaches, techniques and methods selected throughout this research activity have been discussed in order to justify their adoption. 'Methodology' represents a comprehensive research term that outlines the approach and procedures for conducting research. It encompasses a system of beliefs and philosophical assumptions that shape the understanding of research questions and guide the selection of research methods. Research methodology is a fundamental component of a dissertation or thesis, ensuring coherence between the chosen tools, techniques and the underlying philosophical framework.

One prominent framework for constructing a research methodology is the "research onion," as proposed by Saunders *et al.* (Saunders, Lewis, & Thornhill, 2007). The research onion provides a detailed and structured description of the main layers or stages necessary to formulate an effective methodology (Raithatha, 2017). The process of developing a methodology begins with defining the philosophy, and selecting the appropriate research approaches, methods and strategies. These elements collectively form the research logic, leading to the research design, which involves the main techniques and procedures for data collection and analysis. The structure of this chapter is based on an interactive model for research design (as shown below), which connects various components fundamental to research design. Maxwell (2005) identifies five critical components: research questions, research purposes/goals, conceptual framework, research methods and validity and reliability. These components are interconnected, forming a cohesive framework that ensures the research questions remain central to the study.

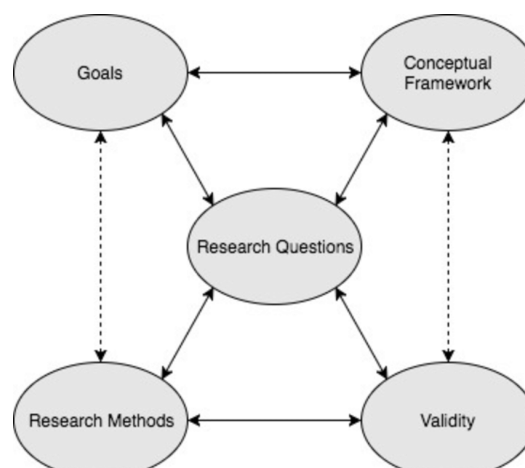


Figure 3.1: Interactive Model for Research Design (Maxwell, 2005).

3.2 Research Design - Aim and Objectives

3.2.1 Research Aim

The research aim for this study has been developed below:

To investigate whether the techniques of Value Management (VM) incorporating Value Engineering (VE), are used in the local scenario and, if not, what benefits can be achieved by implementing a Value Management Framework in the local public service sector environment.

The purpose of this research is twofold.

1. To acquire a comprehensive understanding of the usage of Value Management in Malta and to analyse the understanding of Value Management applications in Malta through a case study: Ambjent Malta.
2. The second purpose builds on this as it tests out Value Management by implementing it through a quasi-experiment methodology using a pre-test, post-test method (which will be explained in depth throughout this chapter).

3.2.2 The Research Questions and Objectives

The two research questions were identified as follows:

- I. Can value management techniques be used to achieve best value in the local public service sector and improve the quality of the public service?***
- II. Do value management methods improve project efficiency and quality in the public sector? If so, how?***

Research Objectives (a) to (f);

- a. To analyse and determine the use of value management in the public sector through a review of international literature;
- b. To determine the extent to which value management can support Best Value Practice in local public sector scenarios, based on the analysis of international literature;
- c. To identify the types of local government projects typically benefitting from the application of value management methodologies;
- d. To determine where intervention possibilities exist in the public service management processes in order to construct a project model that supports value engineering that enhances project success;
- e. To examine the correlation between the implementation of VM in public sector major projects and project success outcome;
- f. To set up the pillars for a value management framework.

3.2.3 The Research Hypotheses

The development of this study was grounded in several key hypotheses, each designed to explore critical aspects of Value Management (VM) in the context of project management and public procurement. The hypotheses for this study were the following:

1. Experiencing a Value Management approach positively influences the belief that structured tools/frameworks ensure a cost-benefit approach.
2. The original intent/need of the project is tested sufficiently to ensure alignment with the client's requirements.
3. The technical solution to the project need is tested using appropriate tools or techniques.
4. The project's objectives in relation to the project needs (scope) are achieved.
5. The level of communication within the project team and between stakeholders improves.
6. There is a correlation between respondents' knowledge or experience of Value Management and project success outcomes.
7. The implementation of a structured tool or framework enhances the cost-benefit approach in awarding public contracts, as recommended in Public Procurement Regulations, compared to current methods.
8. Inadequate alignment and verification processes during project planning and execution phases result in inconsistent achievement of project objectives.

These hypotheses collectively form a comprehensive framework linking the overall research questions and objectives, facilitating a robust analysis of VM's impact on project success and procurement practices.

The following identifies the link between the main research questions set out in the beginning and how the hypothesis fits in within this set of questions.

Overall Research Question 1: "Can value management techniques be used to achieve best value in the local public service sector environment and improve the quality of the public service?"

Hypotheses 1, 2, and 3 directly address this question by investigating the impact of value management approaches on various aspects of project management and outcomes.

Overall Research Question 2: "Do value management methods improve project efficiency and quality in the public sector? If so, how?"

Hypotheses 1, 2, and 3 also address this question by examining the influence of value management methods on project efficiency, quality, and alignment with client requirements.

Research Objectives (a) to (e):

- Objective (a) is addressed by Hypothesis 1, which examines the belief in the effectiveness of structured tools/frameworks after experiencing a Value Management approach.
- Objectives (b) and (c) are indirectly supported by Hypotheses 1, 2, and 3, which investigate the alignment of project objectives with client requirements and the testing of technical solutions using value management methods.
- Objective (d) is addressed by Hypotheses 3 and 4, which examine the testing of technical solutions using value management methodologies, thereby identifying intervention possibilities in project management processes.
- Objective (e) is addressed by Hypothesis 6, which investigates the correlation between the implementation of Value Management in public sector projects and project success outcomes.

3.2.4 Research Design

3.2.4.1 Definition and Purpose

Research design refers to the overall strategy and structure of a research project, outlining the methods and procedures for collecting and analysing data. It provides a framework for conducting research in a systematic and organised manner, ensuring that the study addresses the research questions effectively and reliably. The choice of research design is influenced by the research questions, objectives and the nature of the phenomena being studied (Creswell J. , 2014).

3.2.4.2 Importance of Research Design in a Doctoral Study

A well-structured research design is critical for ensuring scientific rigour and enhancing the validity and reliability of research findings. By providing a systematic approach to addressing research questions, it minimises biases and errors, thereby enhancing the overall quality of the study. Firstly, a comprehensive research design serves as a roadmap for conducting the study, from data collection to analysis, ensuring that research activities are organised and planned efficiently. This structured approach facilitates replication and generalisation, as a clear and detailed research design allows other researchers to replicate the study and apply the findings to different contexts and populations. Secondly, a well-defined research design addresses ethical considerations, ensuring adherence to ethical standards and guidelines, and protecting the rights and welfare of participants. This ethical integrity is paramount in conducting responsible research. Furthermore, a robust research design enhances the credibility and acceptance of the study within the academic community. It provides a solid foundation for defending the research methodology and findings during the dissertation process, thereby increasing the study's impact and recognition.

Finally, a good research design supports theory development and application by contributing to the development and testing of theories. It provides practical implications

and recommendations based on empirical evidence, thus bridging the gap between theory and practice. Saunders *et al.* (2019) provide a comprehensive framework for understanding research design. Their approach, often referred to as the "Research Onion," helps researchers systematically consider the layers of a research design. The Research Onion consists of several layers, each representing a different aspect of the research process (Saunders, Lewis, & Thornhill, 2019). For such a study, research design based on the Research Onion is crucial because it provided clarity and structure; it allowed the researcher to understand the validity and reliability for data collection processes; it allowed for the replicability of the design; facilitated issues concerning ethical requests and assisted in formulating a comprehensive analysis.

3.2.4.3 Description of Research Framework

This section portrays via diagrammatic format the theoretical framework of the study which explains the main components, the key factors, concepts and variables, and the relationships amongst each of the components. The purpose of this element is to help assist the readers through the research purpose and design which was developed, whilst setting select realistic goals towards responding to gaps identified. The technique used, was one entitled 'concept mapping'. This was used to generate the conceptual context of the study. The concept map is also known as an integrative diagram. This 'map' is, therefore, a diagram of the study. Its aim is to make visible the implicit theory and show relationships between different areas of the study (Zainul Abidin, 2005). A concept map, figure 3.2 below, has been developed specifically for this study and features four phases as identified herewith:

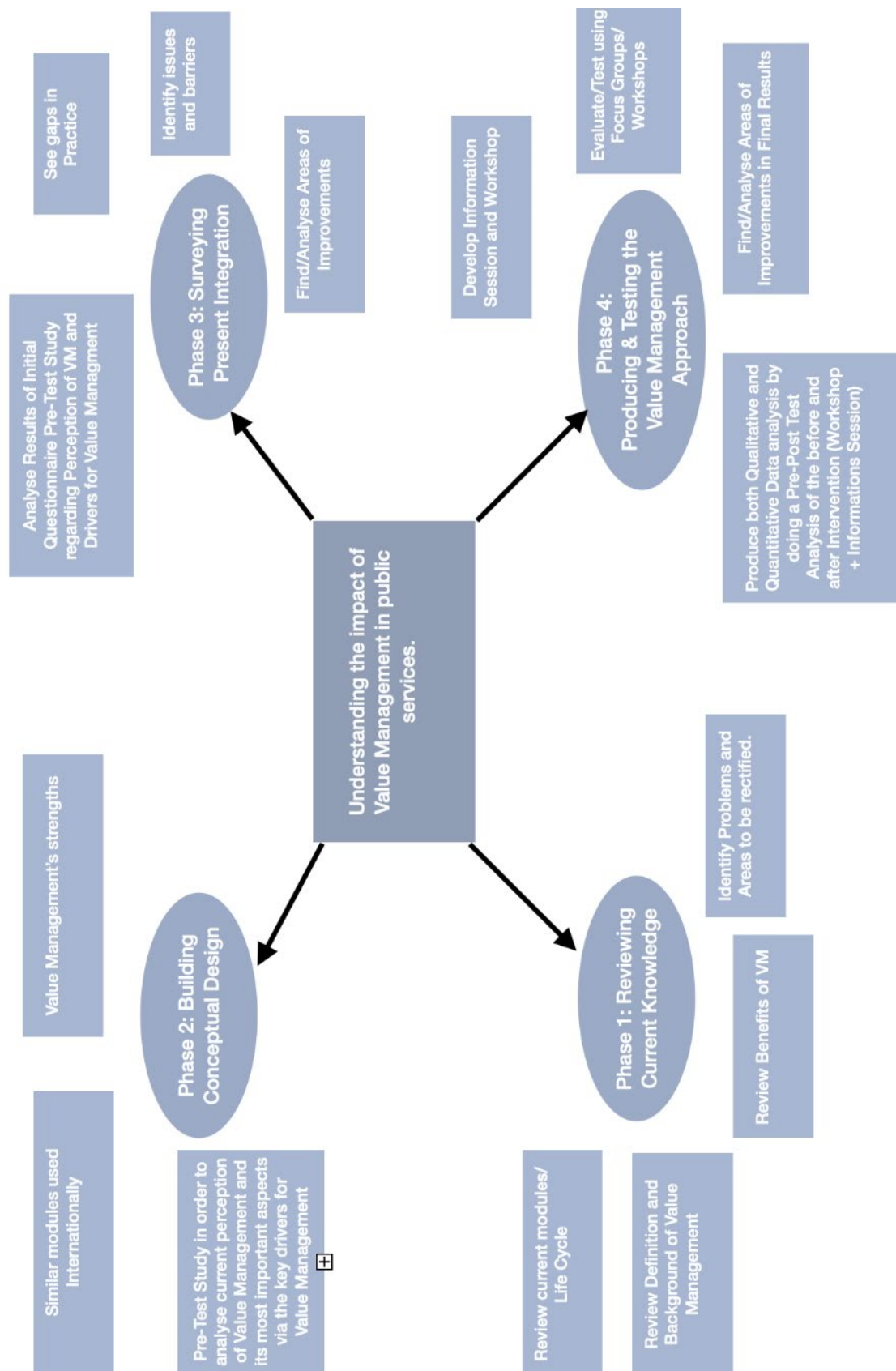


Figure 3.2: Concept Map showing Research Framework.

Phase 1: Reviewing current knowledge – This phase focused on reviewing present knowledge from literature in the area of intended study, therefore the use, benefits and current frameworks of Value Management. This phase also identified problems within the subject area and established the need for the study. The collection and analysis of data utilised both primary and secondary data. The data search strategy included a scoping review of secondary data from various sources, including legal notices, books, journals, reports, articles, and websites. Electronic databases such as Google Scholar, EBSCO, PubMed, PubMed Central, Medline, Scopus, ProQuest, and Web of Science were searched (Falzon, Gonzi, Grima, & Vella, 2024). Material related to both academic and grey literature discussing areas in public procurement, public projects, and the efficiency of processes was selected. The above-mentioned databases were chosen due to their strength and prominence in the research arena of public sector literature and value management.

Phase 2: Building the Concept Model – This phase focused on conceptualising the idea of integration forwarded in this research and to support the overarching idea. An initial pre-test questionnaire was developed through a pilot study. The piloting process was essential to confirm the overall efficacy of the research instrument (Bryman & Bell, 2007). Preliminary research was conducted prior to the distribution of the pre-test questionnaire. Ten individuals were chosen to do a pilot test of the questionnaire. Two questions were restructured, three questions were used to detect deficiencies, while other questions utilised other checks. During the question design process, lengthy inquiries were avoided, unclear terminology was excluded, negative phrasing was eliminated, and leading questions were disregarded (Dalli Gonzi, 2019). Closed questions were designed to improve the comparability of responses and facilitate comparisons across different cases.

Phase 3: Use of the Quasi-Experiment Method – A pre-test/post-test development; this phase analysed the result of the initial pre-test questionnaire study in order to find the gaps present and map iterative stages to identify, support, or negate existing issues and barriers which were addressed through the study. Furthermore, the Quasi-experimental study in the research field was initiated to include a wide array of non-randomised intervention research. This design is often used when conducting a randomised controlled experiment is logistically impractical; (examples of quasi-experimental investigations include hospitals implementing a new order-entry system and aim to examine the effect of this intervention on the incidence of medication-related adverse events before and after its implementation) (Harris, et al., 2006). In this study, this Chapter will be used to explain its application further on.

Phase 4: Producing a final framework for implementation - This phase focused on setting up and administering the Value Management information Seminar and the post-test Workshop to test the level of engagement using Value Management principles in the public service, in the context of Ambjent Malta. Value Management Workshops were used to collect the data required and a post-test questionnaire that was distributed during the session, constituted a second stage data collection. All stages led to the final preparation of the framework and

standards (ie, producing a standard operating procedure; SOP) to support the final aim of the study.

3.3 Research Approach

The Literature Review was the first step in the research investigation. The goal of the literature review stage was to collate information on the present, local, but mostly, global applications and advantages of the Value Management Approach. The electronic library (HyDi) of the University of Malta, together with various books, journals, and online sources, were consulted in this study to obtain comprehensive research of Value Management themes, outcomes and application in Malta's public sector. The data search strategy included a scoping review of secondary data from various sources, including legal notices, books, journals, reports, articles, and websites. Electronic databases such as Google Scholar, EBSCO, PubMed, PubMed Central, Medline, Scopus, ProQuest, and Web of Science were searched (Falzon et al., 2024). This analysis of literature was followed by an exercise in understanding and deciding on the research methodology that would best satisfy the research questions to be tested.

3.3.1. Research Philosophy

The research philosophy adopted contains important assumptions about the way the researcher views the world (Saunders *et. al.*, 2007). In the design and execution of a doctorate research project, the management of the knowledge production process encompasses three phases, with the first stage establishing a 'positioning' to contextualise the research project within a landscape of debates (Lauriol et al., 2006). This encompasses the theoretical and epistemological positions to establish foundations or delineate a worldview. The researcher focused on empirical data is likely to possess a divergent perspective on research methodology compared to the researcher who emphasises emotions and attitudes (Saunders et al., 2007). The meaning was derived from the interpretation of events to comprehend the subjective realities of the subjects via many case studies and in-person interviews (Dalli Gonzi, 2018).

Elemental to any research strategy is the philosophical basis of research, which philosophises on the concept of the research paradigm, along a spectrum of research ideologies, and, differentiating between two extreme research paradigms: the positivist and the phenomenological (Burciaga González, 2023). Positivism and phenomenology provide the underpinnings of research work, with each affecting the way in which knowledge is developed, depending on the approach each takes. Positivism tests formal hypotheses involving the relationship between variables, while phenomenology tests belief statements in less formal ways, such as individuals' perception (Denzin, 2009).

Since the positivist research paradigm is 'objective' in input and output, it is best served by the application of quantitative techniques, as these are reliant on publicly verifiable statements. Alternatively, the phenomenological research paradigm is generally associated

with the 'subjective' and, hence, considered to be best served by the application of qualitative techniques, as these lean towards the interpretive. While these two extreme paradigms should be treated as alternative approaches, a mixed research design combining a positivist and a phenomenological approach is possible and justifiable (Cohen, Manion, & Morrison, 2018), as in this study, where a predominantly positivist approach reinforced by the phenomenological, supported by the application of a variety of inductive and deductive techniques (Levers, 2013), was applied to address the research questions.

There are two types of different research approaches: The Deductive Approach and the Inductive Approach. These approaches are fundamental to the research design and significantly influence the methods of data collection, analysis and interpretation.

3.3.2 Deductive Approach

The deductive approach, also known as the "top-down" approach, begins with a general theory or hypothesis and works towards specific observations to test the theory. This approach is often associated with quantitative research methods (Trochim & Donnelly, 2007).

Theory to Hypothesis: The researcher starts with a theory or existing body of knowledge and formulates a hypothesis based on this theory. **Data Collection:** Data is collected through structured methods such as surveys, experiments, or secondary data sources. **Data Analysis:** Statistical techniques are used to analyse the data and test the hypothesis. **Confirmation or Rejection:** The hypothesis is either confirmed or rejected based on the analysis, contributing to the theory's refinement. The deductive approach is systematic and logical, ensuring that research findings are objective and can be generalised to a larger population (Bryman A. , 2012).

3.3.3 Inductive Approach

The inductive approach, also known as the "bottom-up" approach, starts with specific observations and works towards broader generalisations and theories. This approach is often associated with qualitative research methods. **Observation to Theory:** The researcher begins with detailed observations and looks for patterns or themes. **Data Collection:** Data is collected through unstructured or semi-structured methods such as interviews, focus groups, or participant observations. **Data Analysis:** Thematic or content analysis is used to identify patterns and build theories. **Theory Development:** New theories or models are developed based on the observed patterns. The inductive approach is flexible and exploratory, allowing for a deeper understanding of the phenomena being studied and the generation of new theories (Creswell J. , 2013).

3.3.4 Importance of Deductive and Inductive Approaches in this Doctoral Research

This research whilst mostly deductive in nature, sought to answer the hypotheses set out and understand the use and potential benefits of applying Value Management in the Environmental sector, yet also featured an inductive approach to analyse and derive broader insights into the study. Choosing between the deductive and inductive approach was crucial

for this doctoral research as it shaped the research design, data collection and analysis methods.

In this regard, the researcher was aware that in a Deductive Approach, this ensures the rigorous testing of existing theories, providing clear, measurable, and generalisable findings. It is particularly suited for research aiming to test hypotheses and validate existing theories. While, in the Inductive Approach, the route allows for the discovery of new theories and a deep understanding of complex phenomena. It is well-suited for exploratory research where the goal is to understand underlying meanings and patterns. Therefore, in this academic research, the choice between a deductive and inductive approach depended on the research questions, objectives, and the nature of the phenomena under study. Given that the deductive approach is systematic and theory-driven and ideal for hypothesis testing, and the inductive approach is flexible and exploratory, ideal for theory generation, both approaches were relevant to obtaining the required outcomes.

It was critical to the researcher to understand these approaches and their implications, to help ensure that the research design was coherent and capable of addressing the research questions effectively. As indicated, a deductive approach works by developing a hypothesis based on previous existing theory. This hypothesis is then tested through outcome orientated numerical estimation and/or statistical gathering. A deductive approach is regarded as a way to get to the truth/result. The researcher deduces a hypothesis based on what is known about a particular domain and the theoretical considerations present (Bryman A. , 2012). This hypothesis must then be subjected to empirical scrutiny by translating the concepts to researchable entities. On the other hand, the inductive approach focuses on the creation of a plan followed by the collection of data. The main idea is to create a theory from concepts generated after analysing the data collected (Saunders, Lewis, & Thornhill, 2007).

3.4 Data Collection and Analysis

Data collection methods form the cornerstone of any academic inquiry, providing researchers with the means to systematically gather information relevant to their study. In the pursuit of knowledge and understanding, researchers employ a variety of techniques and approaches tailored to the nature of their research questions and objectives.

Qualitative Approach: The qualitative approach to data collection involves the exploration of complex phenomena within their natural contexts, with the aim of gaining a deep understanding of participants' experiences and perspectives. Through techniques, such as interviews, focus groups, and content analysis, qualitative researchers delve into rich, descriptive data to uncover underlying meanings and patterns that may not be captured through quantitative methods. This approach is particularly valuable for studies seeking to understand the "how" and "why" of human behaviour, experiences, and interactions (Creswell J. , 2014).

Quantitative Approach: In contrast, the quantitative approach to data collection involves the systematic investigation of phenomena by gathering quantifiable data and performing statistical, mathematical, or computational techniques. Quantitative researchers prioritise objectivity, precision, and replicability in their data collection and analysis processes, employing standardised measures and statistical tests to draw conclusions. Surveys, experiments and secondary data analysis are common methods used in quantitative research to test hypotheses, examine relationships between variables and generalise results from a sample to a larger population (Creswell J. , 2014).

Mixed Methods Approach: The mixed methods approach combines elements of both qualitative and quantitative data collection methods to provide a more comprehensive analysis. Researchers using this approach integrate multiple data sources, often collecting and analysing qualitative and quantitative data concurrently or sequentially. By capitalising on the strengths of each approach, mixed methods studies offer a richer understanding of the research problem, enhancing the overall validity and reliability of the study findings. This approach is particularly valuable when a single method is insufficient to address the research questions adequately or when researchers seek to corroborate findings across different types of data (Tashakori & Teddlie, 2010).

Therefore, data collection methods play a pivotal role in shaping the trajectory of research endeavours, guiding researchers in their quest for knowledge and understanding. Whether employing qualitative, quantitative, or mixed methods approaches, researchers contribute to the advancement and the enrichment of collective knowledge in their respective fields.

3.4.1 The Quantitative Research Process

As described by Metler (2016) the quantitative research process follows a sequential order in nearly every quantitative study. The study process is divided in the following steps:

- Identification of research problem to be studied – The purpose of any given study often helps to guide choices and decisions regarding the methodology to be used.
- Statement of one or many research questions and/or hypotheses – The research must at this stage ensure that the research questions and/or hypotheses are clearly stated as these will serve as the guide for the rest of the study.
- Review of Related Literature/Literature Review – This serves to provide a great deal of guidance in quantitative research studies. Understanding and learning what research other academics have done which can help inform decisions regarding research design, sampling, data collection procedures and data analysis.
- Development of the written literature review – This follows the previous step and, once the related literature has been thoroughly reviewed, the researcher must proceed to synthesise the literature reviewed for a future reader of that study.

- Development of Research Plan – This consolidates the information earned from the literature review, together with the research goals. This plan should include strategies for sampling, the appropriate research design, data collection and data analysis.
- Collection of Data – once the data collection strategy has been set, data collection in quantitative studies does not tend to be a lengthy process as data tends to be directly collected from participants through the use of surveys, tests, checklists and other tools that generate numerical data.
- Analysis of Data – Quantitative data is generally analysed statistically focusing on numerical descriptions, comparisons, and measures of relationships amongst variables. The data analysis is typically carried out using statistical analysis software programmes, such as SPSS.
- Development of Conclusions and Recommendations- In quantitative research, conclusions are drawn directly from the interpretation of results of the statistical analysis performed. These conclusions are typically then connected back to the findings of the literature review.
- Preparation and Formalisation of Final Research Report – The final step when conducting a quantitative research study is formalising and preparing the final written report. The report should summarise all aspects of the study, with all the previous steps thoroughly described in the report (Metler, 2016).

The main purpose of such data collection is to describe characteristics of a group or population. It is a research technique which focuses on the researcher administering some sort of survey or questionnaire to a sample of individuals in order to describe their opinions, attitudes, experiences, behaviours and other characteristics of the population (Ponto, 2015). When conducting survey research there are several modes of data collection from which the researcher may choose, these include, email surveys, direct administration, telephone surveys, interviews and web-based surveys. Web based surveys are typically directed to the website through initial contact via e-mail. The respondents complete the survey online and submit their responses via the internet (Metler, 2016).

3.4.2. The Qualitative Research Process

Qualitative approaches can be used to investigate specific criteria and their evolution, since such methods are especially appropriate for exploratory research and act as a 'catalyst for conceptualisation' (Strauss & Corbin, 1990). Qualitative methodologies facilitate the exploration of participants' subjective views and experiences throughout management activities in response to a sudden shift scenario.

Qualitative research is characterised by its focus on understanding phenomena from a holistic perspective, often involving detailed, in-depth data collection methods such as interviews and observations (Creswell J. , 2013). This approach allows researchers to capture the complexity of human experiences and social contexts, providing rich, nuanced insights that quantitative methods may overlook (Denzin, 2009). Additionally, qualitative research is iterative and flexible, enabling researchers to adapt their methods as new insights emerge during the study (Merriam & Tisdell, 2015). This adaptability is crucial for exploring dynamic and evolving

phenomena, making qualitative research particularly valuable in fields such as social sciences and education (Patton, 2002).

3.5 Research Strategy

3.5.1 Different Research Strategies

The justification of a research strategy relies on two factors: the suitability of the technique for examining certain phenomena or assessing specific data kinds, or the total unsuitability of known alternative approaches (Dalli Gonzi, 2019). Prominent writers in the literature delineate the following research strategies; Experimentation (quasi-experiment), Grounded Theory, Ethnographic Study, Action Research, Case Study, Survey Research, and Archival Research. This research examined two pertinent methodologies. The exploratory character of the research warranted the use of case study and a quasi-experiment methodology.

A case study technique is used to get an in-depth comprehension of the research setting and the procedures involved. This method is mostly used for exploratory or explanatory scenarios. The data gathering procedures used include interviews, observation, and documentary analysis, which are likely to be applied within single research (Bryman & Bell, 2007). Yin (2003) identifies four case study strategies: single or multiple, holistic or embedded. In this study, a single case study was used to focus on the results that could be obtained from a series of embedded cases (stakeholders were same throughout all three cases), within an approach whereby multiple units of analysis were studied within that case (ibid) (Yin, 2003).

In a quasi-experiment design, which includes a pretest-post-test design, the dependent variable is measured once before the treatment is implemented and once after it is implemented (Price, Jhangiani, & Chiang, 2015). Quasi-experimental approaches aim to investigate the causal impacts of an intervention, therapy, or stimulus on a subject of research (White & Sabarwal, 2014).

3.5.2 Chosen Research Strategy

In this study, a quasi-experimental research approach was used to test out the research hypothesis and questions. The quasi-experimental research model used a pre-test/post-test research design. A pre-test/post-test design is a research approach commonly associated with experimental and quasi-experimental research. It focuses on measuring changes in a variable or outcome before and after the implementation of an intervention or treatment. This design is more concerned with assessing the effectiveness of an intervention and statistical analysis of numerical data. This was used to determine the impact of a specific intervention, in this case using the Value Management framework on measurable outcomes.

Thus, in the context of the study described, a Quasi-Experimental Research Design (shown in Figure 3.3) incorporating a pre-test/post-test as the Quasi-Experiment was the ideal route amidst other research routes. Additionally, the study utilised three Cases (multiple units of

analysis) within what is termed a holistic approach to case study design (Yin, 2003), in this case Ambjent Malta, to constitute the intervention of the same quasi-experiment. These Case Studies involved an Information Session and Value Management Workshop, offering detailed insights into the effectiveness and outcomes of the intervention within real-world settings.

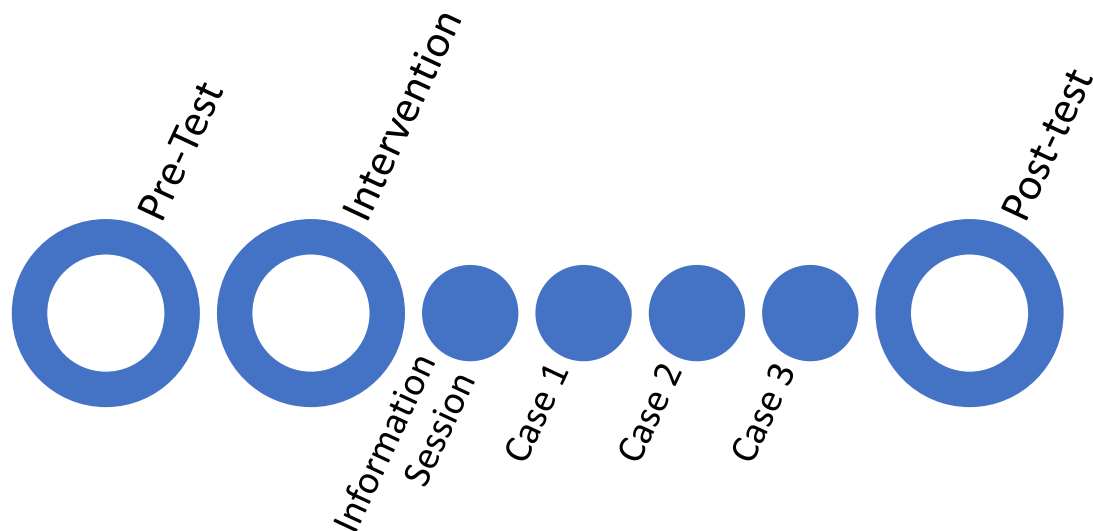


Figure 3.3: Quasi-Experimental Research Design Flow.

3.5.3 Case Study Research Strategy

Case study design, as described by Robert K. Yin, entails a systematic and comprehensive approach to investigating real-life phenomena within their natural context. This methodology is particularly suited for research that seeks to understand complex social, organisational, or behavioural phenomena, as it allows for in-depth exploration and analysis of specific cases. At the core of Yin's approach is a clear articulation of research questions that guide the case study investigation, focusing on the "how" and "why" of the phenomenon under study. Selecting cases that are relevant to the research questions and offer variation in key variables is crucial, whether opting for a single-case or multiple-case design. Yin emphasises the importance of employing diverse data collection methods, such as interviews, observations, and document analysis, to gather rich and multifaceted evidence.

Data analysis techniques, including pattern-matching and explanation-building, are employed iteratively to derive meaningful insights from the collected data. Throughout the research process, attention is given to ensuring the validity and reliability of the findings, with strategies in place to enhance internal and external validity. Finally, interpreting and reporting findings in a coherent and transparent manner is essential, providing a narrative that links empirical data to theoretical frameworks while acknowledging the limitations and potential biases inherent in the case study approach. Overall, Yin's approach to case study design offers a robust methodology for investigating complex phenomena in various fields, contributing to a deeper understanding of real-world contexts and experiences (Yin, Case study research and applications: Design and methods (6th Edition), 2018). A base case study entails the detailed

and intensive analysis of a single case. Case study research involves understanding the complexity and particular nature of the case in question. Case studies are often a great example of the integration of both qualitative and quantitative research (Bell, Harley, & Bryman, 2022). In a case study design, the main emphasis tends to be on the setting. As mentioned by Bryman, Case Studies are frequently sites for using both qualitative and quantitative research, as is the case for this research study (Bryman A. , 2012).

3.5.4. Case Study (Ambjent Malta)

The use of a case study technique was appropriate as it facilitated the analysis of the field's processes, issues, and programs, so enhancing comprehension of responses or growing gaps that might subsequently enhance practice. A case study technique was optimal in this instance, since the research objective was to inform policy. The case study approach provided the opportunity to examine many potentially significant factors within a real-world scenario. Comprehensive and insightful descriptions were acquired, allowing for the examination of the data from alternative perspectives over many tries, so ensuring that the retrieved data remained impartial. Erickson (1986) posits that since the general resides inside the specific, insights gained from one situation may be applied to another (Erickson, 1986). Additionally, Stake (2005) elucidates that in this kind of information transmission, researchers convey to readers their subjective interpretations of events and linkages (Stake, 2005).

Flyvbjerg (2006) contends that context-dependent information has more value. The inclusion of case studies in the method enhanced comprehension of the ultimate objective within a framework reflective of prevailing climatic circumstances and policies during significant transformation (Flyvbjerg, 2006). The design of this approach was directly pertinent to the inquiries posed at the project's inception to stimulate discussion, debate, and contributions to policy development. The case study inquiry addressed a scenario with a greater number of variables of interest than available data points (Dalli Gonzi, 2019). Each outcome depended on many sources of evidence, with data converging via triangulation. From a Yinian perspective, case study research design is comprised of five components: a study's questions; its propositions, if any; its unit(s) of analysis; the logic linking the data to the propositions; and the criteria for interpreting the findings (Yazan et al., 2015). While designing the inquiry, the researcher is supposed to make sure that these components are cohesive to and consistent among each other. Yin directs extra attention to the fourth and fifth components which refer to the planning for the data analysis steps in a case study method (Yazan, 2015).

3.5.4.1 Case Study (Research Strategy, Background and Context)

The research used three cases within a holistic case study design framework (Yin, 2003), with Ambjent Malta serving as the intervention for the selected quasi-experimental method. Ambjent Malta is the governmental department tasked with the protection of the local environment under the Ministry of Environment, Energy and Enterprise. Established in 2018, the Ambjent Malta Department (AM) is tasked with the protection and improvement of Malta's natural capital and biodiversity throughout rural, urban, coastal, and marine

environments. Ambjent Malta is tasked with executing green infrastructure initiatives and habitat restoration efforts to preserve and rehabilitate natural areas and protected places, including regions under the Natura 2000 network (Government of Malta 2021, 2021). Ambjent Malta, hence, encompasses several key areas, including **Natural Heritage Conservation**: This involves the protection of Malta's diverse ecosystems, including coastal areas, marine habitats and terrestrial environments. Efforts are made to preserve biodiversity, rare species and natural landscapes. **Cultural Heritage Conservation**: Ambjent Malta also focuses on preserving Malta's rich cultural heritage, including historical sites, monuments and traditional architecture. This initiative aims to maintain the authenticity and integrity of these cultural assets. **Sustainable Development**: Ambjent Malta emphasises sustainable development practices, promoting eco-friendly initiatives, renewable energy, waste reduction and environmentally conscious urban planning. **Public Awareness and Education**: The initiative raises public awareness about environmental issues and heritage conservation. Educational programmes, workshops and awareness campaigns are organised to engage the local community in conservation efforts. **Collaboration and Partnerships**: Ambjent Malta collaborates with various stakeholders, including local communities, NGOs, and governmental agencies, to achieve its conservation goals. Partnerships are crucial for the success of environmental and cultural preservation initiatives (Government of Malta, 2021).

3.5.4.2 Embedded Cases - A Research Strategy

An embedded case study technique was created to address the highlighted concerns. This research examined Case Study Projects in the Public Environment Sector, specifically the L-Għadira s-Safra, Marfa Radar Stations, and Buskett Public Convenience projects, to evaluate the research questions through a pre-test/post-test Study, utilising Value Management Workshop and Information Session as interventions.

These three projects were all at different stages of the pre-tendering phase when the workshop was carried out and at the very initial stages of the design phase. Hence, they were deemed ideal in order to test the research questions and the potential of applying Value Management Methodology in the Public Service Sector. Each case study, however, had different considerations and used a different form of the Value Management Approach, with the first two using a Hybrid Charette approach whilst the third, being more technical in nature, used a Value Engineering Approach.

For all three case studies, the Client – Ambjent Malta, and to a larger extent the public at large, expected to promote the conservation of the natural habitat as the primary objective for any project it undertakes. Therefore, as a Value Study Leader for these three projects it was the role of the researcher to analyse the client's project requirements and discuss with the key stakeholders what each one was expecting to get out of these projects prior to carrying out the Intervention. This helped form an initial idea as to what direction was required for the workshop and how open to change the individual stakeholders were prior to the workshop. An initial site-visit was also carried out prior to intervention in order to better understand the

project, the requirements and the potential constraints visible and applicable for each project. Each project had its own limitations and potential issues that would be brought up during the Workshop but some of which were apparent from the site visit. This all formed a critical part of the Diagnostics phase as mentioned by various Value Management academics.

3.5.5 Case study Contextualisation

3.5.5.1 Case Study One: L-Għadira s-Safra:

The Case Study in question relates to the construction of a Bird Observatory including the formation of brackish water ponds for wader species. L-Għadira s-Safra is a temporary rainwater body situated on the north-eastern coast of Malta, between L-Iskoll tal-Għallis and Qalet Marku, in a bed of Lower Coralline Limestone less than a metre above sea level. The temporary pool supports biotic assemblages that are typical of freshwater habitats during the wet period and halophytic species colonise the area around the pool. Although the pool is close to the sea, the characteristic fauna is typical of freshwater despite the fact that the highest salinity recorded from this water body is well below the upper limit for “fresh” waters. L-Iskoll tal-Għallis have characteristics of rocky shoals as the sea inundates them for a significant part of the year and, consequently, they neither support terrestrial vegetation nor a real supralittoral zone. However, this shoal is a significant resident, resting and foraging site for avifauna and, also, important for migratory birds. The proposal lies within the Natura 2000 Site MT0000008: L-Għadira s-Safra and L-Iskoll tal-Għallis which is a Special Conservation Area designated under the Habitats Directive (92/43/EEC). The nature of the proposal is such that no significant negative impacts are envisaged on the protected area or its habitats and / or species for which it was designated. The proposal is for the construction of a Bird Observatory including the formation of three brackish water ponds for wader species including a water reservoir.

The Orientation Phase for the L-Għadira s-Safra Project consisted of a thorough visit of the site, together with all stakeholders in order to understand the current state of the project and the works required. This initial site visit was carried out with a number of stakeholders, namely, the Director of Ambjent Malta, Project Architect, Chief Electrical Engineer, Chief Mechanical Engineer, Ambjent Malta Projects Implementation Senior Manager and Quantity Surveyor. The scale of the works required and an understanding of what needed to be done was discussed during the meeting.

The value study was designed in three phases. First, the Orientation and Diagnostics phase involved a 2-week information gathering and analysis period. Second, the Value Workshop phase comprised a one-day combined value management and value engineering workshop period. Finally, the Implementation phase involved a week-long report production period. The study aim was to examine the project design and to review the strategic objectives to ensure they would be met and delivered by the design. The value study was designed in a similar way to the typical value study carried out in the United States.

It was decided that a Charette/hybrid type of study was to be carried out for the first project which dealt with the L-Għadira s-Safra Project. The following Agenda was set for the first workshop:

- Introduction – Project and Value Management Brief.
- Examination of key issues impacting the project - Establish major issues to be tackled.
- Understanding the project functions.
- Examine the technical and detailed proposals to meet the necessary functions and to identify value mismatches.
- Closure – Discussing the way forward.

3.5.5.2 Case Study Two: Radar Station Marfa

The aim of this project was to restore and conserve the historic radar station at Marfa, Mellieħa. The site has been neglected and vandalised for a considerable number of years and is of historical intrinsic value. The area is also a rich natural area for garigue, a low shrubland habitat ecosystem found in Mediterranean climates and regions, close to a Natura 2000 site. As shown in the table hereunder - the SWOT Analysis, the design needed to keep the historical context of the site and buildings, whilst creating a historical public and touristic space. The nature of the site in question and its historical aspect presents various constraints. The original stonework needs to be numbered in order to be dismantled and reconstructed as per original. Care also needs to be taken to ensure that the machinery used on-site and the work practices adopted do not damage the surrounding garigue and the natural habitat present.

Table 3.1: SWOT Analysis.

SWOT analysis from the contracting authority's viewpoint	
Strengths	Weaknesses
<i>Historical Context</i> <i>Opening a new space to the public</i> <i>Removing dangerous vandalised structures</i>	<i>Open Area</i> <i>Natural Habitat with garigue</i> <i>Dangerous structures</i> <i>Require security in order to avoid future vandalism</i>
Opportunities	Threats
Funding – Budget Measure Restore and return to the public a historic building and area. Create a new touristic attraction close to the Red Tower and Natura 2000 site.	Potential future vandalism Weather conditions Requirement of manual means for work on site

The Charette is a hybrid study. It is an audit of the project brief and concept design. In North America, the study is often referred to as being undertaken at 10% design. This means that

the Charette is always an examination of decisions already made in order to validate those decisions and develop the project for the next stage. This is the development of the design. The most common reason for a Charette is that, following the completion of the concept design and the cost plan, it is realised by the client that either the project has lost focus or that the cost plan exceeds the budget, often, significantly. Therefore, the Charette is, commonly, the first study undertaken on a project. It implies that the client has reached the decision to build, completed the project brief, appointed the design team and then undertakes a value study. The study is considered to be wide ranging.

The study focuses on validating the project mission, the project brief and, frequently, the concept design, to ensure that the client's project value system and the strategic mission of the project can be fulfilled. As mentioned by Kelly *et al.*, the Charette is a common type of value management exercise undertaken on construction projects where value management is a single event. On completion of the Charette, the client project value system will have been made explicit, the project brief will have been validated and any outline design audited against the client project value system, strategic brief and project brief. A complete Charette value study will potentially take between two to three weeks to complete, with the workshop taking between one and three days of the time. The length of time for the study will be influenced, principally, by the amount of pre-work undertaken by the team and the complexity of the project (Kelly, Male, & Graham, 2015). The workshop for the second project related to the Project at Marfa deemed a Charette type study to be the most suitable type of study considering the stage of the project and the objectives which were targeted for this workshop. The agenda for the **1-Day Charette style workshop** was the following:

- Introduction – Project and Value Management Brief.
- Examination of key issues impacting the project - Establish Major Issues to be tackled.
- Understanding the Design – SWOT Analysis.
- Understanding the project functions.
- Examine the technical and detailed proposals to meet the necessary functions and to identify value mismatches.
- Closure – Discussing the way forward.

3.5.5.3 Case Study Three: Buskett Public Convenience

The third Workshop carried out together with Ambjent Malta was a Value Engineering Workshop regarding the demolition of the existing Public Convenience at Buskett and construction of a new access-for-all Public Convenience at the same location. The structure of the existing public convenience at Buskett had vertical and horizontal cracks, which were progressing due to a pecan nut tree planted at the back of this structure. These public toilets do not accommodate accessibility and sanitary facilities which are accessible for all. Moreover, the whole building is run down and needs extensive refurbishing.

A Value Engineering Study was the chosen Study type by the researcher as the Scope of the Project was already decided and set and the study required was of a technical nature. This study type, focusing on the Value Engineering aspect, was chosen in order to generate the best technical solutions possible and ensure that with the help of Value Management the most appropriate solutions are chosen for the way forward. A Value Engineering Study focuses on the technical needs of the project, most especially items such as technical designs, lighting, water supply, finishes and equipment. Value Engineering aims to achieve the best value for money while maintaining or enhancing project performance and quality. The following **agenda for this Value Engineering Workshop** was chosen:

- Introduction – Project and Value Management Brief.
- Examination of key issues impacting the project - Establish Major Issues to be tackled.
- Understanding the project Functions.
- Examine the technical and detailed proposals to meet the necessary functions and identify value mismatches.
- Closure – Discussing the way forward.

Once more, the time allocated for this workshop was contained to one day, due to the time constraints of the stakeholders. However, the agenda set ensured that a successful exercise could be carried out and that decisions would be generated from the Workshop delivered. The most significant aspect of the Value Engineering Workshop was the multiple Functional Space Analysis carried out for the various technical aspects discussed namely, the Substructure, M&E's, Apertures, Finishes and Sanitary ware.

3.5.6 Research Strategy: Quasi-Experiment: Pre-Test/Post-Test Method

The Before-After Comparative Study or Pre-Test/Post-Test Study measures outcomes of a group of participants before introducing a product or other intervention, and then again afterwards. This is the same as a before and after assessment to measure whether the participants taking part in the programme had now changed their outlook. A standard test is applied before the initial participation (pre-test or baseline) and re-applied after a set time or end of a programme (post-test or endline) (Davidson, 2014).

The pre-test/post-test research methodology is a widely utilised experimental design found in diverse fields including psychology, education and social sciences (Stratton, 2019). It aims to evaluate the effectiveness of an intervention or treatment. Pre-test and post-test design is used in evaluations of participants' attitudes or perceptions relative to an event or intervention. This approach entails measuring a specific outcome variable in participants both before and after they undergo the intervention (Privitera & Ahlgrim-Delzell, 2018). The objective is to ascertain the intervention's significant impact on the participants. One would assume that an increase in knowledge or positive attitude that is evident in better scoring in the post-test, compared to the pre-test, implies better knowledge or perception relative to the intervention or event that was applied after the pre-test (Stratton, 2019). Pre-test/post-

test research methodology works as per the process hereunder: (Harerimana, Evidence Duma, & Mtshali, 2023) (York, 2017).

Pre-Test: Establishing Baseline Measurements:

Researchers carefully select a measurement that represents the outcome under study.

Various methods like surveys, tests, observations, or physiological assessments are employed, depending on the study's nature.

Intervention: Implementation (Information Session, Case 1, Case 2, Case 3)

The Participants undergo the intervention.

Implementation is often standardised to maintain consistency across participants.

Post-Test: Post-Intervention Measurements:

After the intervention period, researchers measure the outcome variable again.

Similar measurement tools used in the pre-test phase are employed to ensure consistency and comparability.

Comparative Analysis:

Researchers compare the post-intervention measurements with the pre-intervention data. Statistical analyses, such as t-tests or analysis of variance (ANOVA), are utilised to identify significant differences in the outcome variable after the intervention. These variables are carefully planned and taken into account while performing a pre-test/post-test study so that researchers may make valid conclusions about the efficacy of treatments and interventions in a variety of domains (Privitera & Ahlgrim-Delzell, 2018). This type of study design does not rule out that something other than the performed intervention may have caused a change, however, that is discussed in the limitations section of pre-test/post-test methodology, while still substantiating a viable type of research design for this research (Office for Health Improvement and Disparities, 2020).

A method used to improve validity is to design a study with a pre-test, followed by a later post-test. It is not ideal to hold an immediate test as it is important to allow for consideration of learning or attitude decay and on-going external stimulation. Using different questions relative to general knowledge acquisition or attitude on a pre-test and post-test will also improve validity. It is important that both the pre-test and post-test are validated for showing accuracy in measuring the outcomes of interest prior to being used in the study (Stratton, 2019).

3.5.6.1 Advantages of Pre-Test/Post-Test Methodology:

The pre-test/post-test study design is a popular method for assessing the effectiveness of an intervention. It allows researchers to infer causality (Campbell & Stanley, 1963), is straightforward and easy to implement, offers directionality (Trochim & Donnelly, 2007)

which is, significant advantage of the pre-test/post-test study design meaning that there is testing of a dependent variable before and after intervention with an independent variable, is efficient (Kirkpatrick & Kirkpatrick, 2006), and provides a rich literature base for comparison of studies' meta-analysis of previously published research work (Stratton, 2019).

3.5.6.2 Limitations of Pre-Test/Post-Test Methodology:

In this regard, the limitations of a pre-test post-test method, relate to two main concerns. Findings from pre-test/post-test studies, if not properly carried out, might not effectively generalise to real-world situations or different populations. The controlled environment of the study may not fully represent diverse, real-life scenarios (Metler, 2016). This is referred to as external validity.

Pre-test and post-test research methods have been employed in numerous disciplines, such as medicine-nursing, health, mental health, and education, since the 18th century (Stratton, 2019). Because it is a swift and convenient method for evaluating a target group to which an intervention has been applied, it has remained in widespread use and the literature base is full of pre-test/post-test studies, which enables the comparison of these studies and the meta-analysis of previously published work of this nature (*ibid*).

The pre-test and post-test design is not only a convenient research method, but it also enables the statistical analysis of data using established statistical methods (Stratton, 2019). Changes observed in the outcome variable could be influenced by natural maturation processes or historical events occurring during the study period. These external factors may impact the results, making it challenging to attribute changes solely to the intervention (Privitera & Ahlgrim-DeLzell, 2018) (Stratton, 2019). Researchers often use statistical techniques such as analysis of covariance (ANCOVA) to account for initial differences between groups and improve the precision of their conclusions. Despite its limitations, the pre-test/post-test research methodology remains a valuable tool for evaluating the effectiveness of interventions in controlled experimental settings (EMpower – The Emerging Markets Foundation, 2017) (Dimitrov & Rumrill, Jr., 2003).

3.5.6.3 The Pre-Test /Post-Test Method Suitability for the Study and Potential Statistical Methods for Analysis of such Pre-Test/Post-Test Data

A pre-test/post-test study design considering all factors was deemed the best type of Study for this research study as it allows for a comparison before and after undergoing an intervention, in this case an explanation of Value Management, how it works and its benefits. Besides, a Case Study Workshop experience using Value Management tools was included. Considerations were taken in order to strengthen the validity of the study and reduce maturation. This intervention was affected on all key stakeholders involved in real-life projects underway and/or planned at Ambjent Malta. Hence, this pre-test/post-test research study was deemed a quasi-experiment as the stakeholders involved in the Project were directly involved in the before and after tests together with the intervention.

The stakeholders for the projects were asked anonymously and voluntarily to complete a pre-test survey. The pre-test survey was sent out via email to the participating stakeholders a fortnight before the first informational session for the Project was held. A brief overview regarding Value Management was provided, however, no specific details were given in order to avoid biasing responses (Chung & Tse, 2022).

The post-test intervention survey included similar questions and were sent to the same key stakeholders in order to form a comparison. Once more, the response to the surveys were to be anonymous. The pre-test was conducted before the informational session regarding Value Management, whilst the Post-test was conducted in the months following the Workshops, the time gap between the intervention and the post-test was kept to allow for consideration of learning or attitude decay and on-going external stimulation (Stratton, 2019).

The following statistical methods are traditionally used in comparing groups with pre-test and post-test data: the Paired t-test, Wilcoxon signed-rank test, and the Mann-Whitney test. These will be discussed later in this chapter (Dimitrov & Rumrill, Jr., 2003).

3.5.6.4 - Intervention-Information Session.

In a pre-test/post-test research design, an information session is typically used to educate participants about the study, its objectives and the procedures involved. This session was conducted before any interventions or treatments were applied (pre-test). The purpose of the information session is to ensure that participants understand the study, provide informed consent and are aware of what is expected of them during the research process.

An Information Session regarding Value Management was delivered to the stakeholders and other important senior management personnel within the directorate after the Pre-test questionnaire. The aim was to provide background knowledge and information regarding Value Management prior to using the Value Management technique in the Workshops. The hypothesis of this information session was based on the pre-test results that Value Management is a relatively unknown and unused methodology for the stakeholders present. Hence, the Information Session needed to provide a clear understanding of the definition of Value Management, its usage and benefits. The information Session also clarified what a Value Management Workshop entailed, typical tools used during the Value Management Workshop and the importance of entering for a Value Management Workshop with an open-to-change mindset. An explanation, regarding the definition of Value and Function together with their multiple interpretations and uses, including their critical importance in Value Management was also given. The Value Management Study, the different phases that make up the complete Value Management Study and a brief overview of the critical and commonly used tools applied during the Diagnostics stage of a Value Management Study was also given. Real life basic examples helped the team of stakeholders to understand how Value Management works. More complex real-life examples from international and local projects were also provided in order to better explain the Value Management Approach and how it could be implemented

in real life projects with particular attention given to environmental projects in the public sector. This information session was an integral part of the Intervention as it provided the knowledge and appreciation needed before undertaking the Workshop in order to ensure that the Workshop bore fruit and the methodology would be carried out well. Hence, the complete intervention being the Workshop and Information Session could have an impact on the results of the post-test.

The following was **the agenda used for the Value Management Information Session** provided:

- Value Management – Definition.
- Value Management – Background.
- Value & Function.
- Basis of Value Management.
- The Value Management Study.
- The Project Life Cycle.
- Value Management Tools.

These components were chosen as the most important aspects to be delivered to the stakeholders before undergoing the Workshop. The Intervention Session was held via Teams in order to ensure that all stakeholders were present. From the body language and participation of the stakeholders, it was evident that although Value Management was a new concept for the majority, they were buying into it and expressing enthusiasm in using the methodology in the future.

Several questions regarding the process were asked by the stakeholders, including questions regarding its implementation and potential use in real world projects within the same Government Department, Ambjent Malta. This showed interest and willingness from the stakeholders to work with such an innovative framework. The Information session was set-up as a one-day session. Following the Information Session a discussion and questions were permitted by the stakeholders in order to clarify or better understand the advantages and usage of Value Management.

By conducting a comprehensive information session, it was envisaged that clear communication with participants, ensuring their understanding of the study's purpose, procedures and ethical considerations can be established. This transparency is essential for obtaining informed consent and conducting pre-test/post-test with the necessary ethical and methodological rigour.

3.5.6.5 Stakeholder Selection Criteria

Stakeholder/Participants Selection Criteria Matrix

The selected participants were built on the following criteria and shown in the Selection Criterion table hereunder:

1. Key decision-takers.
2. Involved in aspects of strategic planning.
3. Responsible for execution.
4. Involved in environmental/ ecological/ architectural-related projects.

Table 3.2: Stakeholder Selection Criterion Table.

Role	Criteria for Selection	Rationale
Director General, Ambjent Malta	Decision-maker involved in the strategic planning and oversight of environmental projects.	Ensures strategic alignment and senior-level decision-making authority.
Director of Project Implementation	Responsible for the management and execution of the environmental projects at Ambjent Malta.	Direct involvement in the operational aspects of project implementation, ensuring practical application of VM.
Director of Finance, Ambjent Malta	Oversees the financial management and budgetary allocations for environmental projects.	Key stakeholder in understanding cost-management challenges and VM's potential for budget optimisation.
Senior Manager, Project Implementation	Manages the day-to-day operations and coordinates the team responsible for project implementation.	Provides insights into practical challenges and the implementation of VM at the operational level.
Project Architect, Ambjent Malta	Responsible for the architectural planning and design of environmental projects.	Essential for ensuring that project designs align with both environmental goals and VM principles.
Mechanical Engineer, Ambjent Malta	Designs and oversees the mechanical aspects of the environmental projects.	Ensures technical solutions are aligned with VM, focusing on efficiency and sustainability.
Electrical Engineer, Ambjent Malta	Responsible for designing electrical systems within the projects.	Provides technical insight into the sustainability and cost-efficiency of electrical systems within environmental projects.
Quantity Surveyor, Ambjent Malta	Manages project costs and advises on cost-saving measures.	Central to evaluating the financial aspects of VM and identifying cost-saving opportunities in project execution.

Role	Criteria for Selection	Rationale
Environmental Resources Authority	Regulatory body overseeing the environmental impact of projects.	Ensures that projects meet regulatory requirements and that VM contributes to sustainability and compliance.
Client's Project Architect	External stakeholder responsible for client-side architectural requirements and project oversight.	Provides a client-focused perspective on project execution, ensuring alignment with external expectations.
Client	Primary recipient of the project's outcomes.	Critical in evaluating whether VM aligns project outcomes with the client's needs and expectations.

3.5.6.6 Questionnaire Techniques

The term 'questionnaire', defined as a general term that includes all techniques of data collection, requires the respondent to respond to the same set of questions in a pre-determined order. The questionnaire technique is one of the most widely used data collection methods. The reason for this is because each respondent is asked for feedback to the same set of questions, thereby providing an efficient and effective way of collecting data from a large sample as part of a quantitative analysis (Saunders, Lewis, & Thornhill, 2007). There are various types of questionnaire methods, which differ according to how the questionnaire is administered.

3.5.6.7 Designing the Pre-Test/Post-Test Questionnaire:

When designing a pre-test/post-test questionnaire that is sent to specific participants chosen, it is important to ensure that the questionnaire is structured, focused and tailored to the specific objectives of the research (Bhandari, 2023). The following are some key aspects that were duly considered during the design of the pre-test questionnaire:

Demographic Questions that were discussed were built upon the following research areas:

Experience: The experience in number of years working with and within projects.

Size of Projects: Necessary for Project Value.

Project ownership: In order to investigate whether projects are of a public or private nature.

Knowledge and Awareness:

- **Prior Knowledge:** This assesses what participants know about the topic before any intervention was carried out.
- **Awareness of Concepts:** Helps to analyse if participants are aware of specific terms, theories, or initiatives related to the research (Stone, 1993).

Attitudes and Beliefs:

- **Attitudinal Statements:** The use of Likert scale questions to measure attitudes (e.g., Strongly Disagree to Strongly Agree).
- **Belief Systems:** In order to ask about the participants' beliefs regarding specific statements or hypotheses.

Behavioural Patterns:

- **Current Behaviours:** Used to inquire about participants' current behaviours related to the topic.
- **Frequency:** If applicable, to query how often participants engage in certain behaviours or practices.

Preferences:

- **Preferences:** Questions which relate to the participants' preferences regarding specific methods, approaches, or interventions.

Open-Ended Questions:

- **Challenges or Concerns:** Such questions allow participants to express concerns or challenges related to the topic.
- **Additional Comments:** Provide a space for any additional thoughts or comments they might have (Jenn, 2006).

Likert Scale Questions:

- **Effectiveness Ratings:** Likert questions can be used to ask participants to rate the perceived effectiveness of certain interventions or approaches.
- **Agreement Levels:** Measure participants' agreement with specific statements or propositions. (Roopa & Rani, 2012).

Closed-Ended Questions:

- **Yes/No Questions:** Such questions are used for straightforward queries about specific facts or opinions.
- **Multiple-Choice Questions:** These questions offer predefined options for participants to choose from (Roopa & Rani, 2012).

3.5.6.8 Likert Scale Questions

A Likert scale is a form of rating system used in research as a measurement method to evaluate attitudes, opinions and perceptions. Likert scale questions are highly adaptable and can be used across a range of topics, from a customer satisfaction survey to employment engagement surveys, to market research (Question Pro, 2023). In this research study, it was pertinent for each question or statement, that participants were able to choose from a range

of answer options ranging from 'Fully Disagree' to 'Fully Agree'. In studies where answer options are coded numerically, 'Fully agree' would be rated 1 or 5, respectively increasing or decreasing for each response. In between these, it is normal to find a neutral statement like 'neither agree nor disagree'.

As well as judging positive and negative statements, a Likert scale survey question can judge frequency, quality, or feelings of importance. The granularity it provides over simple yes or no responses means that one can uncover and analyse degrees of opinion, giving an accurate and representative understanding of feedback. In this regard, the option of its use gave benefit to the study given the possibility to analyse data in way which calculate mean scores, assess central tendency and provide the opportunity for future interpretations.

3.5.6.8.1 Benefits of Likert Scale

Likert scale options have several benefits including (Qualtrics. XM, 2024). A Likert scale requires respondents to rank their preference based on the Likert Scale chosen by the researcher, therefore making it easy to understand. For example, depending on whether they strongly agree or strongly disagree, the respondents just select their response. This is sometimes referred to as a symmetric agree-disagree scale. This makes the Likert Scale also easy to analyse due to the responses given a rating scale, therefore they can be collated numerically and filtered based on the responses received (Qualtrics. XM, 2024).

Additionally, a Likert scale question is ideal for single topic surveys, as the data can be easily analysed to judge sentiment. In this research a Likert scale was deemed the best fit for the study. It could be easily used to judge respondents' feelings about specific parts of a service, product or theory, then follow-up with a more detailed study. Likert scale questionnaires help to evaluate preferences, sentiment, perspectives, behaviours, or opinions. Rather than extreme response categories, example: giving respondents only two options when discussing polarising topics, Likert scales provide flexibility by providing a wider range of options. However, for difficult topics, respondents may feel that they must answer in a certain way to avoid being seen as 'extreme'.

A Likert scale is effective when trying to assess sentiments towards a business, brand, product or service. Likert scale responses can judge sentiment, along with reasons for the sentiment. In this study, it was pertinent to collate data in a statistical analysis platform, filtering responses to see what percentage of customers are satisfied in a particular category, versus those that are not satisfied within that class. One could also go step further forward to 'break' the percentages down, e.g., those who are highly satisfied versus those who are just satisfied. It is important to note that using a Likert scale questionnaire was deemed fit when asking about a singular topic as was the case herewith, otherwise one risks confusing respondents and damaging the legitimacy of the study.

3.5.6.8.2 Disadvantages and Limitations of Likert Scale

While Likert scaling is highly effective at measuring opinions and sentiments, it does have some limitations (Qualtrics. XM, 2024):

Response choices limit real understanding: While Likert scales help determine sentiment, they are not as effective and helpful when it comes to understand why people decide in a certain way. There is also no interpretation of the sentiment between each choice, whether positive or negative. For example, a respondent might 'slightly agree' with a statement, but this will not explain why the respondent agrees? What made them feel that way, what influences their responses? This kind of granularity can then be achieved by open-ended questions. Respondents might focus on one side of the sentiment: Depending how questions are written, respondents might focus on one side of the scale. If they feel their answers might somehow affect their reputation, lifestyle or portray them negatively, they will pick positive responses. Also, depending on the topic, respondents may be less likely to take extreme sides of the Likert scale, instead agreeing, disagreeing or remaining neutral. Previous questions can influence responses: With any quantitative survey, respondents can get into a 'rhythm' of answering questions. The result is that they start to respond in a certain way, this can be exacerbated by poor questioning, long surveys and/or flicking between themes.

3.5.6.9 Sampling Techniques

Sampling is ideal when it is impracticable to survey the entire population due to size, budget or time constraints. This technique is applicable and equally important whether using interviews, questionnaires or observation as data collection techniques (Qualtrics. XM, 2024). The survey research was divided in three parts using a mixture of multiple choice, Likert scale and open-ended questions and it was specifically targeted towards the key stakeholders taking part in the case studies/projects who underwent the intervention. All the data was gathered via google forms and no incentives were offered to participants for answering the questionnaire (Grima, Romanova , Bezzina, & Chetchuti Dimech, 2014).

The pre-test questionnaire sought to identify the key drivers for Value Management in the Public Service Sector as these key drivers help identify the most critical areas where Value Management can have an impact. Such a research objective also lays out a foundation for a mixed methods research strategy with the first part of the study having quantitative data based on a survey design, whilst the second part of the research objective required the use of both qualitative and quantitative processes from the survey and the case studies undertaken. In this regard, the overall aim is to highlight the benefits, not only in terms of cost, but also in terms of the quality and efficiency that can be provided by VM tools and methodologies when applied to public service entities undertaking major projects, optimising organisational decision-making and performance, for effectiveness and efficiency through value-based methodologies.

The sampling techniques available can be divided into two types:

- Probability/representative sampling.
- Non-Probability/judgmental sampling.

When using probability sampling, the chance of each case being selected from the population is known and usually equal for all cases. This makes it possible to answer research questions from estimating statistically the characteristics of the population from the sample. This sampling technique is usually associated with survey and experimental research strategies (Saunders, Lewis, & Thornhill, 2007).

On the other hand, in non-probability sampling, the probability of each case selected from the population is not known and, therefore, it is not possible to answer research questions that require statistical inferences about the characteristics of the population. Non-probability sampling is usually used for case study research strategies.

3.5.6.9.1 Probability Sampling

Probability sampling is associated with survey-based research techniques. The process for probability sampling can be divided into the four stages below and shown in Figure 10:

- Identify a suitable sampling frame for the research question/s.
- Decide on the suitable sample size for the research.
- Select the most suitable sampling technique and select the sample.
- Ensure that the sample collected is representative of the population.

3.5.6.9.2 Selecting the Most Appropriate Sampling Technique

Probability sampling can be further divided into five main techniques. These are the following: Simple Random; Systematic; Cluster; Multi-stage.

Selecting one from the above options depends on the research question, objectives and sample size. Random Sampling involves selecting at random from the sampling frame using number tables or a computer. Random sampling eliminates bias and the sample selected can be said to be representative of the population (Saunders, Lewis, & Thornhill, 2007). Systematic Sampling involves selecting the sample at regular intervals from the sampling frame. Unlike simple random sampling, systematic sampling works equally well for a small or large number of cases (Saunders, Lewis, & Thornhill, 2007). This sampling technique is a modification of the random sampling technique, in which the population is divided into two or more strata based on one or a number of attributes. A random sample is then drawn from each group. Dividing the population helps to ensure that the sample is more representative as it is ensured that each of the strata is represented proportionally within the sample. However, due to the extra stage involved in this sampling technique it is likely to take longer, be more expensive and harder to explain than random or systematic sampling (Saunders, Lewis, & Thornhill, 2007).

Cluster Sampling is similar to stratified sampling as the sampling is divided into discrete groups prior to sampling. These groups are termed clusters. For cluster sampling, the sampling frame is the complete list of clusters rather than a complete list of individual cases within a population. This is followed by selecting a few clusters using random sampling, selecting the clusters randomly makes this a probability sampling technique. However, this sampling technique has a tendency to represent the total population less accurately than stratified random sampling (Saunders, Lewis, & Thornhill, 2007).

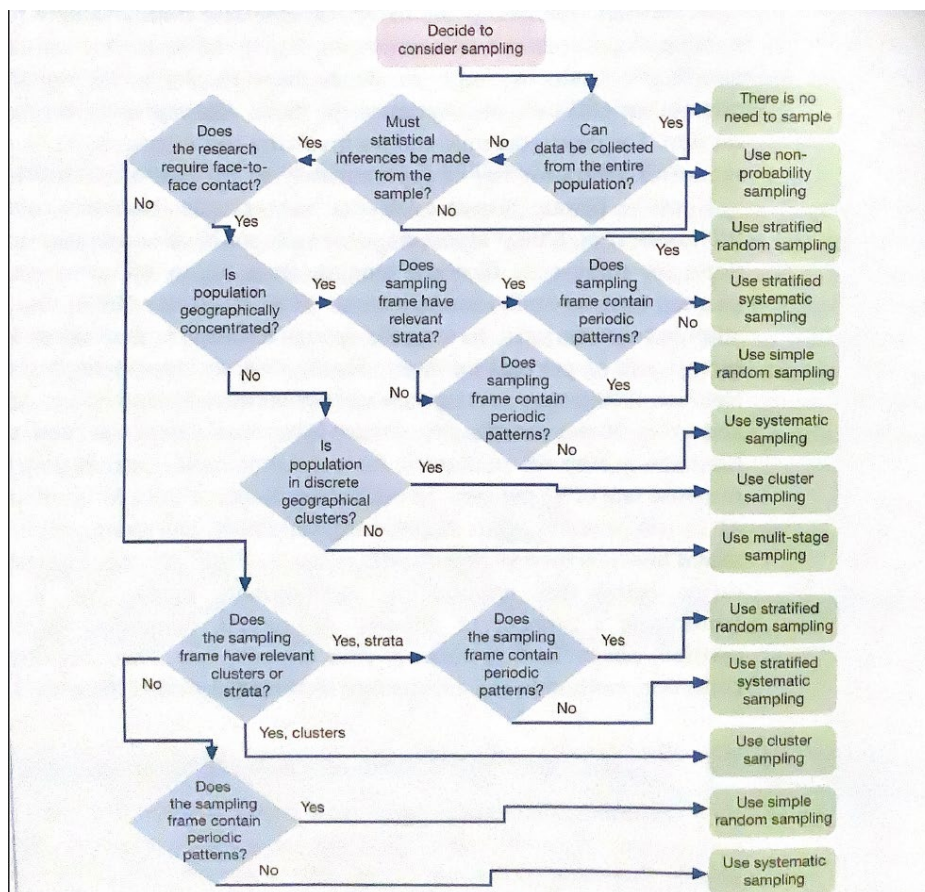


Figure 3.4: Probability Sampling (Saunders, Lewis, & Thornhill, 2019).

The techniques previously discussed considered that the sample was chosen statistically at random. However, as this may not always be possible, non-probability sampling (Figure 11) provides a series of alternative techniques to select samples based upon selective judgement. This is especially useful and normal in the exploratory stages of a research project such as in a pilot study (Saunders, Lewis, & Thornhill, 2007). Quota sampling is entirely non-random and normally used for interview surveys. It works on the premise that the variability of the various quota samples is the same as that in the population. The main advantages of quota sampling are that it is less costly than probabilistic techniques and can be set up very quickly. Purposive or judgmental sampling enables one to use judgement to select cases that will enable the researcher to answer the research question and meet the objectives required. This is, normally, used for very small samples, such as in case study research strategies (Saunders,

Lewis, & Thornhill, 2007). As stated by Campbell *et al.* (2020), the reason for purposive sampling is that it enables the researcher to better match the aims and objectives of the research being carried out. This, in turn, improves the rigour of the study and trustworthiness of the data and results. A relatively small and purposively selected sample may be employed with the aim of increasing the depth of understanding in a particular study. As previously mentioned, purposive sampling is used to select respondents that are most likely to yield appropriate and useful information. Amongst the reasons for choosing purposive sampling, one finds that when the researcher considers the strategy for the study, a specific kind of respondents are required to be included in the sample (Campbell, et al., 2020). This type of non-probability sampling technique is commonly used when it is difficult to identify members of the desired population. Hence, contact between cases is snowballed from one to another. The main difficulty in this sampling technique is identifying initial contact. Once this is achieved, these cases identify further members of the population, who, in turn, identify other members and so the sample snowballs. The biggest problem of snowball sampling is bias resulting in a homogenous sample (Saunders, Lewis, & Thornhill, 2007). This involves allowing individuals to identify their desire to take part in the research. The data is, thus, collected from the respondents who give feedback (Saunders, Lewis, & Thornhill, 2007). Convenience sampling involves selecting sampling haphazardly from the easiest sources. The sample selection process is continued until the required sample size is collected. This technique is widely used. However, it is prone to bias and influences beyond the control of the researcher. The problems are less important where there is little variation in the population (Saunders, Lewis, & Thornhill, Research Methods for Business Students, 2007).

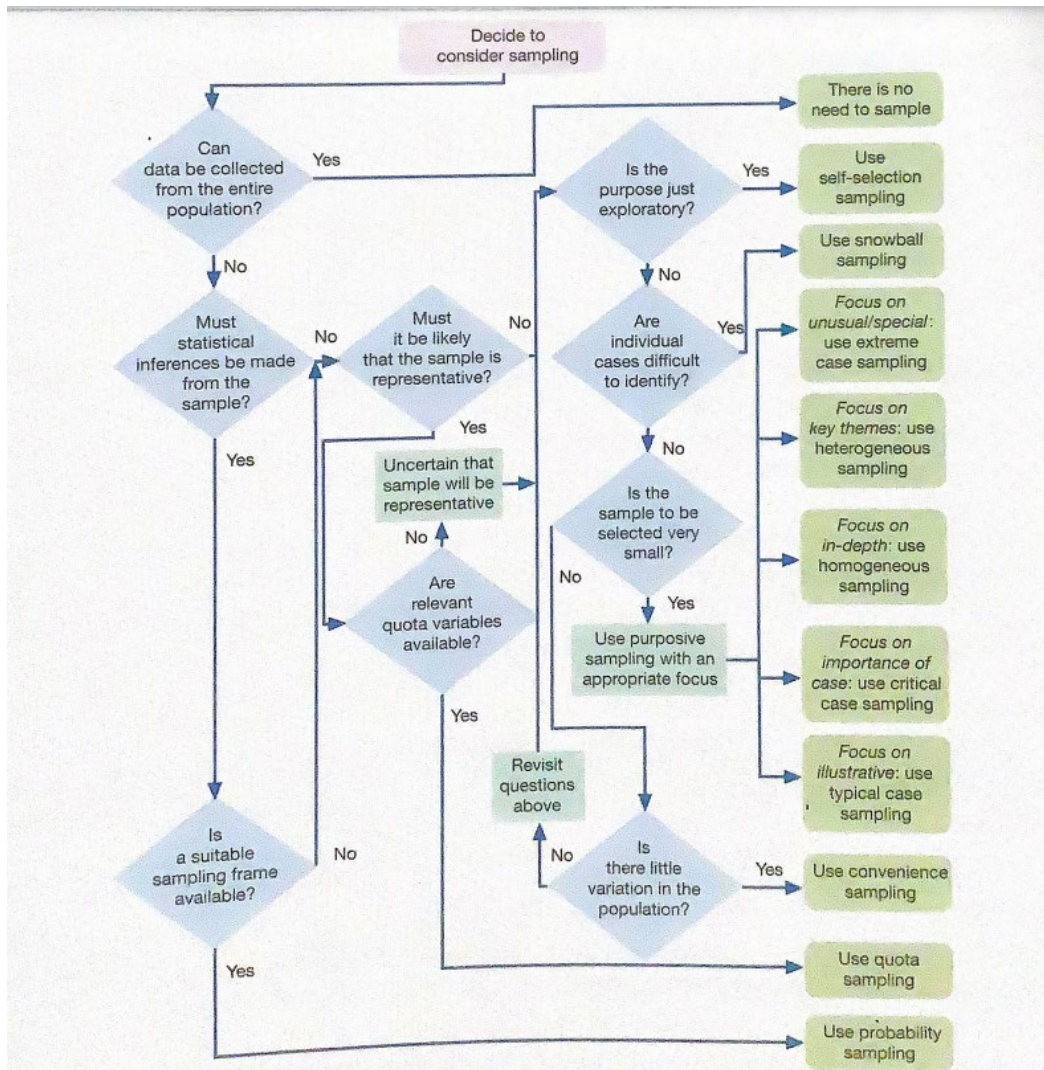


Figure 3.5: Non-Probability Sampling (Saunders, Lewis, & Thornhill, 2019).

3.5.6.9.3 Chosen Questionnaire Type and Sampling Method.

The questionnaire type used for this study was a Purposeful Sampling Questionnaire. In purposeful or judgmental sampling, researchers deliberately pick suitable individuals or groups based on their expertise, experience, or relevance to the research topic. These individuals are chosen because they possess specific knowledge, characteristics, or insights that are valuable for the study. For this study, considering the need to gather targeted and specialised information from a pre-selected group of stakeholders, the purposeful sampling questionnaire type was chosen. Purposeful sampling is a technique widely used in qualitative and quantitative research for the identification and selection of information-rich cases for the most effective use of limited resources (Patton, 2002). This involves identifying and selecting individuals or groups of individuals that are especially knowledgeable about or experienced with a phenomenon of interest. In addition to knowledge and experience, Bernard (2002) and Spradley (1979) note the importance of availability and willingness to participate, and the

ability to communicate experiences and opinions in an articulate, expressive and reflective manner (Palinkas, et al., 2015).

When the focus of the research study is based on an in-depth understanding, rather than on statistical generalisation, the purposeful sampling approach is commonly used in research, expert opinions and case studies. Hence, this was deemed as the most appropriate questionnaire type for the pre-test and post-test questionnaires (Rai & Thapa, n.d.).

The structured questionnaire survey consisted of a series of questions in order to understand the perception and knowledge of Value Management, the Value Management Study, Value Management tools and benefits in different sectors amongst various different categories of respondent and the drivers for the use Value Management. Designing a structured questionnaire for a pre-test involved formulating clear, focused and specific questions to gather relevant information from participants before any interventions were administered. A structured questionnaire ensures consistency in data collection, making it easier to analyse responses quantitatively.

3.5.7 The Qualitative Process

Qualitative research focuses on the contexts and meaning of experiences. Qualitative Research is a systematic and rigorous form of inquiry that uses, amongst others, case studies, observations, review of documents and interviews as methods of data-collection (Creswell, Klassen, Clark , & Smith, 2011). Qualitative research features an epistemological position described as interpretivist. This means that in contrast to the adoption of natural scientific methods found in quantitative methods, in qualitative research the importance is the understanding of the social world achieved by deep examination and interpretation of the same social world by its participants (Bell, Harley, & Bryman, 2022).

3.5.7.1 *Thematic Analysis*

This is a model developed by Virginia Braun and Victoria Clarke in 2006 (Lainson, Braun, & Clarke, 2019). Thematic analysis is a fully qualitative approach in which qualitative techniques are underpinned by a distinctly qualitative research philosophy. It is a method for identifying, analysing, organising, describing and reporting themes found within a particular data set (Braun & Clarke, 2006). It is a method for identifying, analysing and interpreting patterns of themes within qualitative data (Clarke & Braun, Thematic analysis, 2017).

Thematic Analysis places emphasis on, for example, research subjectivity as a resource, the importance of reflexivity and the situational and contextual nature of meaning (Clarke & Braun, 2018). It is appropriate for use with various different forms of data types, collection styles and participant groups thus allowing innovation to suit the context of the research. A detailed and well produced thematic analysis can produce trustworthy and insightful findings, providing a rich, detailed and complex amount of data (Nowell, Norris, White, & Moules, 2017).

Amongst its various advantages, one finds that, even for researchers unfamiliar with qualitative methods, this is a relatively quick-to-learn method as there are very few prescriptions and procedures. It is also highly useful when the researcher needs to summarise key features of a large data set, as it helps the researcher to follow a well-structured approach to handling data (Nowell, Norris, White, & Moules, 2017). Its most advantageous aspect is its flexibility, not just in terms of theoretical flexibility but in terms of research question, sample size and data collection. Thematic Analysis can be used to analyse all datasets being small or large and virtually any data type can be analysed from interviews and focus groups to qualitative surveys (Clarke & Braun, 2017).

Thematic Analysis provides accessible and systematic procedures for generating codes and themes from qualitative data. Codes can be considered to be the smallest units of analysis that capture interesting features of the data relevant to the research question. In this method, codes are the building blocks for themes, which in turn are the larger patterns of meaning, underpinned by a central shared core idea (Clarke & Braun, 2017). This model shall be used in order to analyse the data collected from the open-ended questions asked in the pre-test and post-test. These open-ended questions were analysed by picking out themes from the stakeholder responses using Vos Viewer software. These themes could then be analysed qualitatively.

3.5.8 Combining the Methods in Order to Develop the Research.

Combining qualitative and quantitative methods would seem to allow the various strengths of each research method to be capitalised and the weaknesses of each offset. The term mixed methods research is a simple term normally used to refer to such a methodology that integrates the qualitative and quantitative processes within a single research study. The mixing of the research methods should be mutually illuminating (Bryman A. , 2012).

Mixed Methods is preferred by some researchers and academics as it is considered more likely to generate findings that provide utility when combining different research methodologies. This is also accompanied by a rationale that the inferences derived from one research method can be subsequently tested by another research method (Bryman A. , 2012). For this study, this methodology was deemed the most suitable as it enabled a combination of a Quasi-Experimental Research Design with a Case Study Design. The Quasi-Experimental research consisted of the pre-test/post-test study whilst the case-studies were the three projects on which the Value Management Approach was tested. When combined, these provide a reply to the research questions of this study. Referring to the original research questions, i.e., Are the techniques of Value Management, incorporating Value Engineering used in the local scenario? If not, what benefits can be achieved by implementing a Value Management Approach?

These two questions were analysed and answered considering case studies within the public service environmental sector. Thus, in order to answer both parts of this research question, a

mixture of both quantitative and qualitative data analysis was required. The first part required the gathering of data generated through a survey design, in this case in the form of a questionnaire survey delivered as part of the pre-post-test. Whilst the second required using a mixture of quantitative and qualitative data in order to test the Value Management Approach as part of the Intervention of the same pre-post-test study in three different and distinct case studies.

The data gathering was then divided in two sections: Analysing the Intervention including the Case Studies carried out, which were three in total for three different projects, and analysing the data carried out from pre-post-test questionnaires carried out before and after the intervention respectively. The first part, analysing the Information Session and providing a context and analysis of each of the case studies, provided a detailed and intensive analysis of the particular event. Such a study helps the reader examine and learn how to apply the principles and lessons learned in the case researched to other cases or similar situations. The cases in question were once more selected via purposeful sampling, allowing the researcher to focus on the issues of central importance to the research (Schoch, 2019).

This study was developed using the mixed-methods approach. A mixed methods approach minimises the weaknesses of both qualitative and quantitative methods while combining their advantages in a single study. The various research procedures enable the researcher to accept, cross-validate and verify findings within a single study (Bouteraa, Chekima, Lajuni, & Anwar, 2023).

This required the collection of both quantitative and qualitative data from the aforementioned survey design and the case studies undertaken in order to carry out the research.

3.6 Statistical Tests Applicable to Test the Pre-test/Post-Test Analysis

Several statistical methods can be employed to analyse pre-test/post-test data, depending on the research design and the specific nature of the data. Here are some common statistical methods used in pre/post-test research methodology: (York, 2017).

1. Paired t-tests:

When to use: When comparing the means of a single group at two different time points (pre-test and post-test).

Assumption: The data should be approximately normally distributed.

2. Independent t-tests:

When to use: When comparing the means of two independent groups (experimental and control groups) at a single time point (post-test).

Assumption: The data should be approximately normally distributed, and variances between groups should be equal.

3. Analysis of Covariance (ANCOVA):

When to use: When comparing means of two or more groups at the post-test while statistically controlling for the pre-test scores (covariate).

Assumption: The covariate (pre-test scores) should be linearly related to the dependent variable (Stratton, 2019).

4. Repeated Measures ANOVA:

When to use: When comparing means of the same group at multiple time points (pre-test, post-test 1, post-test 2, etc.).

Assumption: Sphericity (the variances of the differences between all possible pairs of within-subject conditions are equal) (Stratton, 2019).

5. Mixed-Design ANOVA:

When to use: When there are multiple independent variables, some of which are within-subjects (repeated measures) and some are between-subjects (independent groups).

Assumption: Sphericity for within-subject factors and homogeneity of variance for between-subject factors.

6. Regression Analysis:

When to use: When examining the relationship between the pre-test scores (or other variables) and post-test scores. It can also be used for predicting post-test scores based on pre-test scores and other predictor variables.

Assumption: Linearity, independence of errors, homoscedasticity (constant variance of errors), and normally distributed errors.

7. Non-Parametric Tests (Wilcoxon Signed-Rank Test, Mann-Whitney U Test, etc.):

When to use: When the data does not meet the assumptions of parametric tests (normal distribution, homogeneity of variance). Non-parametric tests are used for ordinal or non-normally distributed data.

Assumption: Fewer assumptions compared to parametric tests but still requires independence of observations.

8. Effect Size Calculations:

When to use: Regardless of the specific statistical test used, calculating effect sizes (such as Cohen's d for t-tests or partial eta-squared for ANOVA) helps in understanding the practical significance of the results.

The choice of a specific statistical method depends on the research question, the experimental design and the characteristics of the data. Researchers often consult with statisticians or data analysts to select the most appropriate method for their study and ensure accurate interpretation of the results.

3.6.1 Paired-T-Test

A paired t-test is a statistical test used to compare two population means where one has two samples taken from the same individual, object or related units. These 'paired' measurements can represent things like: (York, 2017):

- A measurement taken at two different instances/times, therefore a pre-test and post-test, with an intervention taking place between the two tests.
- Measurements taken from two halves of a subject or experimental unit.

In this study, the Paired t-test was used in order to measure the responses by the same individual pre and post-test carrying out the Value Management Information sessions and workshop/s, this being considered as the intervention between the before and after tests.

The purpose of this test is to determine whether there is statistical evidence that the mean difference between paired observations is significantly different to zero. The paired t-test is a parametric test.

Procedure for Carrying Out a Paired T-Test

Suppose a sample of n students were given a diagnostic test before studying a particular module and then again after completing the module. The objective is to find out if, in general, teaching leads to improvements in students' knowledge/skills (i.e., test scores).

The results from the sample of students can be used to draw conclusions about the impact of this module in general. Let x = test score before the module, y = test score after the module. To test the null hypothesis that the true mean difference is zero, the procedure is as follows:

1. Calculate the difference ($d_i = y_i - x_i$) between the two observations on each pair, making sure to distinguish between positive and negative differences.
2. Calculate the mean difference.
3. Calculate the standard deviation of the differences, sd , and use this to calculate the standard error of the mean difference, $E(\bar{d}) = \frac{sd}{\sqrt{n}}$.
4. Calculate the t-statistic, which is given by $T = \frac{\bar{d}}{SE(d)}$

Under the null hypothesis, this statistic follows a t-distribution with $n - 1$ degrees of freedom.

5. Use tables of the t-distribution to compare the value for T to the t_{n-1} distribution. This will give the p-value for the paired t-test (Shier, 2004).

Where:

- x : Represents the test score before the module (or the first observation in a pair). This would correspond to the pre-test scores of the participants.
- y : Represents the test score after the module (or the second observation in a pair). This refers to the post-test scores obtained after the intervention.
- d_i (d -sub- i): Stands for the difference between the two observations on each pair. For each individual participant (i), you calculate this by subtracting their pre-test score (x_i) from their post-test score (y_i), so $d_i = y_i - x_i$. It's crucial to distinguish between positive and negative differences, as they indicate the direction of change.
- n : Represents the sample size, which is the total number of individuals or paired observations in the study.
- $\bar{d}$ (d -bar): Represents the mean difference. This is calculated by summing all the individual differences (d_i) and dividing by the sample size (n). It provides a single average value for the change observed across all participants.
- s_d : Represents the standard deviation of the differences. This measures the spread or variability of the individual differences (d_i) around their mean ($\bar{d}$). A smaller standard deviation indicates that the individual changes are more consistent, while a larger one suggests more variability.
- $SE(\bar{d})$: Represents the standard error of the mean difference. It's calculated using the formula $S_d/\sqrt{n}$. This value estimates how much the sample mean difference ($\bar{d}$) is likely to vary from the true population mean difference if you were to repeat the study multiple times. It's a measure of the precision of your estimate of the mean difference.
- T : Represents the t-statistic. This is the calculated test statistic, given by the formula $T = \bar{d} / SE(\bar{d})$. The t-statistic quantifies how large the observed mean difference ($\bar{d}$) is relative to the variability within the data ($SE(\bar{d})$). A larger absolute value of T suggests a greater difference between the pre-test and post-test means.
- t-distribution with $n - 1$ degrees of freedom: This refers to the specific probability distribution that the t-statistic follows under the null hypothesis. The "degrees of freedom" (df), calculated as $n - 1$, account for the number of independent pieces of information used to estimate the variability in the data.
- p -value: This is the probability value obtained by comparing the calculated T -statistic to the t-distribution. The p -value indicates the probability of observing a mean difference as extreme as, or more extreme than, the one calculated, assuming that the null hypothesis (i.e., that the true mean difference is zero) is true. A small p -value (typically less than a chosen significance threshold like 0.1 or 0.05) suggests that the observed difference is unlikely to have occurred by chance, leading to the rejection of the null hypothesis and supporting the idea that the intervention had a significant impact.

Performing a paired t-test for a pre-post-test involves comparing the means of a single group at two different time points.

3.6.2 Multiple Linear Regression Analysis

Multiple linear regression models have been extensively used in education and academic research. Interestingly, the name regression, borrowed from the title of the first article on this subject back in 1885 does not reflect either the importance or breadth of application of this method (Peterson, Baker, & McGaw, 2010).

Multiple linear regression is a statistical technique that is used to predict the outcome of a variable based on the value of two or more variables. The variable that the researcher wants to predict is known as the dependent variable, while the variables used to predict the value of the dependent variable are known as independent or explanatory variables (Taylor, n.d.).

For this study, the Multiple Linear Regression shall be used in order to analyse whether:

- A structured tool/framework would help in order to ensure a cost-benefit approach when awarding public contracts as recommended in Public Procurement Regulations.
- The project's objectives in relation to the project need (scope) are achieved.

These two dependent variables shall be tested for the following independent variables relating to the demographic:

- Work Experience ranging from 0-20+ years.
- Project Ownership being Private, Public or both.

The above shall be tested for both the pre-test and post-test and the results analysed.

3.7 Validity of the Study

In the context of the study, validity was defined as the degree to which the research accurately measured its intended constructs or the credibility and trustworthiness of its findings. It encompassed the accuracy with which methods, instruments, or techniques captured the essence of the research objectives. The consideration of validity was integral to the research design, methodological planning and reporting of results (Complete Dissertation, n.d.).

In this study, the following aspects of validity were examined:

Content Validity, Construct Validity, Internal and External Validity and Ecological Validity

Content validity was concerned with ensuring that the study's content accurately represented the constructs being measured. This was achieved through the comprehensive literature review conducted in Phase 1, which ensured that the research questions, hypotheses, and survey instruments were grounded in a thorough understanding of the subject area. Construct validity was focused on determining whether the study accurately measured the intended theoretical constructs. This was addressed through the development of a conceptual model in Phase 2, which outlined the key constructs and their relationships. Additionally, validated survey instruments and careful operationalisation of variables contributed to construct

validity. Internal validity addressed the extent to which the study's design and methods minimised bias and alternative explanations for the observed results. In the pre-test/post-test Study conducted in Phase 4, internal validity was ensured through the use of a quasi-experimental research design with a pre-test/post-test. This design allowed for the comparison of outcomes before and after the intervention while controlling for external factors.

External validity examined the generalisability of the study's findings to other populations or contexts. While the purposeful sampling method limited generalisability to the entire population, efforts were made to enhance external validity through the inclusion of diverse case studies and the use of a mixed-methods approach. This approach allowed for triangulation of findings across different contexts. Ecological validity assessed the extent to which the study's findings could be applied to real-world settings. By conducting the study in the context of the public service sector and involving stakeholders in the Value Management workshops, efforts were made to enhance ecological validity. This ensured that the interventions and findings were relevant and applicable to real-world scenarios. Overall, the study addressed various aspects of validity through rigorous methodology, careful design and consideration of real-world applicability. These efforts aimed to establish the validity of the findings and contribute credible insights to the field of Value Management in the public service sector.

3.8 Data Triangulation

The study employed a triangulation methodology to ensure the robustness and reliability of the findings, integrating multiple data sources and methods such as literature reviews, statistical analyses and thematic analyses of stakeholder feedback. Firstly, literature laid the theoretical foundation for understanding VM practices and their application in the public sector. These reviews included a comprehensive examination of global standards and best practices, serving as benchmarks for evaluating the efficacy of local VM practices in Malta (Yin, 2018). The literature provided critical insights into how VM principles could be tailored to meet the unique challenges of Malta's public service projects. Secondly, statistical analyses were performed to quantify the benefits of VM interventions. Quantitative measures, such as paired t-tests and multiple regression analyses, were employed to assess improvements in project efficiency, quality and stakeholder satisfaction. These statistical approaches provided empirical evidence supporting the impact of VM on project outcomes (Field, 2013). For instance, significant correlations were found between VM implementation and enhanced project efficiency, demonstrating the measurable benefits of adopting VM. Thirdly, thematic analyses were conducted on qualitative feedback gathered from stakeholders via open-ended survey questions. This feedback provided contextual insights into the practical challenges and benefits experienced during VM implementation. The thematic analysis, following Braun and Clarke's (2006) methodology, identified recurring themes such as improved collaboration,

enhanced communication and better-aligned project objectives (Braun and Clarke, 2006). By incorporating stakeholder perspectives, the study enriched its understanding of VM's real-world efficacy. By converging these diverse data sources and methods, the study ensured a comprehensive and well-rounded analysis. The integration of quantitative data, qualitative feedback and existing literature enhanced the credibility and validity of the findings, providing a robust foundation for the study's conclusions.

3.9 Justification for the Small Sample Size

While the sample size in this study was relatively small, it comprised the complete population of relevant stakeholders for the selected case studies. This comprehensive inclusion ensures that the findings are representative of the targeted group. The statistical significance observed in the results underscores the effectiveness of the intervention within this specific context. Moreover, the small sample size is justified given the scope and focus of the study. Despite this limitation, the significant improvements observed post-intervention provide robust evidence of the efficacy of VM practices. Future research could expand on these findings by including larger and more diverse samples across different regions to enhance the generalisability of the results. The choice of purposive sampling was also chosen with thorough consideration given that the stakeholders present for the studies were chosen together with the headship of the Government Department, Ambjent Malta, as the key decision takers/stakeholders who impact the projects in question and have the last say when it comes to the departmental projects.

3.10 Ethical Considerations

Conducting such a pre-test/post-test study involved numerous ethical considerations that had to be carefully addressed to ensure the well-being and rights of participants, as well as the integrity of the research. Amongst these ethical considerations, a number of significant ones were considered for the purpose of this study (Franco, et al., 2023) (Fleming & Zegwaard, 2018).

Ensuring that participants were fully informed about the study, its purpose, procedures, potential risks and benefits was a critical part. Clearly communicating the voluntary nature of participation, including participants' consent to participate in the study as well as the confidentiality of the participants was safeguarded by protecting their personal information. No disclosure of individual data without explicit consent was carried out. Coding or anonymisation techniques when reporting results was used in order to prevent the identification of individual participants.

The privacy of participants was respected, especially when collecting sensitive information by ensuring that data collection methods did not unduly intrude on personal or professional

spaces. The selection of participants and the administration of the Value Management intervention were chosen using fair and equitable means in order to carry out the research in a correct and unbiased manner. Participants were provided with clear and accurate information about the study results after its completion; whilst the opportunity for debriefing, to address any questions or concerns the participants had, was also provided. It was considered critically important to maximise the benefits of the study for both participants and the broader community and ensure that the research contributed positively to the public service sector and aligned with the principles of value management.

Being informatively transparent about the study design, methodology and results was deemed important throughout the study. This was achieved by providing clear and honest information to participants and stakeholders about the purpose and outcomes of the research. Ethical approval was obtained from the University of Malta by completing all the ethical forms required and gaining approval from the Ethics Committee before initiating the study. The established ethical guidelines and standards were adhered to.

Finally, the study was conducted with integrity and professionalism, adhering to ethical principles throughout the research process. These considerations helped to ensure that the pre-test/post-test study was conducted ethically, with due regard for the rights and well-being of participants and the broader ethical standards governing research by the University of Malta (Saunders, Lewis, & Thornhill, 2007).

3.11 Future Research/Limitations of the Study

Limitations of Pre/Post-Test Methodology

Findings from pre/post-test studies might not effectively generalise to real-world situations or different populations as the controlled environment of the study may not fully represent diverse, real-life scenarios. Changes observed in the outcome variable could be influenced by natural maturation processes or historical events occurring during the study period. These external factors may impact the results, making it challenging to attribute changes solely to the intervention. However, considerations were taken in order to strengthen the study and validity of the results and interpretations.

Duration of Workshops

The Workshops carried out had to take on a different nature to the ones normally recommended and found in literature due to the availabilities of the stakeholders. Due to the nature of the projects, most of the stakeholders required to participate in the workshops were those in headship positions and senior key decision makers, which made it difficult in terms of time availability. Hence, the duration of the workshop had to be reduced significantly in order to fit in with all the stakeholders' schedules. Nonetheless, with detailed pre-workshop planning and carrying out diagnostics prior to the workshop as well as using direct tools as

efficiently as possible during the workshop, it was possible to test out the projects using a value management approach effectively and obtain significant breakthroughs for the projects under test.

Limited Research Carried Out Prior to this Study Regarding Value Management in Malta

Prior research is characterised by a lack of willingness for change and bureaucratic barriers present in order to push such an approach within the public service.

Limited Scope of Stakeholder Participation: Most participants in the Value Management (VM) workshop were internal or closely affiliated with Ambjent Malta. This focused participation, while enabling in-depth study within the department, means that broader stakeholder engagement could potentially reveal additional tensions or alignments between policy-level and operational-level perspectives that were not fully captured in this study.

Limited Generalisability to Other Sectors: The study's framework was primarily validated within Ambjent Malta, a specific governmental environmental department. While this provided in-depth insights into its application within this context, its immediate generalisability to other diverse public service sectors (e.g., transport, health, or education) in Malta may be limited, suggesting a need for further validation across broader contexts.

Future Research on Broader Generalisability and Cross-Sectoral Validation: Future research is recommended to explore broader generalisability by applying the developed Value Management framework in other public sector entities beyond Ambjent Malta, such as transport, health, or education, to validate its effectiveness and applicability across multiple public service sectors. Additionally, comparative studies with other small states could be conducted to assess the framework's performance in similar constrained environments, serving as a model for other regional governments and small states aiming to enhance project delivery and mitigate issues like scope creep and misalignment of objectives.

3.12 Chapter Summary

The methodology section of this research study plays a pivotal role in testing the research questions within the context of real-world projects utilising the value management framework. A thorough investigation was conducted to determine the most appropriate methodology and research methods to ensure the validity of the results. After exploring various research methodologies and sampling techniques, a mixed methods approach incorporating both quantitative and qualitative methodologies was deemed most suitable. The pre-test/post-test methodology was selected to evaluate the effectiveness of the Value Management framework. Purposive sampling was employed due to the known set of stakeholders involved in the intervention. The questionnaire utilised a combination of Likert scale, multiple-choice and open-ended questions to gather comprehensive and unbiased data, thereby enhancing both internal and external validity. The intervention comprised an

information session followed by a workshop, aimed at familiarising stakeholders with the Value Management methodology. Three projects being undertaken by the Ambient Malta Government Department were chosen for the study: the construction of a bird observatory at L-Għadira s-Safra, the restoration and regeneration of the Marfa Radar Tower, and the demolition and construction of a public convenience in Buskett. The post-test was conducted several months after the Value Management study to allow time for effective developments, with responses collected anonymously online. By integrating quantitative data from the pre-test/post-test Study with qualitative insights obtained from the workshops and open-ended questions, the research investigated the benefits of the Value Management approach in the public service, specifically within the environmental sector. This comprehensive methodology effectively addressed the research questions posed in the study.

Chapter 4 - Results

4.1 Background

This chapter will present data generated from the Pre-Test Study, Intervention, Post-Test Study, the hypothesis testing and the thematic analysis that was carried out. The data provided was generated via Google Forms, SPSS, and VOS Viewer respectively.

The Results section shall be divided into five parts as indicated below:

- Section 4.2: Outcome to pre-test study data, depicting summaries and frequencies from the main transcripts.
- Section 4.3: Results obtained from case study data documenting the participatory processing.
- Section 4.4: Outcome from post-test study data depicting summaries and frequencies from the main transcripts.
- Section 4.5: Hypothesis testing outcome.
- Section 4.6: Thematic analysis data.

4.2 Pre-Test Study Results:

As explained in the Methodology Chapter, the initial pre-test questionnaire was sent to eleven (11) respondents. All respondents replied to the pre-test study. These were all primary stakeholders and key decision makers who took part in the case studies throughout the process. The detailed results can be found in Appendix 1.

4.2.1 Demographics – Work Designation

Of the eleven respondents, the majority, seven individuals (63.6%), held a Project Management work designation. This strong representation from project management roles is significant as these individuals are typically deeply involved in both the strategic and operational aspects of projects, making their insights particularly valuable for understanding project execution and oversight. The remaining respondents consisted of one Client Architect, one Stakeholder, one Public Administration Headship position, and one from the Design Office.

4.2.2 Section 1 - Understanding the Perception and Current Use of Value Management

This section explored the stakeholders' existing understanding and utilisation of Value Management.

Question 1: Belief in a structured tool/framework for a cost-benefit approach in public contracts

A strong consensus emerged regarding the utility of a structured tool or framework. Eight respondents (72.7%) considered it "useful" for ensuring a cost-benefit approach in public contract awards, while two respondents (18.2%) believed it would be "very useful".

Only one respondent (9.1%) remained neutral. This indicates a predominantly positive perception among stakeholders that such tools would enhance transparency, efficiency, and effectiveness in public procurement, aligning with Public Procurement Regulations.

Question 2: Extent to which awarding tenders by lowest cost criteria measures good quality

A resounding majority, 91% of respondents, unequivocally believed that awarding tenders based on the lowest cost criteria is NOT a measure of good quality. This finding is critical as it highlights a widespread recognition that prioritising cost alone often compromises the quality of project outcomes. This sentiment aligns with information found in international literature.

Question 3: Original intent/need of the project tested enough for client alignment

72.7% of respondents believed that the original intent or need of the project is currently only partially being tested to ensure alignment with client requirements. This indicates a perceived gap or lack of thoroughness in current evaluation processes.

Conversely, 27.3% believed that this alignment is being adequately met. The responses suggest an opportunity to strengthen the alignment process by incorporating more systematic testing of project intents and needs.

Question 4: Technical solution to project need tested using a tool/technique prior to tender issuance

Responses were mixed, indicating uncertainty or variability in current practices. 45.5% of the respondents were neutral regarding whether the technical solution is tested using a tool or technique before a tender is issued.

Meanwhile, 36.4% agreed that it is, and 18.2% disagreed. This ambiguity suggests a deficiency in clarity or uniformity in the use of technical testing instruments and methodologies prior to bids being issued.

Question 5: Achievement of project's objectives in relation to project need (scope)

Just under half (45.5%) of respondents believed that the Project Scope is being achieved. However, a slightly larger portion, the other 54.5%, held a neutral/unsure position regarding this. This balanced distribution underscores an uncertainty or variability in experiences related to project scope achievement, suggesting a need for more precise scope delineation and enhanced management protocols.

Question 6: Current level of communication within project team and stakeholders

The ratings for communication levels were notably mixed and polarised: 36.4% reported "Very Good," 27.3% were "Neutral," and an equal 36.4% rated it as "Poor". This indicates a significant variability in communication practices, highlighting areas for improvement.

Question 7: Problems arising from awarding projects based on lowest cost criteria

Respondents clearly indicated that the "biggest loser" when it comes to awarding tenders by lowest cost criteria is quality. "Loss of quality" was the most common theme mentioned by the majority of respondents throughout their replies, highlighting a major perceived problem with this procurement approach.

4.2.3 Section 2 – Definition of Value Management

This section probed the stakeholders' knowledge and understanding of Value Management itself.

Question 1: How respondents define Value Management

The responses received linked to the definitions provided in the literature, showing that the definition of Value Management is indeed a "tapestry of definitions". This implies a multi-faceted understanding rather than a single, universally agreed-upon definition.

Question 2: What respondents understand by Value Management

All replies highlighted at least a basic understanding of Value Management's meaning. This suggests that while a comprehensive definition might not be universal, the fundamental concept was grasped by all participants.

Question 3: Knowledge or experience of Value Management

A critical finding was that knowledge and/or experience of Value Management was found to be "poor and limited". Specifically, 36.4% stated it was "very poor," another 36.4% stated it was "poor," and 18.2% were neutral.

Only one respondent (9.1%) reported having "good knowledge or experience". This underscores the initial premise of the research that VM is not widely recognised or used in Malta.

Question 4: Knowledge or experience of using the Value Management Standard

EN12973:2020

Knowledge of this specific European standard was found to be "very limited": 63.6% reported "very poor knowledge" and 27.3% reported "poor knowledge".

No respondents (0%) had "good or excellent knowledge" of the standard. This highlights a significant lack of familiarity with established VM standards.

Question 5: Prior use of Value Management in work

A significant majority, 90.9% of respondents, stated they had "never used Value Management prior to this research study". This strongly reinforces the conclusion that VM was a largely unused methodology in the local industry, particularly within the public sector, before this research intervention.

4.2.4 Section 3 - Use of Value Management

This section focused specifically on the experience of the *single respondent* who indicated prior use of Value Management.

Question 1: Industry where Value Management was applied

The single respondent with prior VM experience indicated applying it in the Energy and Engineering sectors.

Question 2: Most effective tools found

The respondent found "Back to Basics," "Life Cycle Costing," and "SWOT Analysis" to be most notably useful.

Interestingly, "Function Analysis/FAST," which is classified as "predominantly the most important tool when using the Value Management Approach," was *not* deemed very useful by this respondent. This raises questions about the depth or completeness of the VM approach previously undertaken by this individual.

Question 3: Stage of Project Life Cycle for Value Management implementation

The single experienced respondent used Value Management in the Initiation Phase. This is significant because the Initiation Phase is "considered the most effective phase to get the most out of Value Management," as benefits are maximised when VM is applied early in a project's life cycle.

Question 4: Usefulness of Value Management workshops

The same respondent was "undecided" about the usefulness of Value Management Workshops as an integral part of their Value Management approach. This finding is noteworthy as Value Management Workshops are considered an "integral part of the Value Management Approach and cannot appropriately function without them," raising doubts about the quality of the VM approach undertaken by this respondent.

4.2.5 Section 4 - Drivers of Value Management

This section explored the motivations behind adopting Value Management.

Question 1: General drivers to use Value Management

The main predominant driver identified was "Best Value," with 81.8% of respondents marking it as such. This highlights a strong desire among stakeholders to achieve optimal value in projects.

Question 2: Agreement with statements regarding Efficiency as a driver

The statement with the most "Agreed" scores was "Increased efficiency through team-based activity with a common focus". This suggests that stakeholders perceive VM as a means to enhance efficiency through collaborative efforts.

Question 3: Agreement with statements regarding Best Value as a driver

The majority of respondents agreed with all statements regarding Best Value as a driver for Value Management. This indicates a comprehensive understanding and endorsement of Best Value as a core motivation for VM implementation.

Question 4: Agreement with statements regarding Lowering Cost as a driver

The statement "Ensures all aspects of the design are cost effective for their required purpose" was most agreed upon, with 80% of respondents (70% Agree and 20% Fully Agree) defining it as the best statement for Lowering Cost as a VM driver. This suggests that "lowering cost" is seen not just as reduction, but as achieving cost-effectiveness for a *purpose*, implying a value-driven approach even within cost considerations.

Question 5: Agreement with statements regarding Transparency as a driver

The statement "Ensuring that decisions are rational, explicit and countable" had the highest agreement (90% combined 'agree' and 'fully agree') as the best definition for Transparency as a VM driver. This highlights the importance of clear and justifiable decision-making within VM.

Question 6: Agreement with statements regarding reducing wastefulness as a driver

The statement "The practice of awarding contracts to the lowest bidders encourages contract amendments, which in turn leads to cost overruns" was deemed by the absolute majority to emphasise Reducing Wastefulness as a key driver for VM implementation. This explicitly links the problems of lowest-cost tendering to the need for VM to prevent waste.

Question 7: Agreement with statements regarding reducing fragmentation as a driver

While only one respondent initially considered fragmentation a useful driver, others agreed that "aligning members to the goals, critical success factors and enhancing communication" could be useful for considering reducing fragmentation as a VM driver. This points to the VM's potential for fostering cohesion and shared objectives within project teams.

4.2.6 Demographics

4.2.6.1 Work Experience

The study participants had extensive work experience, with all of them having over 10 years of experience, and a significant majority, 72.7%, having 20 years or more of work experience. This vast experience lends further validity and credibility to the insights gathered from their responses, indicating a deep understanding of project and public sector dynamics.

4.2.6.2 Size of Project in Euro (Estimate of project size usually carried out)

The majority of participants typically dealt with projects ranging from €1-500,000 and €1-5 million. Understanding the approximate project sizes is important because it helps in assessing the potential gain or benefits if Value Management had been implemented in these projects, as VM is often applied to optimise value and manage costs in projects of varying scales.

4.2.6.3 Project Ownership

The majority of participants had experience working in publicly funded projects. This was an expected finding, as many of the key stakeholders participating in the study were employees of government entities, which primarily handle public-funded initiatives. This focus on public projects provides relevant context for the study's aim of investigating VM's application in the public service sector.

4.3 Case Study Results

4.3.1 Case Study 1 – L-Ghadira s-Safra

After a brief introduction provided by one of the key stakeholders and a brief explanation regarding the Value Management tools to be used, an Issues Analysis exercise was carried out with all stakeholders participating to bring out issues until Issues Exhaustion.

The following figure shows the issues brought up segmented according to headings hereunder:

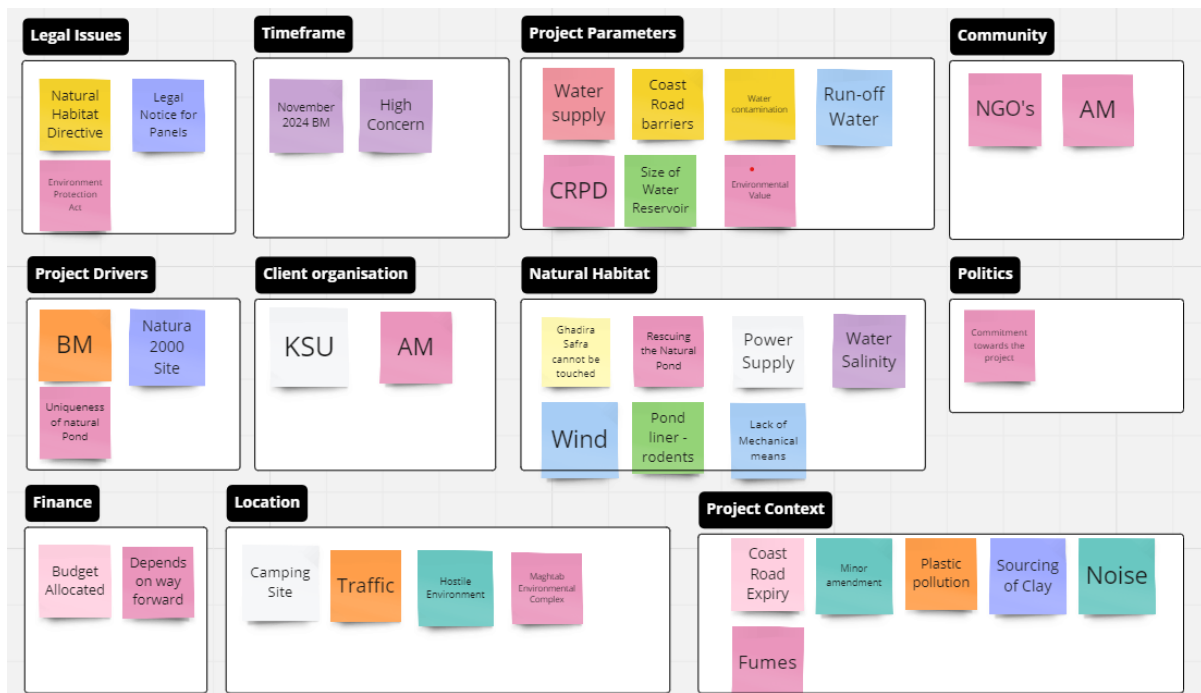


Figure 4.1: Issues Analysis Project 1.

The main Issues were highlighted as being the:

- Sustainability - Water Supply,
- Timeframe – November 2024 completion and,
- Infrastructure (due to Coast Road).

Following this exercise, the main issues mostly considered were tackled in order to ensure project success. A Function Analysis Exercise was then introduced by the VSL. This consisted in listing the Needs and Wants in order from High Order Needs to Low Order Wants. All members/stakeholders participated in this exercise once more and numerous needs were listed as per the figure hereunder:

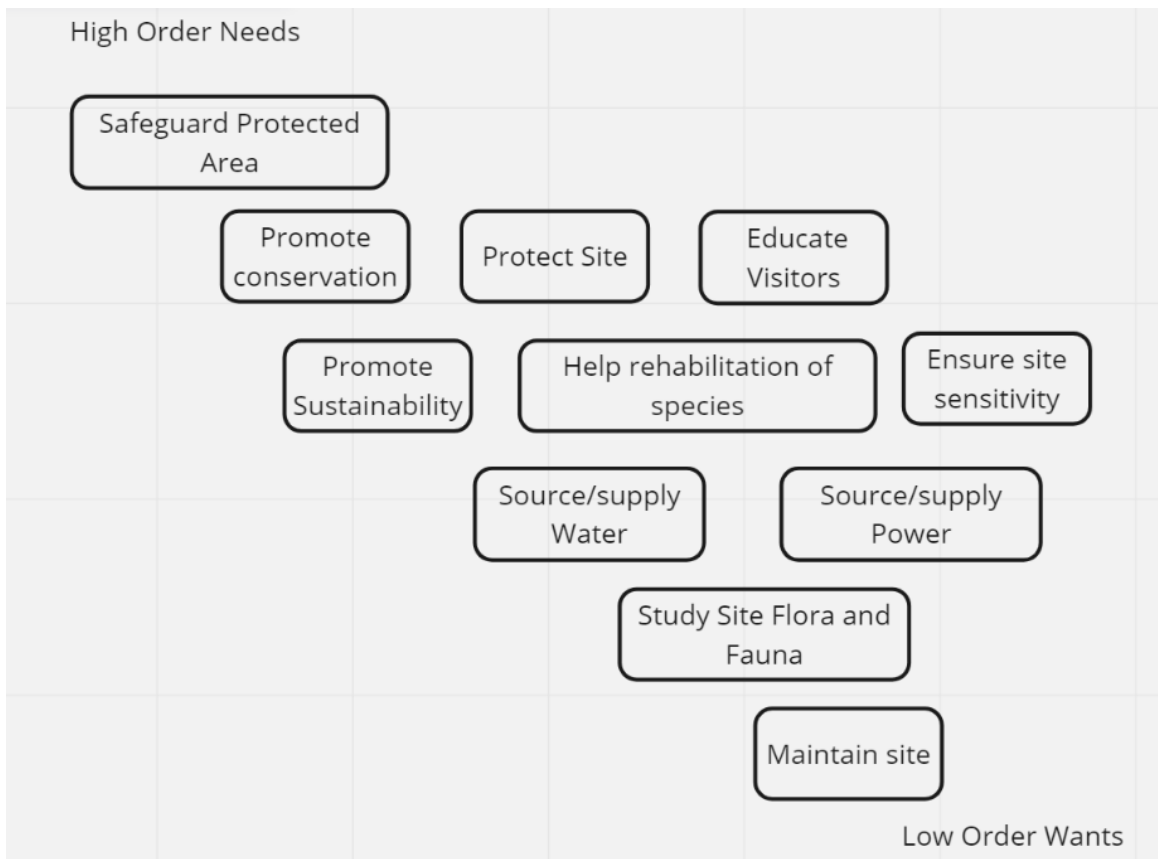


Figure 4.2: Function Analysis Case Study 1.

From the above process, the most critical need was decided between the stakeholders to be 'Safeguard Protected Area', as the area for the Project is a Natura 2000 Site. Other critical needs observed were to 'Promote Conservation, Protect Site' and 'Educate Visitors'. From the Needs and Wants listed, a Function Analysis Diagram was listed by the VSL, from which solutions for each function were agreed upon by the team as per diagram hereunder.

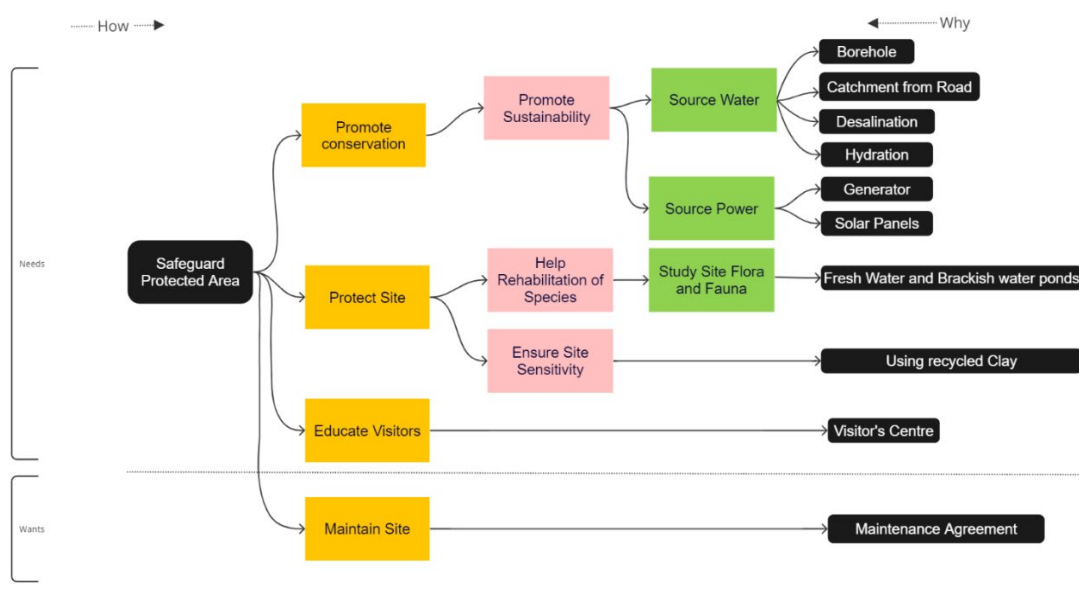


Figure 4.3: FAST Diagram Project 1.

Each of the Potential Solutions generated was listed in a table and their pros and cons discussed as per the table hereunder:

Table 4.1: Project 1 Solutions Matrix table

Solution	Advantages	Disadvantages
Water Supply - Borehole	Large Water Supply volumes, easy to source, low cost	Legal Aspects, site limitations
Water Supply - Catchment from Road	At the moment water being lost, cost effective, easy supply	Road Level, contamination and pollutants
Water Supply De-salination Plant	Continuous supply of water	Cost, power supply and consumption, noise pollution
Water Supply - Humidity conversion	Continuous supply of water	New Technology, power consumption, cost
Power Supply - Solar Panels	Environmentally friendly, Silent	Space limitations and Output supply
Power Supply – Generator	High Output	Uses Fuel, Noise pollution and Area to be placed.
Fresh Water and Brackish Water Ponds	Helps Bird Migration	Water Sourcing
Using Recycled Clay	Anchors Pond liner, stops rodents puncturing the liner, reuses used clay.	Sourcing, storage and manual placement
Visitor's Centre	Educate Visitor's, new public space	Construction, visual impact
Maintenance Agreement	Maintaining site	Cost, Area harsh

The most important need was considered to be to promote conservation and, hence, requiring ample water supply. However, sourcing water was also deemed as the biggest Issue for the project.

4.3.2 – Case Study 2 - Radar Station Marfa

After a brief introduction provided by one of the key stakeholders and a brief explanation regarding the Value Management tools to be used an Issues Analysis exercise was carried out with all stakeholders participating to bring out issues until Issues Exhaustion. The following figure is a list of issues brought up segmented according to headings hereunder:

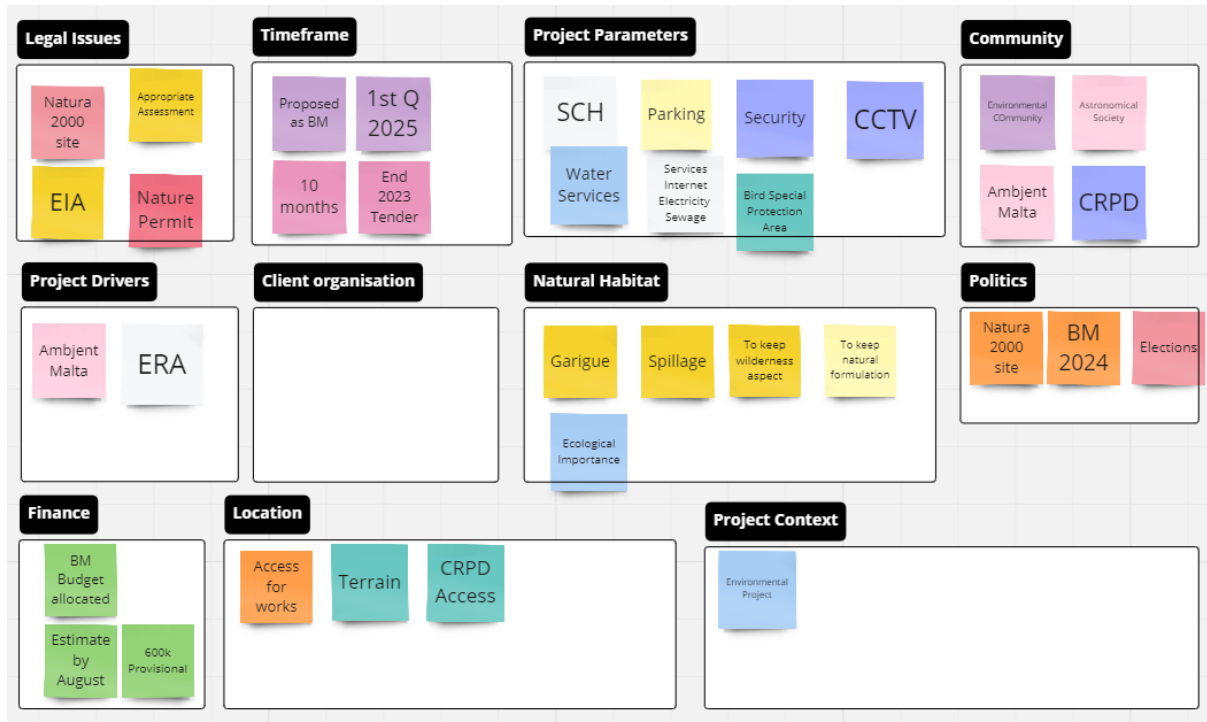


Figure 4.4: Issues Analysis Project 2.

The main issues were highlighted as being:

- Protecting the Natural Habitat - mainly the unique garigue in the area and,
- A Visitor's parking facility so that the area would become a new open public area to be enjoyed by visitors of the Picnic Area and the Observation Centre.

Following this exercise, the main issues were brought up as the issues to be mostly considered and tackled in order to ensure project success. A Function Analysis Exercise was then introduced by the VSL. This was to consist of listing the Needs and Wants in order from High Order Needs to Low Order Wants. All members/stakeholders participated in this exercise once more and numerous needs were listed as per the figure hereunder:

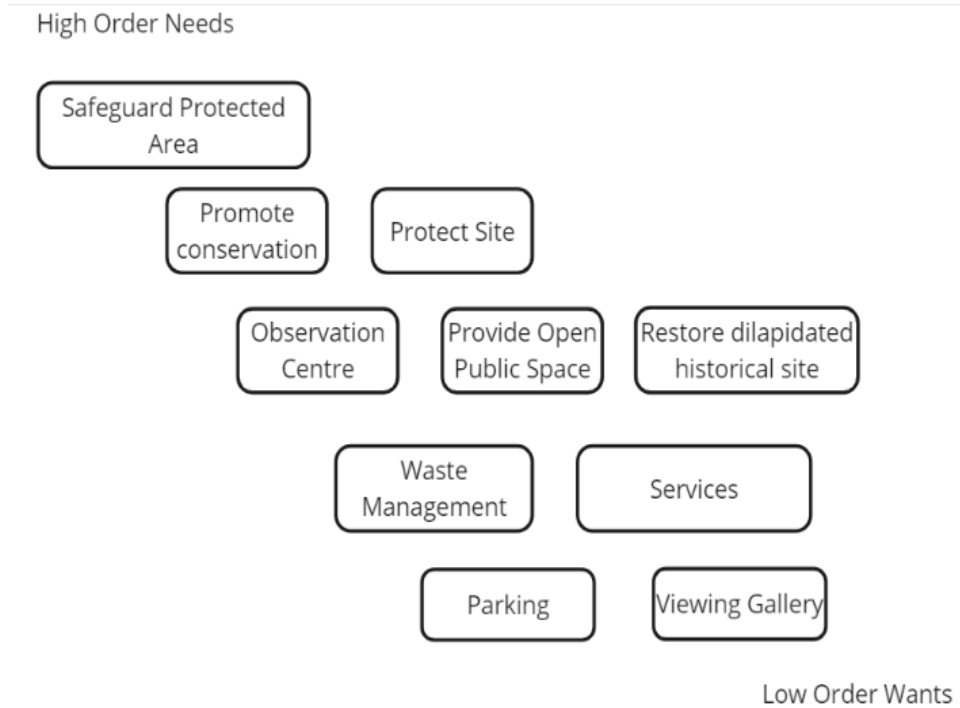


Figure 4.5: High/Low Order Needs/Wants.

From this process the most critical need was decided between the stakeholders to be ‘Safeguard Protected Area’, as the area for the Project is a Natura 2000 Site. Other critical needs observed were to ‘Promote Conservation, Protect Site’ and ‘Restore dilapidated historical site’. From the Needs and Wants listed, a Function Analysis Diagram was listed by the VSL, from which solutions for each function were agreed upon by the team as per diagram hereunder:

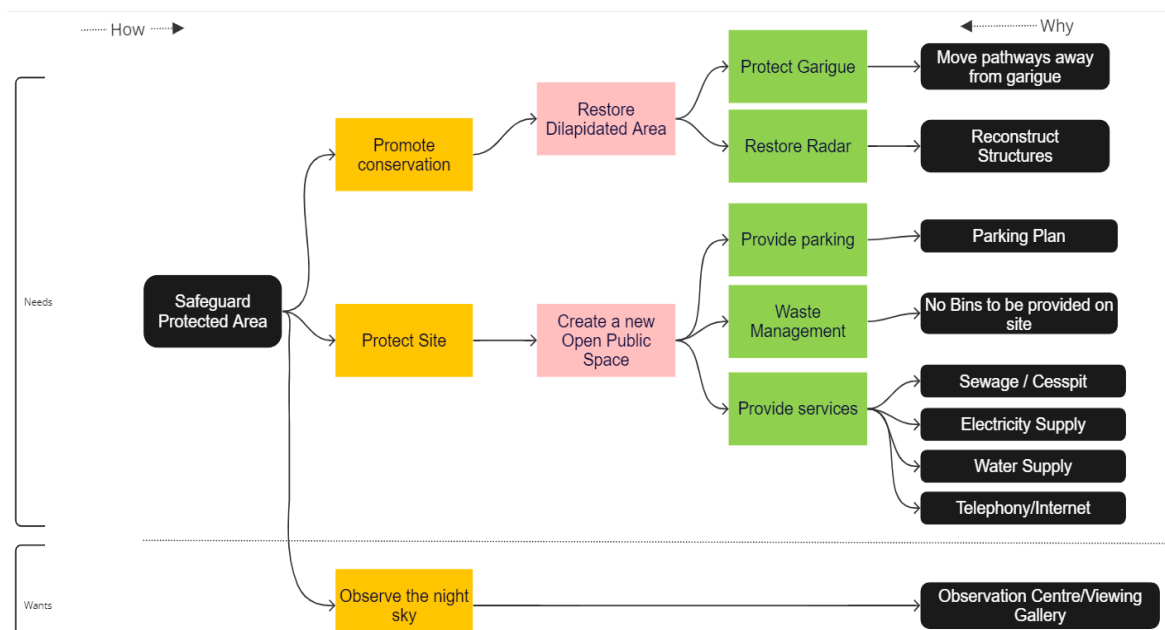


Figure 4.6: FAST Diagram Project 2.

Each of the Potential Solutions Generated was listed in a Table and their pros and cons discussed as per the table hereunder:

Table 4.2: Solutions Matrix Table Project 2

Solution	Advantages	Disadvantages
Protect garigue – create boundary	Keep people from disturbing natural garigue	Constructing a form of boundary in natural environment
Parking Option 1	Larger Picnic Area	Less parking/difficult to manoeuvre
Parking Option 2	More parking/Easy manoeuvrability for cars, easier access	Smaller Picnic Area
Waste Management –no bins	Promote a cleaner environment as the visitors take the litter with them	Some litter might be thrown away in natural habitat
Services – water supply	To be able to have water facilities at observation centre	Connection and sourcing
Services – lighting emergencies only (no trenches)	Safety	Light pollution
Sewage – cesspit (original)	To be able to have toilets at observation centre	Restoration of current cesspit only option
Internet/telephony to check	To promote visitation by the public	Cable and installation of service
Reconstruct structures	Restore a vandalised historical building	Current conditions require extensive works

Finally, the way forward was discussed, considering the most important need to safeguard the protected area by restoring the dilapidated site and creating a new open public space for the public to enjoy. The best option to ensure the natural garigue is protected whilst still satisfying the need of creating a new open space was deemed by the stakeholders to be the creation of a natural boundary at the perimeter of the pathways in order to limit the disturbance of the garigue. A ten-car parking lot was also proposed to facilitate visitors visiting the site whilst keeping them away from parking on the natural habitat. Hence, the way forward is for the Project Architect to propose a new drawing featuring the above recommendations and considering the issues discussed and highlighted during the Issues Analysis. This new drawing is to be discussed with the Superintendence of Cultural Heritage due to the nature of the site.

4.3.3 – Case Study 3 – Buskett Public Convenience

Once more, the time allocated for this workshop was contained to one day, due to the time constraints of the stakeholders. However, the agenda set ensured that a successful exercise could be achieved and that decisions would be generated from the Workshop delivered. The most significant outcome of the Value Engineering Workshop was the multiple Functional Space Analysis carried out for the various technical aspects discussed, namely, the Substructure, M&Es, Apertures, Finishes and Sanitaryware.

After a brief introduction by the Chief Architect, as one of the key stakeholders, the Project Brief and the status of the Project at that current point in time were highlighted. The project in question was the demolition of the current Public Convenience at Buskett and the construction of a new Public Convenience allowing access for all. The implementation period is planned to take approximately six (6) months, with the tender expected to be issued towards the end of 2024. The ideal implementation date was deemed to be June 2025 in order not to affect the feast and activities held during that particular time of year, namely, Mnarja 2025. This considers that the planning application process requires approximately six (6) months prior to the start of the tendering process.

This introduction was followed by a round table introduction of all stakeholders present who were, in fact, all the stakeholders critical to the project success and outcome. This was then followed by an Introduction to Value Management by the researcher.

Following this Introduction, a brief explanation of Issues Analysis was provided by the VSL before an Issues Analysis exercise was carried out, with all stakeholders participating to bring out issues until Issues Exhaustion. The List of Issues brought up were segmented by the VSL according to headings and shown in figure hereunder:

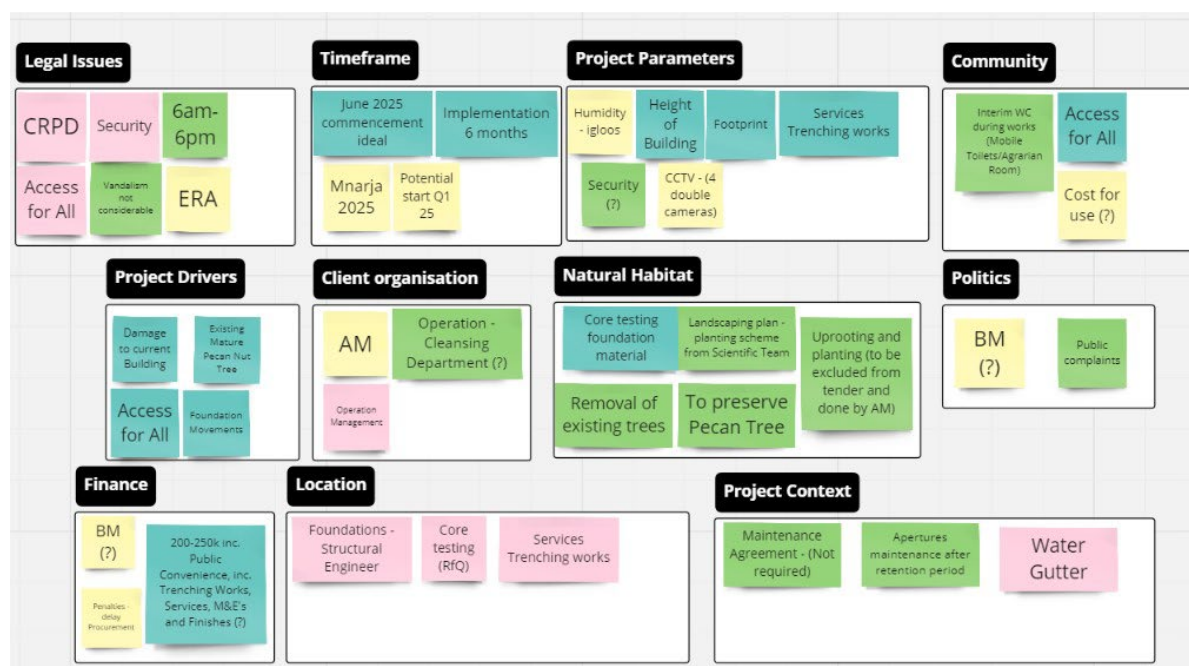


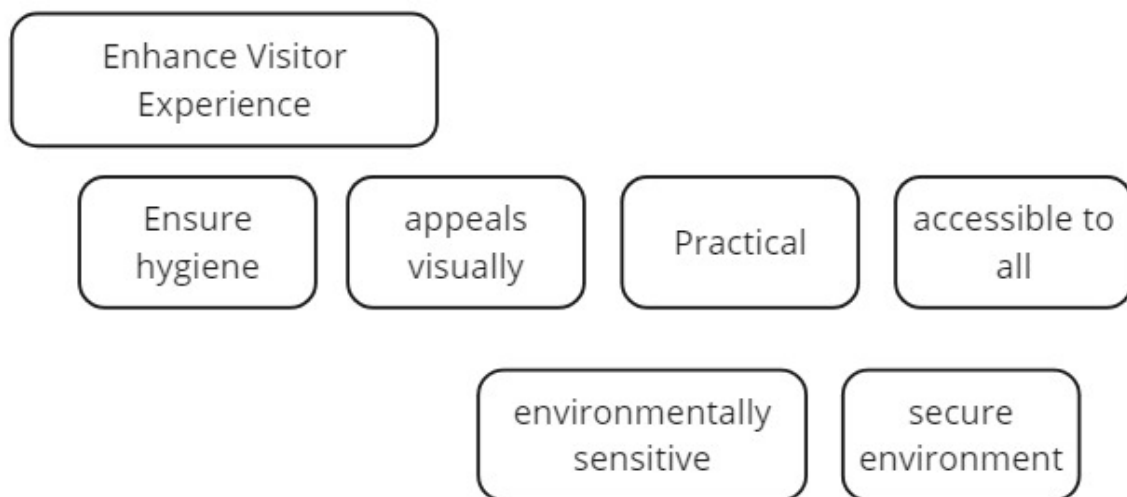
Figure 4.7: Issues Analysis Case Study 3.

Amongst the Main Issues highlighted was to carry out a study and analyse the structural foundations including the material strength and bearing capacity so that the foundations structural design can be carried out. Another major issue highlighted during the study was the onus of the operational management after implementation. Following this exercise, the main issues were brought up as those to be mostly considered and tackled in order to ensure project success.

A Function Analysis Exercise was then introduced by the VSL. This consisted of listing the Needs and Wants in order from High Order Needs to Low Order Wants. This was then followed by a more technical analysis, the Functional Space Analysis for the various technical aspects discussed namely, the Substructure, M&Es, Apertures, Finishes and Sanitary ware.

All members/stakeholders participated in this exercise once more and numerous needs were listed as per the figure hereunder:

High Order Needs



Low Order Wants

Figure 4.8: Function Analysis Case Study 3.

From the above, it was decided between the stakeholders that the most critical need was to 'Enhance the Visitor Experience' by providing an 'Accessible to All' Public Convenience. As the area for the Project is a Natura 2000 Site other critical needs observed were to ensure that it shall be visually appealing and environmentally sensitive.

This was followed by a number of Element Functional Analysis Diagrams for the technical aspects of the project as shown hereunder:

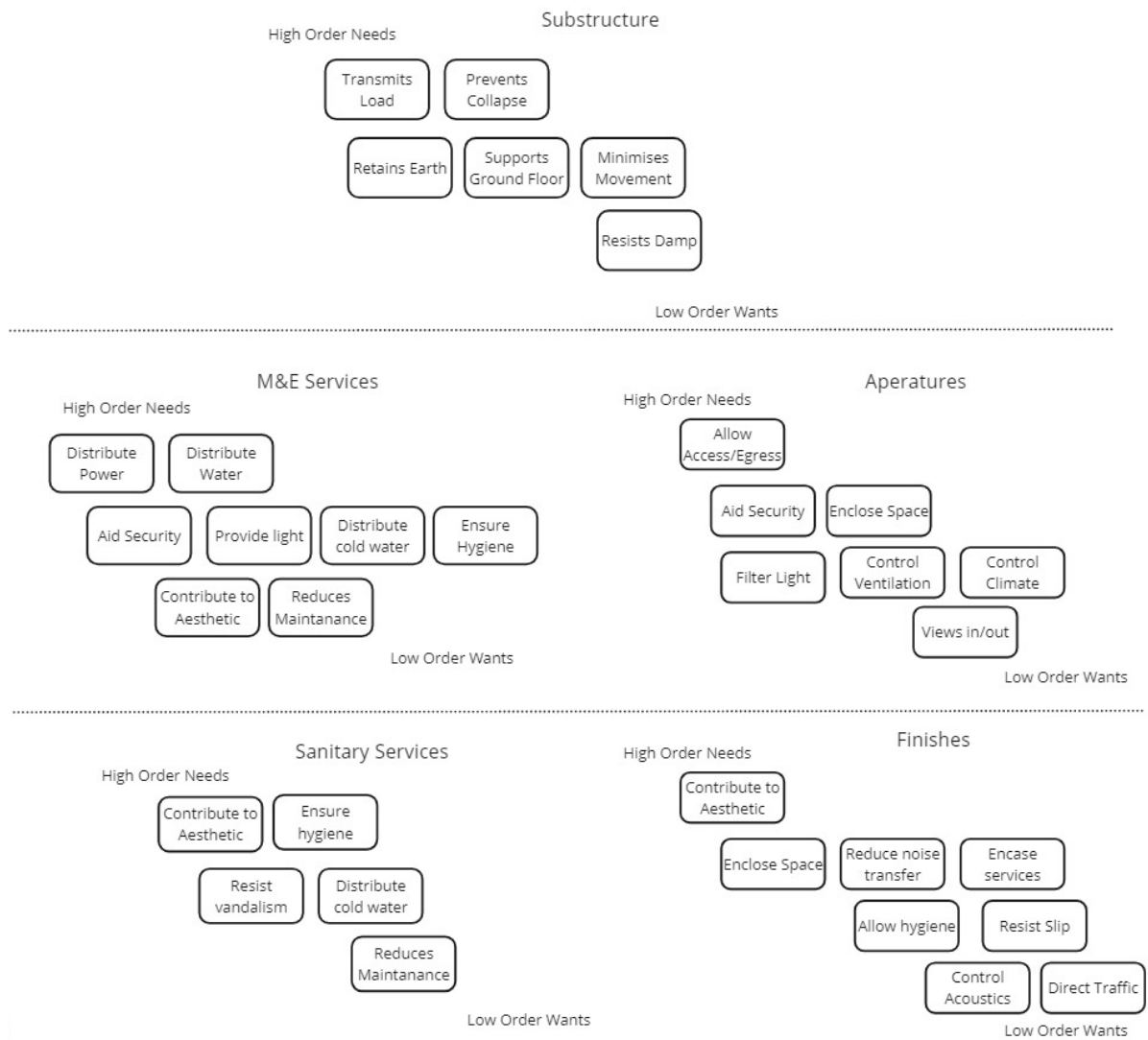


Figure 4.9: Element Functional Analysis Case Study 3 – Technical Aspects.

From the Needs and Wants Listed for each Space Analysis and following consideration, a Function Analysis Diagram was listed by the VSL from which solutions for each function were agreed upon by the team, as per the diagram shown below:

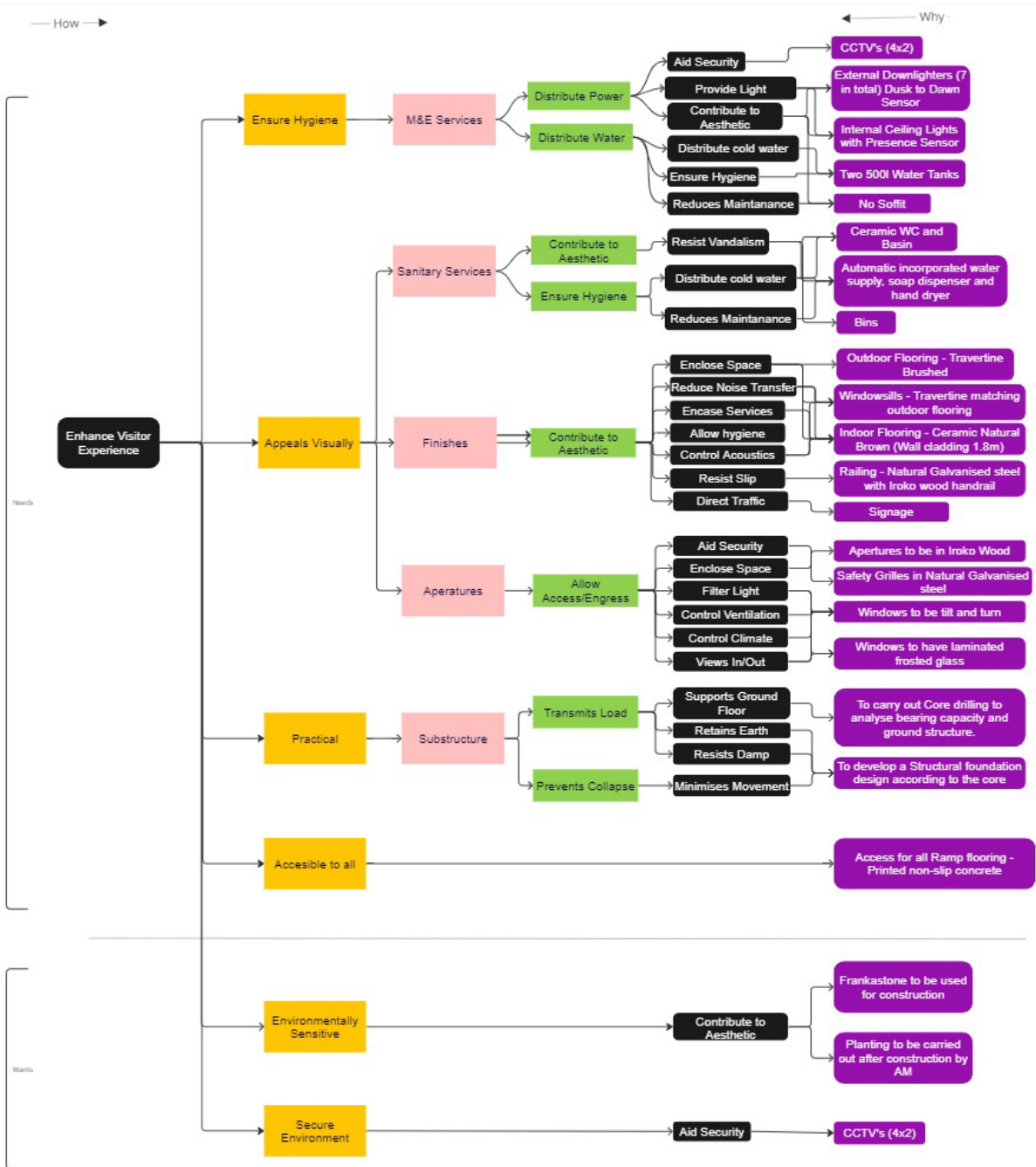


Figure 4.10: FAST Diagram Project 3.

This enabled the team to list the most important potential solutions and their pros and cons discussed as per the table hereunder:

Table 4.3: Solutions Matrix Table Project 3

Solution	Advantages	Disadvantages
Foundation Core Study	Knowing beforehand the foundation properties	Cost to carry out study
Iroko Wooden Apertures	Durability and Aesthetic	Cost compared to other solutions
CCTV's	Safety and Security	Cost for supply and installation. Require monitoring. (operation after implementation?)
Travertine outdoor flooring	Aesthetic, durability, natural material.	Cost of material
Automated sanitary equipment	Vandal resistance, reduced maintenance, hygiene and aesthetic	Original cost outlay
Printed concrete for ramp	Non-slip, safe, cost-effective	Aesthetic
No Soffit at ceiling	Less maintenance, aesthetic	Services must use other means
Downlighters (7) for external	Aesthetic, safety	Procurement and installation cost
Laminated frosted glass for windows	Privacy and safety	Procurement cost compared to clear standard glass

Finally, the way forward was issued by the VSL with the core drilling study considered to be the most important aspect to be carried out in order to understand the foundations before developing the final structural design. This should ensure that building movement is reduced as much as possible. Following this, the Chief Architect and M&E Engineers shall proceed to incorporate the agreed upon M&Es and finishes in the drawings in order to be eventually incorporated in the tender document.

4.4 Post-Test Study Results:

The Post-Test Questionnaire was sent to the same participants taking part in the study and, therefore, also the pre-test and Intervention. These were all primary stakeholders as per below and as indicated earlier in the methodology chapter:

- Director General Ambjent Malta,
- Director Project Implementation Ambjent Malta,
- Director Finance Ambjent Malta,
- Senior Manager Project Implementation Ambjent Malta,
- Project Architect Ambjent Malta,
- Mechanical Engineer Ambjent Malta,
- Electrical Engineer Ambjent Malta,
- Quantity Surveyor Ambjent Malta,
- Environmental Resources Authority,
- Project Architect – Client, and the
- Client

All participants replied to the questionnaire received. Hereunder is a brief overview of the responses received and general comments. The detailed results can be found in Appendix 2.

4.4.1 Demographics – Work Designation

Of the eleven respondents, six (60%) were from a Project Management work designation.

The remaining respondents included one Client Architect, one Stakeholder, one Public Administration Headship position, an Engineering Manager, and one from the Design Office.

4.4.2 Section 1 - Understanding the perception and current use of Value Management

Question 1: After experiencing a Value Management approach, do you believe that having a structured tool/framework helped in order to ensure a cost-benefit approach?

- All participants believed that having a structured tool/framework would be at least useful after undergoing the intervention.
- Two participants specifically believed it would be very useful. This indicated a positive shift in perception and reinforced participants' existing beliefs in the usefulness of such tools for a cost-benefit approach.

Question 2: Was the original intent/need of the project tested during the Workshops in order to ensure that it is aligned to what is required by the Client?

- 54.5% of participants believed the project's original intent/need was tested.
- 45.5% of participants believed it was partially tested.

- None believed it was fully tested or not tested at all, suggesting that the Value Management (VM) workshops were generally effective in validating project intent against client requirements.

Question 3: Was the technical solution to the above question (Project need) tested by using a tool or technique?

- 81.8% of participants agreed that the technical solution was tested using a Value Management Framework after the intervention. This indicates a strong endorsement of the VM framework's utility in evaluating technical solutions.

Question 4: Were the project's objectives in relation to the project need (scope) achieved?

- 72.7% of respondents agreed that the project's objectives were achieved.
- 9.1% strongly agreed.
- Only 18.2% replied neutrally. This high agreement suggests a broad consensus on the VM framework's effectiveness in aligning project outcomes with predefined objectives.

Question 5: How do you rate that the level of communication improved within your project team and stakeholders?

- There were no replies indicating "no improvement" in communication.
- All respondents felt Value Management generated some form of improvement, ranging from slight to great.
- The majority (36.4%) found a considerable improvement in communication within the team when using Value Management. This positive shift is significant, especially considering that 30% of participants had rated communication as "poor" in the pre-test.

4.4.3 Section 2 – Definition of Value Management

Question 1: How do you define Value Management?

- 54.5% of participants chose the definition: "A methodical approach as a means of achieving value for money through clearly defining the objectives and establishing a technical consensus as to how to meet these objectives". This definition highlights the goal of using a VM framework in public projects and shows a shift in understanding compared to the pre-test.

Question 2: What do you understand by Value Management?

- The responses indicated that the information session was successful, as participants had a clear and good understanding of Value Management following the session. Responses reflected a clear understanding of its definition, key principles, and recognition of benefits, though articulation of its application in projects was slightly lower.

Question 3: What is your knowledge or experience of Value Management?

- While knowledge remained relatively poor, a mild shift was observed: 70% had "very poor" or "poor" knowledge in the pre-test, which shifted to 45.5% after the intervention. This still emphasises that Value Management is not commonly known or used in Malta and that more knowledge is needed for successful implementation.

4.4.4 Section 3 – Use of Value Management

Question 1: Indicate the industry where Value Management was applied to.

- The environment-related industry emerged as the area where Value Management has been applied the most to date, according to participants' knowledge.

Question 2: Which tools have you found most effective?

- Participants found Function Analysis, Issues Analysis, and FAST Diagrams useful and effective. These tools were perceived to align with practical needs in project planning and problem-solving.

Question 3: At what stage of the Project Life Cycle did you implement Value Management?

- Value Management was mostly and equally implemented during both the Initiation and Planning Phase by 63.6% of respondents in each scenario. This reflects a strategic and proactive approach to project management.

Question 4: Did you consider the Value Management Workshop an integral and useful part of your Value Management Approach?

- The majority (54.6%) considered the Value Management Workshop an integral and very useful part of Value Management. Only one respondent disagreed. Overall, 79.6% expressed strong agreement (Strongly Agree and Agree combined).

Question 5: What strengths, opportunities and problems have you encountered during the application of the Value Management Approach?

- This was considered a very important question, generating "perspicacious responses," and was designated for further discussion in a later chapter. This question was intentionally omitted from the pre-test to allow participants to reflect on their experiences after being exposed to the VM framework.

4.4.5 Section 4 - Drivers for Value Management

Question 1: What are the drivers to use Value Management?

- The main predominant driver was Best Value, with 100% of respondents marking this as a driver. This is similar to the pre-test where Best Value was also the predominant driver (81.8%).
- Efficiency (54.5%) and Transparency (36.4%) were also marked as critical drivers.

Question 2: Do you agree with the below statements regarding Efficiency as driver to use Value Management?

- The most popular agreement was for the statement: “Increased efficiency through team-based activity with a common focus”.

Question 3: Do you agree with the below statements regarding Best Value as driver to use Value Management?

- All respondents deemed Best Value as the most critical driver.
- The two most agreed-upon statements were: “Prioritising and satisfying the customers’/users’ real needs” and “Ensures all aspects of the design are cost effective for their required purpose”.

Question 4: Do you agree with the below statements regarding Lowering Cost as driver to use Value Management?

- The statement best defining Lowering Cost as a driver was once more: “Ensures all aspects of the design are cost effective for their required purpose”. This implies that participants view lowering cost in terms of cost-effectiveness rather than just reducing initial expenses.

Question 5: Do you agree with the below statements regarding Transparency as driver to use Value Management?

- The most agreed-upon statement was: “Clearly defined duties and single point of leadership with explicit authority and responsibility should be ensured”.

Question 6: Do you agree with the below statements regarding reducing wastefulness as driver to use Value Management?

- The statements most agreed to were: “The practice of awarding contracts to the lowest bidders encourages contract amendments, which in turn leads to cost overruns” and “Inadequate planning and weak management and monitoring mechanisms”.

Question 7: Do you agree with the below statements regarding reducing fragmentation as driver to use Value Management?

- The statement chosen as the most agreed to was: “Teams focused in contributing to the objectives of the business and greater project control”.

4.4.6 Demographics

Work Experience:

- All participants had considerable work experience, with all having more than ten years, and 72.7% exceeding twenty years in the field.

Size of Project in euro (Estimate of project size usually carried out):

The estimated size of projects varied, ranging from 1-500,000 euro to 11–20-million-euro projects.

Project Ownership:

- The majority of participants worked within public funded projects, with 36.4% also having experience in private funded projects. This was expected as many stakeholders were government employees.

4.4.7 Overall Summary of Post-Test Results

The post-test study results, following the intervention (information sessions and workshops) demonstrated significant positive shifts in participants' perceptions and understanding of Value Management.

- Participants showed increased knowledge and appreciation of VM principles.
- There was a clear recognition of the benefits of a structured tool/framework for a cost-benefit approach.
- Communication within project teams and among stakeholders improved significantly.
- VM was perceived to have enhanced decision-making and problem-solving abilities.
- There was a strong consensus on VM's effectiveness in aligning project objectives with scope and testing technical solutions.
- The themes emerging from post-test responses focused more on maximising value and efficiency and adopting a comprehensive approach to project management, a shift from initial concerns like quality issues and cost/budgeting alone in the pre-test.
- The study highlighted that VM also generated "soft benefits" such as improved working relationships, organisational learning, and enhanced competitiveness.

These findings underscore the efficacy of the Value Management approach within the public service sector, particularly in the environmental domain.

4.5 Hypothesis Results:

Paired t-test analysis

The following presents an analysis using the paired t-test as described in the Methodology Chapter. The paired t-test was carried out in order to measure the responses by the same individual pre and post-test carrying out the Value Management Information sessions and workshop/s, this being considered as the intervention between the before and after tests.

The purpose of this test is to determine whether there is statistical evidence that the mean difference between paired observations is significantly different from zero. The paired t-test is a parametric test. The detailed Results can be found in Appendix 3.

Table 4.4: Summary of Hypotheses Tests 1-6 Results.

Hypothesis	Question	Pre-Test Mean	Post-Test Mean	Cohen's d	p-value
Hypothesis 1	Experiencing a Value Management approach positively influences the belief that structured tools/frameworks ensure a cost-benefit approach.	4.09	4.18.	-0.130	0.676
Hypothesis 2	The original intent/need of the project is tested sufficiently to ensure alignment with the Client's requirements.	2.73	2.45.	0.347	0.277
Hypothesis 3	The technical solution to the project need is tested using appropriate tools or techniques.	3.18	3.82.	-0.688	0.046
Hypothesis 4	The project's objectives in relation to the project need (scope) are achieved.	3.45	3.91.	-0.487	0.138
Hypothesis 5	The level of communication within the project team and stakeholders improves.	3.00	2.73.	0.202	0.518

Hypothesis	Question	Pre-Test Mean	Post-Test Mean	Cohen's d	p-value
Hypothesis 6	There is a correlation between respondents' knowledge or experience of Value Management and project success outcomes.	2.00	2.45.	-0.302	0.341

4.5.1 Hypothesis 1:

Experiencing a Value Management approach positively influences the belief that structured tools/frameworks ensure a cost-benefit approach.

Findings: The pre-test mean was 4.09, and the Post-Test mean slightly increased to 4.18. The paired t-test yielded a p-value of 0.676 and a Cohen's d effect size of -0.130.

Interpretation: Although the p-value indicates that the observed difference is not statistically significant at common thresholds ($p > 0.1$), the slight increase in the post-test mean suggests a positive reinforcement of participants' existing beliefs. This indicates that stakeholders already held a strong positive perception regarding the usefulness of structured tools for a cost-benefit approach even before the intervention. The minimal effect size further supports that while the belief was already high, the VM experience did not negatively impact it but subtly confirmed it.

Relation to Research Objectives: This finding directly addresses and supports Hypothesis 1, indicating that the VM approach indeed reinforces positive beliefs about structured tools in ensuring a cost-benefit approach.

Trends and Implications: This implies that VM interventions can validate and strengthen existing positive perceptions among stakeholders regarding structured tools in public procurement. The strong baseline belief suggests an inherent understanding among professionals of the value of systematic approaches, making them receptive to VM frameworks.

4.5.2 Hypothesis 2:

The original intent/need of the project is tested sufficiently to ensure alignment with the Client's requirements.

Findings: The pre-test mean was 2.73, and the Post-Test mean decreased to 2.45. The p-value was 0.277, and the Cohen's d effect size was 0.347.

Interpretation: While the change is not statistically significant ($p > 0.1$), the moderate effect size and the decrease in mean (assuming a lower score indicates better alignment) suggest a noticeable positive impact on participants' perception of the project's original intent aligning

with client requirements after the intervention. In the post-test, 54.5% of participants believed the original intent was "tested," compared to only 27.3% who felt it was "met" in the pre-test, indicating a positive shift in perception towards better alignment.

Relation to Research Objectives: This directly relates to Hypothesis 2, showing that VM contributes to improving the alignment of project intent with client needs.

Trends and Implications: This indicates that VM workshops are effective in clarifying project intent and ensuring it aligns with client requirements, fostering a more client-centric approach in public sector projects. Continued application of VM could lead to stronger alignment and reduced discrepancies between project goals and client expectations.

4.5.3 Hypothesis 3:

The technical solution to the project need is tested using appropriate tools or techniques.

Findings: The pre-test mean was 3.18, and the Post-Test mean increased significantly to 3.82. The paired t-test showed a p-value of 0.046, which is below the significance threshold of 0.1, and a Cohen's d effect size of -0.688.

Interpretation: This represents a statistically significant improvement in the perception that technical solutions are adequately tested using a VM framework post-intervention. The increase in the mean (assuming a higher score is better) and the moderate to large effect size (-0.688) strongly support the VM framework's effectiveness in enhancing technical solution testing. In fact, 81.8% of participants agreed that the technical solution was tested using a VM framework after the intervention.

Relation to Research Objectives: This finding directly and strongly supports Hypothesis 3. It also relates to Research Objective (d), which aims to identify intervention possibilities to enhance project success through value engineering.

Trends and Implications: The VM framework, with its practical tools like Function Analysis, Issues Analysis, and FAST Diagrams, demonstrably improved the rigorousness of technical solution testing. This implies a greater potential for project robustness and reduced technical risks when VM is integrated into project planning and execution.

4.5.4 Hypothesis 4:

The project's objectives in relation to the project need (scope) are achieved.

Findings: The pre-test mean was 3.45, and the Post-Test mean increased to 3.91. The p-value was 0.138, and the Cohen's d effect size was -0.487.

Interpretation: Although the change is not statistically significant ($p > 0.1$), the increase in the mean score suggests a positive trend indicating that participants felt project objectives were better achieved after the intervention. The moderate effect size further points to a noticeable impact, even if it did not reach statistical significance. This positive shift aligns with the post-

test survey data, where 72.7% of respondents agreed that project objectives were achieved, with 9.1% strongly agreeing.

Relation to Research Objectives: This finding directly supports Hypothesis 4. It also aligns with Research Objective (d), highlighting how VM interventions can enhance project success by ensuring objective achievement.

Trends and Implications: VM facilitates a clearer understanding and alignment of project activities with overall objectives, leading to a strong perception of improved scope achievement. This emphasises VM's utility in keeping projects focused on their core goals and delivering intended value.

4.5.5 Hypothesis 5:

The level of communication within the project team and stakeholders improves.

Findings: The pre-test mean was 3.00, and the Post-Test mean was 2.73. The p-value was 0.518, and the Cohen's d effect size was 0.202.

Interpretation: The paired t-test results indicate no statistically significant difference in communication levels. However, the source interprets the slight decrease in the mean as participants becoming "more critical of communication post-intervention", which is viewed as a positive step towards recognising areas for improvement. This nuanced interpretation aligns with qualitative findings from Section 4.4.6 and 5.3, where all respondents reported *some form of improvement* in communication, and a majority (36.4%) noted "considerable improvement," especially significant given that 30% had rated communication as "poor" in the pre-test.

Relation to Research Objectives: This directly relates to Hypothesis 5, supporting the qualitative perception of improved communication within project teams and stakeholders.

Trends and Implications: VM fosters a more open and collaborative environment, leading to perceived improvements in communication, a crucial "soft benefit" for stakeholder engagement and project success. The statistical interpretation further suggests that VM also cultivates a heightened critical awareness of communication quality, paving the way for targeted future enhancements.

4.5.6 Hypothesis 6:

There is a correlation between respondents' knowledge or experience of Value Management and project success outcomes.

Findings: The pre-test mean was 2.00, and the post-test mean increased to 2.45. The p-value was 0.341, and the Cohen's d effect size was -0.302.

Interpretation: While the change is not statistically significant ($p > 0.1$), the increase in the mean score suggests a positive effect on participants' knowledge of Value Management post-

intervention. The small to moderate effect size indicates some impact, demonstrating that the information sessions and workshops were effective in enhancing participants' understanding of VM principles.

Relation to Research Objectives: This finding directly supports Hypothesis 6 and Research Objective (e), which aims to examine the correlation between VM implementation and project success outcomes.

Trends and Implications: The intervention successfully increased participants' understanding of VM, which is a foundational step for its effective application and potential future project success. This underscores the critical importance of training and information sessions for promoting VM adoption and competence within the public sector.

4.5.7 Multiple Linear Regression

Following the Paired t-test analysis on a number of questions asked in the pre-test/post-test questionnaire, a multiple linear regression analysis was carried out where "Work Experience" and "Project Ownership" were the independent variables and the "Pre-test Question" is the dependent variable. The aim was to assess whether work experience and project ownership had a significant effect on participants' beliefs about the usefulness of a structured tool/framework in awarding public contracts.

Table 4.5: Summary Table for Hypotheses 7&8.

Hypothesis	Dependent Variable	Independent Variables	R-squared	F-statistic	p-value
7 (Pre-Test)	Belief in usefulness of structured tool/framework.	Work Experience, Project Ownership.	0.101	0.449	0.653.
7 (Post-Test)	Belief in usefulness of structured tool/framework.	Work Experience, Project Ownership.	0.154	0.727	0.513.
8 (Pre-Test)	Achievement of project objectives.	Work Experience, Project Ownership.	0.267	1.455	0.289.
8 (Post-Test)	Achievement of project objectives.	Work Experience, Project Ownership.	0.471	3.564	0.078.

4.5.7.1 Hypothesis 7:

The implementation of a structured tool or framework enhances the cost-benefit approach in awarding public contracts, as recommended in Public Procurement Regulations, compared to current methods.

Findings (Multiple Linear Regression - Test 1 for Pre-Test, Test 3 for Post-Test):

- Pre-Test: R^2 of 0.101, F-value of 0.449, and a p-value of 0.653.
- Post-Test: R^2 of 0.154, F-value of 0.727, and a p-value of 0.513.

Interpretation: For both the pre-test and post-test, the low R^2 values and non-significant p-values indicate that the independent variables (work experience and project ownership) were not strong predictors of the belief in the usefulness of a structured tool/framework for a cost-benefit approach. This suggests that other, more complex factors beyond these demographics influence this perception. The non-significant results imply that the intervention did not make work experience or project ownership significantly *more* influential in predicting this belief.

Relation to Research Objectives: This directly relates to Hypothesis 7. The analysis indicates that while VM may enhance cost-benefit approaches, the tested demographic factors do not significantly explain this belief.

Trends and Implications: The drivers for stakeholders' belief in the cost-benefit of structured tools are more nuanced than just their work experience or project ownership. Future research should explore other influencing factors, such as organisational culture, specific VM training received, or prior exposure to successful VM projects, to build a more comprehensive predictive model.

4.5.7.2 Hypothesis 8:

Inadequate alignment and verification processes during project planning and execution phases result in inconsistent achievement of project objectives.

Findings (Multiple Linear Regression - Test 2 for Pre-Test, Test 4 for Post-Test):

- Pre-Test: R^2 of 0.267, F-value of 1.455, and a p-value of 0.289.
- Post-Test: R^2 of 0.471, F-value of 3.564, and a p-value of 0.078.

Interpretation: In the pre-test (Test 2), work experience and project ownership were not significant predictors of perceived project objective achievement. However, in the post-test (Test 4), the model showed a statistically significant trend ($p < 0.1$), with a moderate R^2 of 0.471. This implies that post-intervention, work experience and project ownership gained a more substantial influence on the belief that project objectives are achieved. This is a positive outcome, suggesting that VM effectively *addressed* the "inadequate alignment and verification processes" to some extent.

Relation to Research Objectives: This directly relates to Hypothesis 8. The shift to statistical significance post-intervention implies that VM helps establish a clearer link between professional background and the successful realisation of project goals.

Trends and Implications: After the VM intervention, the professional background and project ownership context of the participants became more relevant to their perception of project objective achievement. This suggests that VM facilitates a clearer understanding and strengthens the connection between professional roles and successful project delivery, potentially by standardising processes and enhancing awareness of verification mechanisms within public sector projects.

4.5.8 Overall Trends and Implications from Statistical Results:

The statistical analyses collectively provide compelling evidence of the positive impact of Value Management interventions on project outcomes and stakeholder knowledge within the Maltese public sector.

- **Enhanced Perception of VM Efficacy:** There was a statistically significant improvement in the perception of technical solution testing post-intervention, highlighting VM's direct, measurable benefit in a critical project phase.
- **Positive Trends in Key Areas:** While not always statistically significant (partially due to the small, but comprehensive, sample size, or high baseline perceptions), positive trends were observed in the belief that structured tools ensure a cost-benefit approach, the achievement of project objectives, and increased knowledge of VM. This suggests that the VM interventions reinforced and improved existing good practices and understanding.
- **Improved Communication (Qualitative Confirmation):** Despite the paired t-test for communication being non-significant (and interpreted as increased criticality), the qualitative survey responses strongly affirm that VM significantly improved communication within project teams and among stakeholders. This "soft benefit" is crucial for collaborative project environments.
- **Demographics and Perceived Success:** Work experience and project ownership, while not always strong predictors initially, showed a statistically significant influence on the perception of project objective achievement in the post-test. This indicates that VM interventions helped align professional roles with a clearer understanding of project success.
- **Reinforcement of VM's Value:** The study consistently shows that VM is perceived as a valuable tool for maximising value, improving efficiency, and aligning project outcomes with objectives and client needs, reinforcing its effectiveness in the public service sector.

4.6 Thematic Analysis Data

This section presents the qualitative findings derived from the thematic analysis of open-ended questions in both the pre-test and post-test questionnaires. The data was processed to identify recurring themes and perceptions, using both manual qualitative coding and visual analysis via VOS Viewer software. The analysis aims to provide insights into stakeholders' evolving understanding and appreciation of Value Management (VM) before and after the intervention. Detailed data can be found in Appendix 4.

4.6.1 Analysis of Question: "How do you define Value Management?"

This subsection examines how participants defined Value Management in both the pre-test and Post-Test phases, highlighting any shifts in their understanding.

4.6.1.1 Pre-Test Definitions

Prior to the intervention, the thematic analysis of responses to the question "How do you define Value Management?" revealed a "tapestry of definitions". The most common words in responses included "value," "project," "best," "cost," "objectives," "integration," "proven," "structured," and "problem-solving".

Six key themes were identified, with "Best Value" and "Means" having the highest frequency (3 each), followed by "Integration," "Multidisciplinary Team," and "Performance" (2 each), and "Knowledgeable Value Practitioner" (1).

The VOS Viewer maps further illustrated these initial perceptions:

- **Map 1** (Figure 4.11) displayed interconnections between "best value" and "lowest over life cycle cost".
- **Map 2** (Figure 4.12) showed "means" as a key theme, interconnected with "money," "value," "technical consensus," and "methodical approach".
- **Map 3** (Figure 4.13) presented terms such as "multidisciplinary team," "knowledgeable value practitioner," "performance," and "integration".

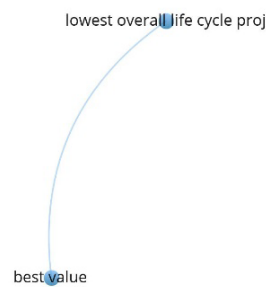


Figure 4.11: VOS Viewer Q1.

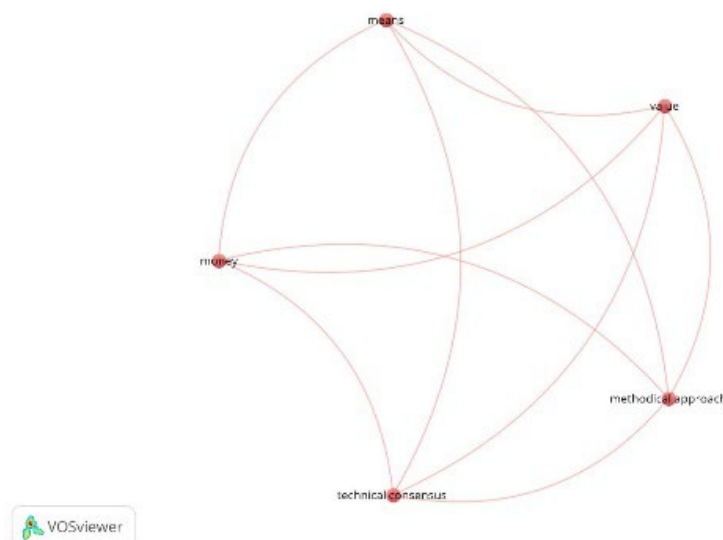


Figure 4.12: VOS Viewer Q1 Cluster 2.

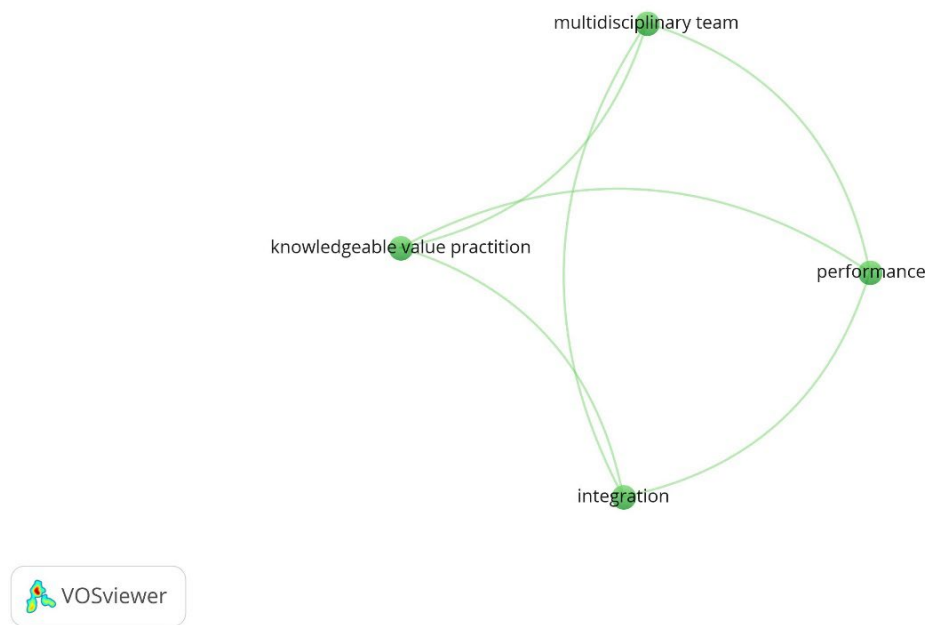


Figure 4.13: VOS Viewer Q1 Cluster 3.

These manual and VOS Viewer analyses aligned, particularly for "integration" and "best value," while other themes like "multidisciplinary team" and "knowledgeable value practitioner" were less directly referenced but inferable.

4.6.1.2 Post-Test Definitions

Following the intervention, participants' definitions of Value Management showed a notable shift towards a preferred definition: **"A methodical approach as a means of achieving value for money through clearly defining the objectives and establishing a technical consensus as to how to meet these objectives"**. This definition was chosen by 54.5% of participants.

Four main themes emerged:

1. **Methodical Approach for Value for Money:** Most frequent (6 times), emphasising a structured method to achieve value for money through clear objectives and technical consensus.
2. **Integration of Multidisciplinary Team and Value Practitioner:** Appeared 3 times, highlighting structured problem-solving by a multidisciplinary team guided by an experienced practitioner to balance cost, reliability, and performance.
3. **Explicit and Appraised Needs:** Appeared once, defining VM as a process making project needs explicit and evaluating them per stakeholder requirements.
4. **Adding Value to a Project:** Also appeared once, describing VM as simply adding value to a project.

The VOS Viewer map for post-test responses (Figure 4.14) reflected these themes, with "money," "technical consensus," and "value" as major interconnected nodes, indicating a strong emphasis on achieving value for money through clear objectives and consensus. The

connection between "project" and "value" further highlighted the focus on enhancing project outcomes. While "multidisciplinary team" and "base needs" nodes were not directly shown, their concepts were implied within broader terms like "technical consensus" or "value".

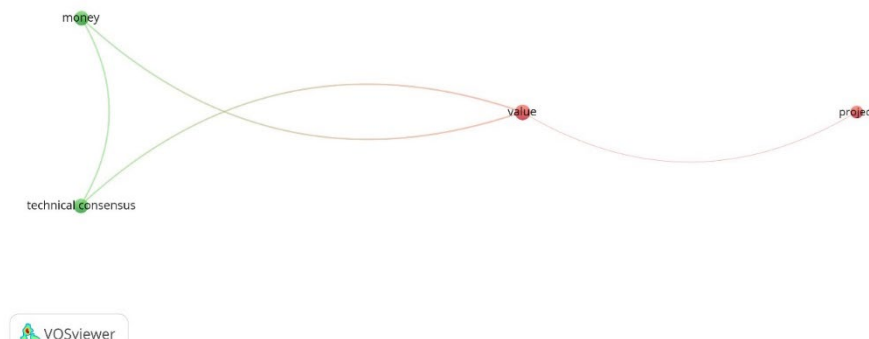


Figure 4.14: Vos Viewer Map Post-Test Q1.

4.6.1.3 Comparison of Pre-Test and Post-Test Definitions

Comparing the themes from both phases reveals a reinforcement and deepening of participants' understanding of Value Management following the intervention.

- **Methodical Approach for Value for Money:** This theme remained strong and consistent across both tests. The post-test responses, with repeated mentions of "value for money," "clearly defining objectives," and "technical consensus," suggest that the intervention reinforced the importance of this structured approach.
- **Integration of Multidisciplinary Team and Value Practitioner:** While present in the pre-test, the post-test emphasised the continued importance of a "multidisciplinary team" and "value practitioner." Mentions of structured problem-solving and balancing cost, reliability, and performance indicate a more profound appreciation for the practical application of these roles.
- **Explicit and Appraised Needs:** This theme remained relevant in both tests, underscoring the ongoing recognition of defining and appraising needs to meet stakeholder requirements.
- **Adding Value to a Project:** The core idea of "adding value" was significant in both pre- and post-tests, indicating that the intervention effectively reinforced this fundamental concept.

The visual comparison of VOS Viewer maps showed similar strong links between "money," "technical consensus," and "value" in both phases. However, the post-test map exhibited an **additional emphasis on "project," suggesting a more project-focused understanding of Value Management.** This indicates that the intervention not only reinforced existing understanding but also deepened participants' appreciation for specific aspects like the role of multidisciplinary teams and structured problem-solving techniques, leading to a more nuanced and applied understanding of VM concepts.

4.6.2 Analysis of Question: "What do you understand by Value Management?"

This subsection explores participants' broader understanding of Value Management, contrasting initial perceptions with the post-intervention.

4.6.2.1 Pre-Test Understanding

The pre-test questionnaire provided insights into initial perceptions of Value Management, revealing distinct themes related to project execution and management concerns. All responses highlighted at least a basic understanding of VM.

Six themes were identified, with **"Quality Concerns" being predominant at 40%** (4 mentions), followed by "Cost and Budgeting" at 20% (2 mentions). Other themes, each at 10% (1 mention), included "Oversight and Accountability," "Skill and Qualification Issues," "Impact on Local Labour," and "Adaptation and Flexibility".

- **Quality Concerns (QC):** Focused on poor workmanship, substandard materials, and compromised project quality.
- **Oversight and Accountability (OA):** Highlighted concerns about inadequate monitoring by authorities.
- **Skill and Qualification Issues (SQ):** Emphasised the detrimental effects of unqualified personnel.
- **Cost and Budgeting (CB):** Related to hidden costs and budgeting challenges.
- **Impact on Local Labour (IL):** Expressed apprehension about the influx of foreign workers.
- **Adaptation and Flexibility (AF):** Stressed the need for adaptability in project planning.

The VOS Viewer analysis (Figure 4.15) categorised responses into three broader themes:

- **Value Management:** Described as a structured approach emphasising leadership, communication, skill development, and balancing stakeholder needs.
- **Structured Approach:** An analytical planning approach aiming for better results, value for money, and optimal outcomes with minimal costs.
- **Value:** Achieving sustainable value through careful project management, budget control, and quality maintenance for long-term benefits.



Figure 4.15: Vos Viewer Q2 Pre-Test.

Alignment and Differences: While manually generated themes focused on specific issues, the VOS Viewer clusters presented a more integrated view. Quality concerns, oversight, skill issues, and cost/budgeting were incorporated into the broader VOS Viewer themes of "Value Management," "Structured Approach," and "Value," suggesting a holistic understanding of achieving overall project value through systematic management. The "Impact on Local Labour" theme, however, appeared less central in the VOS Viewer analysis.

4.6.2.2 Post-Test Understanding

Following the intervention, participants' understanding shifted towards a more holistic and strategic view of Value Management, indicating the information session was successful.

Two main themes emerged from the responses:

1. **Maximising Value and Efficiency:** Most frequent (5 times), this theme described VM as a systematic and strategic approach to maximise value, efficiency, and benefits while optimising costs and resources. It included aspects like increasing project budgets without compromising quality/time, achieving value for money, and creating sustainable value.
2. **Comprehensive Approach to Project Management:** Appeared 3 times, viewing VM as a multidisciplinary and structured approach encompassing procurement, project phases, and key criteria like quality, budget, and timeliness.

The VOS Viewer map for post-test responses (Figure 4.16) identified three primary clusters:

1. **Value Management:** Keywords included "value management," "budget," and "quality," emphasising a structured approach to managing these aspects.
2. **Structured Approach:** Keywords like "structured approach," "project," and "process," illustrating VM as an analytical and structured method for planning projects, ensuring value for money and optimal outcomes.
3. **Value:** Keywords "value" and "sustainable value," promoting achieving sustainable value through careful project management and long-term benefits.



Figure 4.16: VOS Viewer Q2 Post-Test.

Alignment: Both the manually generated themes and VOS Viewer clusters showed strong alignment, underscoring the importance of structured, efficient, and comprehensive approaches to Value Management. Themes like "Maximising Value and Efficiency" aligned with the "Value Management" and "Value" clusters, emphasising cost management and quality standards. The "Comprehensive Approach to Project Management" aligned with the "Structured Approach" and "Value Management" clusters, highlighting the holistic nature of VM across project stages.

4.6.2.3 Comparison of Pre-Test and Post-Test Understanding

The comparison of themes and frequencies between the pre-test and post-test reveals significant shifts in perception, indicating that the intervention effectively broadened respondents' understanding of VM's opportunities and benefits.

- **Quality Concerns:** Decreased significantly from 4 mentions in the pre-test to 0 explicitly in the post-test.
- **Cost and Budgeting:** While 2 mentions in the pre-test, the focus shifted dramatically to "Maximising Value and Efficiency" with 5 mentions in the post-test, indicating a move beyond mere cost reduction to optimising value.
- **Oversight and Accountability & Skill and Qualification Issues:** Each had 1 mention in the pre-test, but themes related to "Comprehensive Approach to Project Management" rose to 3 mentions in the post-test, suggesting that these concerns became integrated into a more holistic project management view.
- **Impact on Local Labour & Adaptation and Flexibility:** Each had 1 mention in the pre-test but were not explicitly represented as standalone themes in the post-test, possibly integrated into broader concepts or becoming less central after the intervention.

This shift demonstrates a clear evolution: initial concerns about specific problems (e.g., quality, costs) transformed into a stronger focus on proactive strategies for "maximising value and efficiency" and adopting a "comprehensive approach to project management".

4.6.3 Post-Test Analysis of Question: "What strengths, opportunities and problems have you encountered during the application of the Value Management Approach?"

This question was exclusively posed in the post-test to gather participants' reflections on their practical experiences with the VM framework. The analysis highlighted several strengths, opportunities, and problems encountered.

4.6.3.1 Identified Themes and Frequencies

Eight common themes emerged:

- **Collaboration and Effective Decision-Making (CED):** Highlighted encouragement of stakeholder collaboration (Frequency: 2).
- **Communication Improvement (CI):** VM improves communication pathways for better project handling (Frequency: 1).

- **Efficiency and Problem-Solving (EPS):** VM is a useful tool for addressing problems and finding solutions collaboratively (Frequency: 2).
- **Conflict Resolution (CR):** Challenges of managing diverse opinions and resolving disputes (Frequency: 1).
- **Challenges Anticipation (CA):** VM helps pre-empt project challenges (Frequency: 1).
- **Regulatory Compliance (RC):** Importance of complying with regulations (Frequency: 1).
- **Lack of Follow-Up (LFU):** Instances where issues are not effectively followed up (Frequency: 1).
- **Detailed Discussion and Planning (DDP):** VM involves thorough planning, idea sharing, and effective execution monitoring (Frequency: 1).

Overall Analysis: These themes underscore VM's collaborative and problem-solving strengths, along with opportunities for communication improvement and addressing challenges like conflict resolution and regulatory compliance. Positive aspects included: encouraging collaboration, efficient problem-solving, communication improvement, proactive anticipation of challenges, and emphasis on detailed planning. Noted challenges included conflicts from diverse opinions and the need for better follow-up and regulatory compliance.

4.6.3.2 VOS Viewer Map Analysis and Comparative Review

The VOS Viewer post-test map (Figure 4.17) clustered terms into four key themes: "Strength," "Opportunity," "Problem," and "Stakeholder".

Comparative Review with Manually Identified Themes:

- **Collaboration and Effective Decision-Making (CED):** Aligns with the VOS Viewer's emphasis on the "Stakeholder" role, though "collaboration" isn't explicit in the map.
- **Communication Improvement (CI):** While not explicit in the map, stakeholder involvement indirectly leads to improved communication, making it an implicit part of engagement.
- **Efficiency and Problem-Solving (EPS):** Aligns with the "Problem" theme in VOS Viewer, reinforcing VM's role in addressing and solving issues.
- **Conflict Resolution (CR):** Also aligns with the "Problem" theme, as conflict is a critical aspect of problems addressed by VM.
- **Challenges Anticipation (CA):** The VOS Viewer map highlights "problems," which aligns with anticipating and addressing challenges proactively in VM.
- **Regulatory Compliance (RC):** Not explicitly mentioned in the map keywords, but is an essential aspect of VM, especially in public procurement.
- **Lack of Follow-Up (LFU):** The map highlights the need to address ongoing "problems," which continuous follow-up helps to ensure.
- **Detailed Discussion and Planning (DDP):** Aligns with the "Opportunity" theme, as thorough planning and discussions are integral to seizing opportunities in VM.

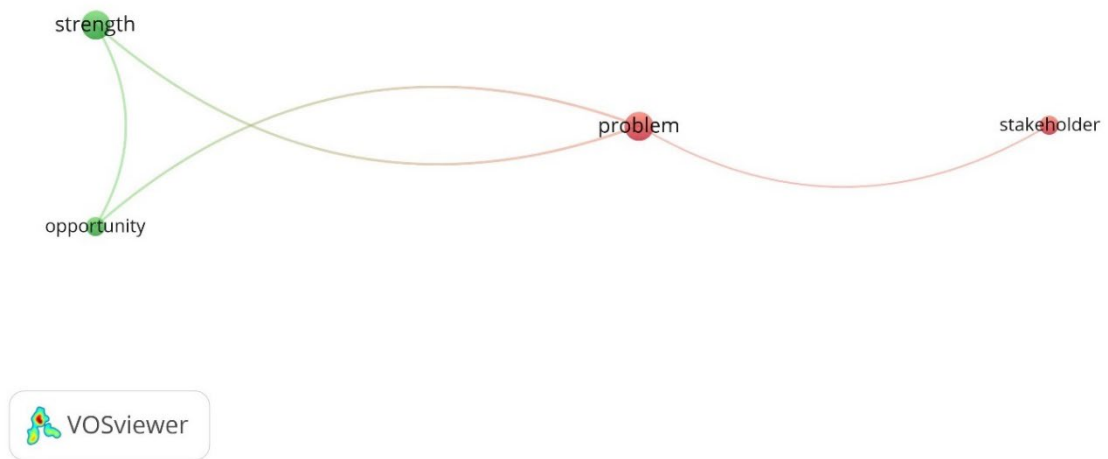


Figure 4.17: VOS Viewer map

Conclusion: The strong alignment between manually generated themes and the VOS Viewer map confirms that both methods emphasise stakeholder collaboration, problem-solving, and addressing challenges as integral components of Value Management. The qualitative analysis provides a structured and insightful perspective on the strengths, opportunities, and problems, highlighting benefits and areas for improvement.

4.6.4 Thematic Analysis Summary

Qualitative Support for Quantitative Findings:

This qualitative data **complements** the quantitative findings from the pre-test and post-test questionnaires, which showed positive shifts in attitudes and beliefs towards structured tools and the potential benefits of Value Management.

The thematic analysis adds depth and context to these quantitative changes, illustrating the actual evolution in understanding among the participants as shown in summary table hereunder.

Table 4.6: Thematic Analysis Summary (Mifsud Grimaud, Dalli Gonzi, & Grima, 2025).

Shift from Cost to Value	Recognition that value incorporates quality, sustainability, and stakeholder input.
Enhanced Collaboration and Communication	Workshops improved communication and consensus among cross-disciplinary teams.
Improved Decision-Making	Function analysis and value criteria led to a more systematic project evaluation.
Stakeholder-Centric Solutions	Increased awareness of user needs and community impact.
Sustainability Integration	Greater emphasis on eco-friendly, long-term planning in design decisions.

4.7 Chapter Summary

This chapter meticulously presented the culmination of findings from each phase of the study, drawing data generated via Google Forms, SPSS, and VOS Viewer respectively.

The initial pre-test study findings revealed a significant landscape regarding Value Management (VM) in the local context. It was notably found that all eleven primary stakeholders and key decision-makers who participated in the study lacked prior knowledge and usage of Value Management. A prevailing concern emerged regarding the limitations of awarding tenders based solely on the lowest cost criteria, with a large majority (91%) believing this is not a measure of good quality. Furthermore, significant uncertainty existed regarding current practices for testing technical solutions prior to tender issuance, indicating a need for more rigorous and standardised validation methods. Respondents also reported varied levels of communication within their project teams, with a notable portion rating it as poor.

The Intervention phase involved comprehensive information sessions on Value Management and a series of Value Management Workshops conducted for three distinct projects within the Ambjent Malta Project Implementation Directorate: L-Għadira s-Safra, Radar Station Marfa, and Buskett Public Convenience. These workshops utilised various VM tools such as Issues Analysis, Function Analysis, and FAST Diagrams to tackle issues and understand critical functions and their solutions.

Following the intervention, the post-test Study unveiled significant shifts in stakeholder perceptions and attitudes towards Value Management. There was unanimous agreement among all participants that a structured tool/framework is useful in facilitating a cost-benefit approach. The intervention proved effective in demonstrating the application of appropriate tools and techniques for testing technical solutions in projects prior to tender issuance, a key area of uncertainty in the pre-test. Post-intervention, stakeholders also emphasised the importance of ensuring that all aspects of project design are cost-effective for their required purpose, aligning with core VM principles. A strong majority (81.8%) agreed that project objectives in relation to project scope were achieved after the VM intervention. Additionally, all respondents perceived some form of communication improvement within their project teams and with stakeholders following the intervention.

Hypothesis testing, conducted using quantitative software, provided conclusive results regarding the impact of the VM intervention. Key findings from the paired t-tests indicated a statistically significant improvement in the perceived thoroughness of technical solution testing post-intervention ($p\text{-value} = 0.046$), demonstrating the effectiveness of the VM framework in enhancing this critical aspect. Furthermore, participants showed a stronger conviction that project objectives related to project scope were effectively achieved through VM implementation. Multiple Linear Regression analysis revealed that work experience had a statistically significant positive effect on post-test perceptions of scope alignment, suggesting that VM resonates more with experienced professionals who have witnessed the consequences of poor planning. Project ownership, however, did not show a significant effect, indicating VM's broad applicability.

The Thematic Analysis of open-ended questions from both pre-test and post-test questionnaires offered rich qualitative insights into stakeholders' evolving understanding and

appreciation of Value Management. A notable shift was observed from initial project-specific concerns (such as quality, cost, and lack of oversight) to a more holistic understanding centred on core VM principles, including maximising value, efficiency, and adopting a comprehensive, structured approach to project management. Themes like improved communication, enhanced decision-making, and increased efficiency in task output emerged strongly in the post-test responses, highlighting the transformative potential of VM. The analysis also indicated that participants recognised the importance of early intervention in projects.

In conclusion, through a meticulous examination of these findings, the chapter provides valuable insights into the efficacy of the Value Management approach within the public service sector, with a specific focus on the environmental sector. The study demonstrates how VM moves beyond conventional cost-cutting measures to emphasise holistic value creation, encompassing enhanced quality, optimised efficiency, and enriched stakeholder value. The research directly responds to the acknowledged limitations of solely relying on lowest-cost tendering and advocates for a value-driven approach aligned with Public Procurement Regulations. This comprehensive research journey culminates in the development of a bespoke Value Management Framework, operationalised through a Standard Operating Procedure (SOP), tailored to the unique needs and challenges of public service sector projects in Malta, serving as a significant contribution to knowledge and a blueprint for sustainable project excellence.

Chapter 5 - Discussion and Analysis

The Discussion and Analysis chapter is divided into parts to build up towards the value management framework as indicated below:

5.1 Analysis of results pertaining to the Pre-Test Study

5.2 Analysis obtained following the Information session and case study carried out

5.3 Analysis of results pertaining to the Post-Test Study

5.4 & 5.5 Hypothesis testing results analysis

5.6 Analysing the complete Statistical Results

5.7 Thematic Data

In the development of a value management framework, defining and documenting the processes that regulate the capture, analysis, and prioritise the requirements as the initial step in this Chapter 5, are key to the study. The use of pillars to support the creation of a framework is supported or discussed by the data as it is drawn from the data extracted in each section. Each section contains the Implications for setting up the Value Management framework:

5.1 Analysis of results pertaining to the Pre-Test Study

The pre-test study served as a crucial baseline, providing insights into existing perceptions and practices of Value Management (VM) within the targeted Maltese public service environmental sector department Ambjent Malta prior to any intervention. The findings highlight several key areas that underscore the necessity and potential impact of the proposed VM framework.

Pillar 1: The Impact of Work Designation

Findings and Interpretation: The demographic analysis of the pre-test participants revealed a diverse, yet project-centric, composition of stakeholders. The largest group, 63.6%, occupied project management executive roles, indicating a strong representation of individuals deeply involved in project execution and oversight. This suggests that the cohort for the study was well-positioned to offer practical insights into project realities. Smaller, but valuable, proportions included client architects (9.1%), general stakeholders (9.1%), public administration headship positions (9.1%), and design office personnel (9.1%). Each of these roles brings a unique perspective, from end-user satisfaction and design integration (client architects) to regulatory compliance (public administration) and technical feasibility (design office). The overall composition reflects the multidisciplinary

team approach advocated in Value Management literature, which emphasises diverse expertise for comprehensive project analysis.

Relation to Research Objectives and Literature: The selection criteria, as discussed in the Methodology (Chapter 3), ensured that participants possessed experience in project implementation. This diverse yet experienced group is critical for understanding the complexities of public procurement decisions in Malta, a context where "public administration continually encounters difficulties and possibilities arising from evolving developments and trends in contemporary society". The presence of individuals with significant project experience (72.7% with over 20 years, all with over 10 years' experience) enhances the validity of the study's findings by increasing the perceived knowledge among participants. This aligns with the research's aim to address critical gaps and develop a context-specific framework for the Maltese public sector. The composition underscores the existing human capital available that could, with appropriate tools and training, drive improvements in public procurement capability in Malta.

Trends and Implications for the Value Management Framework: The varied work designations highlight the necessity of a VM framework that caters to multiple perspectives and integrates diverse expertise. The strong representation of project management roles suggests a receptive audience for a VM approach that enhances project execution and oversight. The presence of public administration officials and design professionals indicates an opportunity to embed VM principles across strategic, regulatory, and technical aspects of public projects. Establishing a team "adept at comprehending and executing the value management exercise is a crucial outcome". Therefore, Pillar 1 of the proposed VM framework, "Multidisciplinary Team Composition," directly reflects this finding by emphasising the need for diverse expertise (e.g., project managers, engineers, client architects) in project teams to enhance multidisciplinary cooperation and equitable decision-making.

Pillar 2: The Use of a Structured Tool/Framework to Ensure a Cost-Benefit Approach

Findings and Interpretation: A compelling 90.9% of respondents indicated that a structured tool or framework would be "Useful" or "Very Useful" in ensuring a cost-benefit approach when awarding public contracts. This finding is highly significant as it demonstrates a widespread recognition among experienced stakeholders of the potential benefits that structured methodologies can bring to public procurement processes. This strong consensus suggests a perceived gap in current practices and an openness to adopting new tools to enhance transparency, efficiency, and effectiveness beyond traditional cost-focused tendering. The remaining 9.1% were neutral, indicating a potential area for further awareness and education.

Relation to Research Objectives and Literature: This finding directly supports Hypothesis 1, which states that "Experiencing a Value Management approach positively influences the

belief that structured tools/frameworks ensure a cost-benefit approach". The pre-test results, even prior to intervention, already reveal a strong predisposition towards structured approaches, indicating an innate understanding of the need for better project outcomes through comprehensive cost-benefit analyses. This aligns with the research aim to investigate whether VM techniques can achieve best value and improve quality in the public sector. Literature consistently supports the idea that structured approaches, such as Value Management, are crucial for optimising resource allocation and improving project alignment with stakeholder needs. The Maltese public procurement regulations, which have established the "Most Economically Advantageous Tender" (MEAT) as the sole award criterion, implicitly require a cost-effectiveness approach like Value Management.

Trends and Implications for the Value Management Framework: The robust support for structured tools provides a solid foundation for implementing Value Management in public procurement in Malta. The recognition by stakeholders that these tools can lead to better project outcomes, ensuring contracts are awarded based on comprehensive cost-benefit analyses, signals a readiness for institutional change. This pre-existing belief strengthens the rationale for Pillar 2 of the VM framework: "Structured Cost-Benefit Approach," which advocates for a formalised tool or framework in public procurement for thorough cost-benefit analysis in accordance with Public Procurement Regulations. Furthermore, the presence of neutral responses highlights the need for continued "Training and Awareness Initiatives" to fully demonstrate the advantages and practical implementations of VM.

Pillar 3: Adjudication - Awarding Tenders by Lowest Cost Criteria as a Measure of Good Quality

Findings and Interpretation: A substantial majority of respondents, 91%, believed that "awarding tenders by the lowest cost criteria is not a measure of good quality". This overwhelming consensus indicates a widespread dissatisfaction with a cost-centric approach to procurement and a clear recognition among practitioners that prioritising only the lowest cost often compromises the quality of project outcomes. The remaining 9.1% who might consider lowest cost as a measure of quality represents a very small segment, possibly focusing solely on immediate financial savings.

Relation to Research Objectives and Literature: This finding directly addresses one of the core problems identified in the study: the limitations of traditional problem-solving approaches in public project delivery, particularly those rooted in cost-minimisation. It aligns strongly with international literature and the premise discussed in Chapter 2, which highlights that "the cheapest initial cost is rarely the best". Numerous sources within the literature review emphasise the negative consequences of lowest-cost tendering, such as poor quality, contract amendments, cost overruns, and a decline in overall project value. The research aims to move beyond mere cost reduction to encompass enhanced quality and optimised efficiency. The data provides empirical support for this shift in focus within

the local Maltese context, substantiating the claim that stakeholders recognise the importance of value-based decision-making over solely cost-based criteria.

Trends and Implications for the Value Management Framework: The strong opposition to lowest-cost tendering as a quality metric underscores the urgent need for a more comprehensive approach to contract review that balances cost with other quality indicators. The negligible costs of a VM exercise (typically less than 1% of total project costs, with potential savings of 10-15%) compared to its benefits further strengthen the argument for its mandatory inclusion in the tendering process to ensure a 'good quality' approach. This finding directly informs Pillar 3 of the VM framework: "Holistic Value-Based Adjudication," which operationalises a value-based approach to overall project value, including quality, performance, and life-cycle cost, moving away from simplified cost-centric decision-making. The intent to omit this question from the post-test (as detailed in Chapter 5.3) further signifies a deliberate shift in the study's focus towards the holistic value perspective that VM promotes.

Pillar 4: Aligning Original Project Intent and Technical Solutions with Client Needs

Findings and Interpretation: The pre-test revealed that 72.7% of respondents believed the original intent or need of a project was *only partially* tested to ensure alignment with client requirements. Conversely, 27.3% felt it *was* being met. This indicates a significant perceived gap in the thoroughness of current evaluation processes for aligning projects with client needs. This perceived ambiguity is further exacerbated when considering whether the technical solution to the project need is tested using a tool or technique prior to a tender being issued: 45.5% were neutral, 36.4% agreed, and 18.2% disagreed. This mixed response suggests a lack of clarity, inconsistency, or insufficient practices regarding technical validation before bids are issued.

Relation to Research Objectives and Literature: These findings are critical for Research Question 2: "Do value management methods improve project efficiency and quality in the public sector? If so, how?". They highlight a fundamental challenge in project success: ensuring that the project genuinely meets the client's needs and that technical solutions are robustly validated. Value Management, by its very definition, focuses on ensuring that projects deliver the "intended value" to clients by clarifying requirements and optimising solutions. The perceived gap in intent alignment and technical testing points to an opportunity for VM to strengthen these processes. Chapter 2 discusses how VM workshops can provide gains in "updating standards, criteria and objectives" and "finding solutions that best fit the specific project objectives". The significant investment in VM workshops (e.g., ~€90k for a 2-day workshop) is justified by these potential gains. The analysis also acknowledges that the scientific background of participants (60% project managers/engineers) might influence their views on management strategies, emphasising the importance of context in identifying suitable tools.

Trends and Implications for the Value Management Framework: The widespread perception of partial alignment and ambiguous technical testing underscores a crucial need for more explicit rules, enhanced training, and standardised protocols for thorough technical validation. This reinforces the importance of early intervention in the project lifecycle, a key principle of VM, as earlier application typically yields greater benefits and results. Therefore, Pillar 4 of the VM framework, "Precise Project Intent & Client Alignment," directly addresses this by strengthening the process of rigorously testing and aligning initial project intent and technical solutions with client needs from early stages. The framework aims to mitigate ambiguity and ensure that the "technological solution aligns with project requirements [which] is essential for project success".

Pillar 4 (continued): Achieving Project's Objectives Relating to Project Need (Scope)

Findings and Interpretation: Regarding the achievement of project objectives related to scope, the pre-test showed a near-balanced division: 45.5% believed the project scope was being met, while 54.5% held a neutral or uncertain stance. This indicates a noticeable level of uncertainty or variability in experiences regarding project scope achievement. It suggests that while some projects successfully define and meet their intended scope, a significant portion of stakeholders remains unsure or perceives inconsistencies in this area.

Relation to Research Objectives and Literature: This finding reinforces the broader research objective to improve project efficiency and quality in the public sector, as scope clarity and achievement are fundamental to both. The ambiguity points to a need for more robust scope delineation, management protocols, and stakeholder engagement. Literature emphasises that Value Management "prioritises the assurance that projects realise their intended value, including the precise definition and attainment of project scope". This aligns with the idea that VM can provide a structured mechanism to "mitigate uncertainties and guarantee more uniform attainment of project scope across all initiatives".

Trends and Implications for the Value Management Framework: The pre-test results signal an opportunity for the VM framework to significantly enhance scope management techniques. By embedding VM, organisations, particularly in the public sector, can improve their capacity to define, manage, and verify project scope, leading to more uniform attainment of project goals. The VM framework, through its emphasis on clear objectives and stakeholder consensus, can serve as an "optimal instrument" to tackle these challenges. This underscores the framework's role in addressing fundamental issues of project delivery and ensuring that public resources achieve their desired value.

Pillar 5: Communication Levels Within Project Team and Stakeholders

Findings and Interpretation: Communication levels within project teams and stakeholders showed a concerning split in the pre-test: 36.4% rated it as "Very Good," 27.3% as "Neutral," and another significant 36.4% as "Poor". This indicates a notable inconsistency in communication practices, with nearly 40% experiencing significant issues. Such a varied

assessment highlights critical areas for improvement, as effective communication is foundational to successful project execution and stakeholder collaboration.

Relation to Research Objectives and Literature: This finding directly relates to Research Question 2, which probes how VM methods improve project efficiency and quality. Poor communication is a known impediment to project success, leading to misunderstandings, delays, and misallocation of resources. Literature consistently identifies "improved communication" as a key benefit of Value Management. Value Management, by promoting cooperation, decision-making, and alignment among stakeholders, inherently addresses these communication gaps. Historical case studies like the Scottish Parliament building project further underscore the detrimental impact of a "lack of communication and coordination" on project outcomes. The pre-test results confirm that such challenges are present in the local Maltese context, establishing a clear need for intervention in this area.

Trends and Implications for the Value Management Framework: The observed communication inconsistencies highlight a significant opportunity for the VM framework to drive improvement. The framework must incorporate strategies to evaluate existing practices, execute thorough communication plans, provide training, and implement frequent feedback systems. Therefore, Pillar 5 of the VM framework, "Enhanced Project Communication," directly aims to address this critical need by fostering improved communication among project teams and all stakeholders. The successful integration of VM can lead to enhanced cooperation, better decision-making, and overall project success.

Problems Arising from Awarding Projects on the Basis of Lowest Cost Criteria

Findings and Interpretation: The open-ended responses regarding problems arising from awarding projects based on lowest cost criteria consistently highlighted quality as the "primary casualty". Specific issues mentioned included poor quality, inexperienced workers, lack of professionalism, insufficient follow-up by authorities, subsequent increases in current and maintenance costs, prevalence of "sena u arti" (traditional, perhaps less professional, methods), and cost increases/variations with often sub-par quality. This paints a picture of short-sighted procurement practices leading to significant long-term detriments and a strong perception among stakeholders that cost minimisation frequently compromises project integrity.

Relation to Research Objectives and Literature: This direct feedback from practitioners provides qualitative evidence supporting the critical need for the study to move beyond "conventional cost-cutting measures to emphasise holistic value creation". It substantiates the "Statement of the Problem," which identifies the inadequacy of traditional problem-solving approaches in the face of volatile markets and resource constraints. The findings are consistent with extensive literature on public procurement issues, which warns that "lowest price" tendering often forces contractors to price unsustainably, leading to compromised quality, cost overruns, and even legal disputes. The OECD report on public

procurement in Malta also notes a need for improvement in areas that would enhance effectiveness and efficiency, including procurement planning and risk management, which are directly impacted by lowest-cost tendering. The research directly advocates for a "value-driven approach aligned with Public Procurement Regulations".

Trends and Implications for the Value Management Framework: The prevalence of these problems underscores the urgent practical necessity for the VM framework. By emphasising "Holistic Value-Based Adjudication" (Pillar 3), the framework aims to counteract the negative consequences of lowest-cost tendering by promoting a comprehensive assessment of project value beyond initial cost. The framework's focus on early-stage alignment and structured decision-making is designed to mitigate issues like poor quality, cost variations, and lack of follow-up, which are symptomatic of a system that prioritises cheapness over true value. The conscious exclusion of this question from the post-test (as discussed in Chapter 5.3) signifies the study's deliberate shift from *identifying* the problems of cost-centricity to *evaluating the solutions* offered by VM, demonstrating the framework's capacity to transform project outcomes and decision-making processes.

Defining Value Management

Findings and Interpretation: Pre-test responses indicated that the concept of Value Management was perceived as a "composite of definitions," reflecting its multifaceted nature. Key elements chosen by respondents included "a methodical approach as a means of achieving value for money through clear pathways" (36.4%), "integration of proven and structured methods" (36.4%), and "a process in which the base needs and objectives of a project are identified and met efficiently" (9.1%). This demonstrates an initial understanding that connects VM to systematic processes, cost-efficiency, and meeting project objectives. Further open-ended responses elaborated on VM as an "analytical approach in planning process aiming for better results," "value for money," and an "extension to the Best Price Quality Ratio". Overall, respondents showed a "solid comprehension of the concept" emphasising balancing cost with quality, structured approaches, leadership, and long-term public benefit.

Relation to Research Objectives and Literature: This foundational understanding, even prior to the intervention, aligns with the research aim to comprehensively understand VM usage and applications in Malta. The emphasis on a "methodical approach" and "structured methods" resonates directly with Value Management's core tenets, which define it as a "systematic, multidisciplinary effort directed toward analysing the functions of projects for the purpose of achieving the best value at the lowest overall life cycle project cost". The notion of balancing cost and quality is central to VM's evolution from Value Analysis, which initially focused on cost reduction but later incorporated broader value considerations. The responses also tie into the "Most Economically Advantageous Tender" (MEAT) criteria in Maltese public procurement, which requires a cost-effectiveness approach like VM. The

conceptualisation of VM as extending the "Best Price Quality Ratio" further highlights its potential relevance in the local regulatory context.

Trends and Implications for the Value Management Framework: The pre-test's initial comprehension of VM, particularly its methodical and value-for-money aspects, provides a strong starting point for the framework's development. The "Implications" suggest that the framework should "prioritise not just cost reduction but also the preservation of quality standards" and emphasise the need for "clear, defined procedures" to achieve uniform outcomes. This reinforces the overall design of the VM framework as a "structured and methodical approach aimed at optimising the value of a project by balancing cost and quality, engaging stakeholders, facilitating informed decision-making, and integrating proven methods and processes". The "Standard Operating Procedure (SOP)" developed as a doctoral output directly formalises these definitions and principles into a practical guide.

Using Value Management in work practices

The respondents tally with the hypothesis stated at the beginning of the study that Value Management is hardly ever used, if used at all locally. 90% of the respondents replied in the negative and have never used Value Management prior to today. This result linked to the result of Question 25 relating to the work experience of the respondents were 80% of the respondents have more than 15 years’ experience, highlights the perception that Value Management is not used in the Local Industry especially within the Public Sector.

Industry wherein Value Management was applied

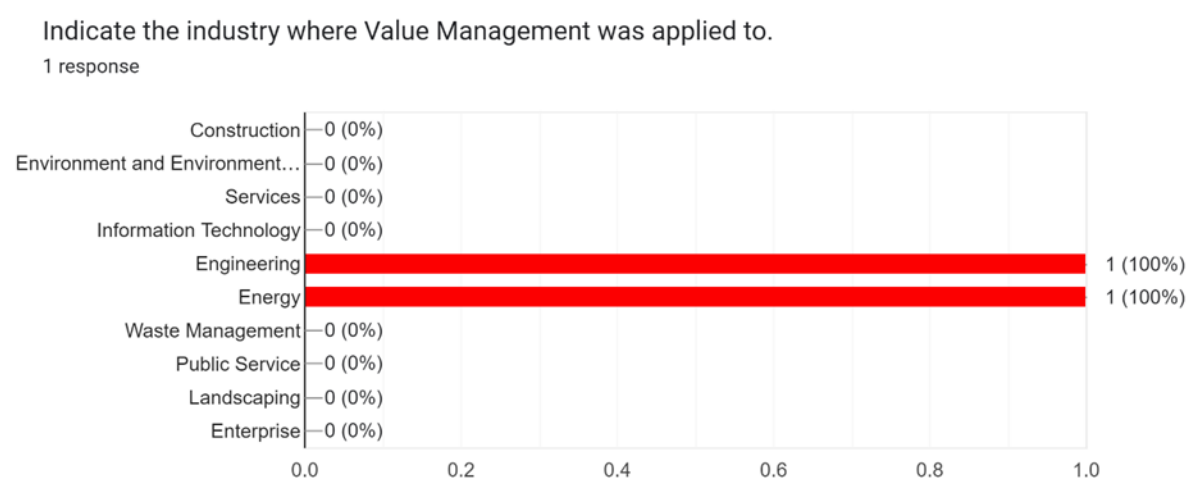


Figure 5.1: Application of VM Industry.

The only respondent who replied positively was then asked to specify the industries in which Value Management strategies were used. The user selected the Energy and Engineering sectors as per figure above (Figure 5.1).

Value Management Tools most effective

The only responder with expertise in Value Management used many beneficial methods, particularly Back to Basics, Life Cycle Costing and SWOT Analysis. It is noteworthy that Function Analysis/FAST, seen as a crucial tool in the Value Management Approach, was not considered very beneficial by the responder.

Stage of the Project Life Cycle at which to implement Value Management

Only one responder with experience in Value Management used it during the Initiation Phase. This phase is regarded as the most effective for maximising the benefits of Value Management.

Value Management Workshops as an integral and useful part of the Value Management Approach

The responder was uncertain about the efficacy of the Value Management Workshop inside the Value Management framework. This casts doubt on the efficacy of the Value Management Approach used by the responder since Value Management Workshops are essential to this methodology and cannot operate effectively in their absence.

A Reflection on the Reasons for a Single Response

The fact that only one respondent indicated familiarity or experience with using Value Management (VM) and the EN12973:2020 standard warrants reflection. There are several possible explanations for this outcome, which provide valuable insights into the broader context of Value Management adoption in Malta.

1. **Limited Use of Value Management in the Local Industry:** The hypothesis from the outset of the study—that VM is rarely, if ever, used in Malta, particularly in the public sector—appears validated by the responses. With 90% of respondents indicating they have never used VM before, this suggests that the local industry has not yet embraced VM principles as part of its project management or procurement processes. This aligns with the broader observation that knowledge and application of VM standards, such as EN12973:2020, are extremely limited in Malta.
2. **Lack of Awareness and Expertise:** The low level of awareness and expertise regarding VM practices, as revealed by the majority of responses, could explain why there was only one respondent with direct experience in using the approach. The absence of VM in education, training and policy frameworks locally could contribute to this limited uptake. The respondents' lack of exposure to VM principles during their careers, despite many having more than 15 years of experience, highlights the need for further capacity-building efforts to introduce VM into the local industry.
3. **Cultural and Organisational Barriers:** Organisational culture and procurement practices in Malta may also play a role in the limited adoption of VM. The focus on awarding contracts based on the lowest cost, as opposed to long-term value, may disincentivise

organisations from adopting VM approaches, which emphasise life-cycle cost analysis and value optimisation. This focus on cost minimisation rather than value creation may discourage the use of more strategic, holistic management tools like VM.

The single response underlines the necessity for a greater push to raise awareness and foster understanding of VM principles within the public and private sectors. To promote the integration of VM and the EN12973:2020 standard into local procurement processes, targeted training, workshops and policy reforms will be essential. This will help bridge the knowledge gap and facilitate the broader adoption of VM in Malta, particularly in sectors where its benefits are yet to be fully realised.

Drivers to use Value Management

What are the drivers to use Value Management?

11 responses

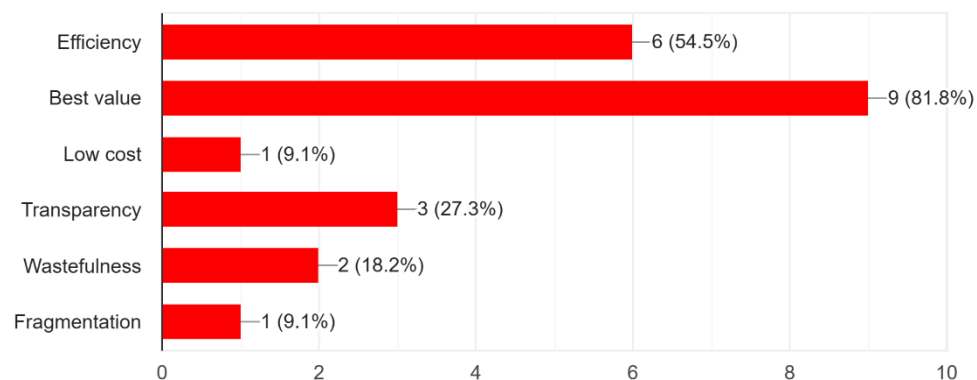


Figure 5.2: Drivers for the Use of Value Management.

The emphasis of the inquiries in Question 18 was directed at all participants of the pre-test questionnaire. Questions 18 to 24 pertain to the Project Drivers for implementing Value Management. The first inquiry pertains to the overarching motivators for using Value Management. The primary determinant was best value, with 81.8% of respondents identifying it as a motivation for using value management.

In setting up the value management framework it is pertinent to note that an Analysis of Statements regarding the following as extracted from the literature was required.

Analysis of Statements regarding the following as extracted from the literature

- Do you agree with the below statements regarding **Efficiency as driver to use Value Management?**
- Do you agree with the below statements regarding **Best Value as driver to use Value Management?**
- Do you agree with the below statements regarding **Lowering Cost as driver to use Value Management?**

- *Do you agree with the below statements regarding Transparency as driver to use Value Management?*
- *Do you agree with the below statements regarding Reducing wastefulness as driver to use Value Management?*
- *Do you agree with the below statements regarding Reducing fragmentation as driver to use Value Management?*

Statement 1: Efficiency as a driver to use Value Management;

This inquiry presents many assertions from the literature that emphasise efficiency as a catalyst for Value Management. The statement with the highest number of "Agreed" responses was "Increased efficiency through team-based activity with a common focus" (Institute of Value Management, 2014).

Statement 2: 'Best Value' as driver to use Value Management

This inquiry solicited input from stakeholders about Best Value as a catalyst for Value Management. The majority of participants agreed with all assertions pertaining to Value Management.

Statement 3: Lowering Cost as driver to use Value Management

This inquiry currently pertains to reducing costs as a catalyst for using Value Management. The statement considered the most pleasing based on the comments collected was "Ensures all aspects of the design are cost-effective for their intended purpose", with 90% of respondents (70% Agree and 20% Fully Agree) endorsing this statement as the most accurate definition of cost reduction as a driver of Value Management.

Statement 4: Transparency as a driver to use Value Management

This inquiry elicited several affirmative replies for all assertions. When paired with the 'strongly agree' answer, the first statement, 'Ensuring that choices are reasonable, clear, and countable,' garnered 80% agreement among respondents, identifying it as the most accurate description of Transparency as a driver for Value Management.

Statement 5: Reducing wastefulness as a driver to use Value Management

The subsequent inquiry, centred on minimising wastefulness, was regarded as a significant driver for the implementation of Value Management in the literature. The assertion that "the practice of awarding contracts to the lowest bidders encourages contract amendments, which subsequently results in cost overruns" (Paquette, 2014) was recognised by the vast majority of respondents as a pivotal statement highlighting the reduction of wastefulness as a fundamental motivator for adopting a Value Management approach.

Statement 6: Reducing fragmentation as a driver to use Value Management

Although only one respondent views fragmentation as a beneficial driver for Value Management, it is noteworthy that respondents concurred that aligning members with the goals, critical success factors and improving communication could be deemed advantageous in mitigating fragmentation as a driver for employing Value Management.

Demographics (Question 25) as an impact on the Value Management Framework setup

Work Experience: From the demographic in question, it was noted that the majority of the participants taking part in the study had vast experience, with all participants eclipsing the 10 years' experience and 54.5% of them having 20 years plus work experience. This gives further validity to the study as it increases the perception of knowledge amongst the participants. A multiple Linear Regression using this demographic was carried out.

Size of Project in euro (Estimate of Project size usually carried out): This question related to the approximate project size in terms of value the participants have mostly encountered during their work experience. This is important in order to understand better whether the application of Value Management would have provided considerable gain had it been implemented. From the data gathered the majority of the participants dealt with projects ranging between 1-500,000 euro and 1-5million euro projects.

Project Ownership: This question was posed to the participants to ascertain if their job experience mostly included publicly sponsored projects, privately funded initiatives, or a combination of both. The majority of participants have experience in publicly sponsored initiatives. This was anticipated given that some stakeholders involved in the research are employees of government entities. The inquiry sought to determine whether participants' employment experiences were mostly in government financed projects, privately funded initiatives, or a combination of both. The main conclusions derived from the study were that the majority of participants reported experience with publicly funded projects. This aligns with the fact that many of the stakeholders involved in this study are employed by government entities. Some participants have experience in both public and private funded projects, indicating a diverse background and versatility in handling different funding sources. Few participants reported working exclusively on privately funded projects, which may suggest that the sample group is more inclined or currently positioned in roles related to public sector projects.

Implications for setting up the Value Management Framework:

Government Entity Influence: The strong representation of public project experience underscores the influence of government entities among the study participants. This could impact their perspectives and insights on Value Management practices, especially in the context of public procurement and regulatory compliance.

Opportunity for Cross-Sector Learning: Those with experience in both public and private projects provided valuable insights into how Value Management practices may differ or translate between sectors, potentially offering best practices and lessons learned.

5.2 Intervention

5.2.1 Analysis of Information Session

Results and discussion from Information Session (Lecturing Session)

The significance of research refers to its impact. It pertains to the contributions and influence of the study on a research domain. The importance indicates the beneficiaries of the study results and the manner of their benefit. In this section, data is analysed, and the results provide significant insights for guidance and information. The Information Session was a pivotal step in the research process, successfully laying the groundwork for stakeholder engagement and participation in Value Management initiatives. The following is general feedback obtained from transcribed observations during the workshop:

Observation 1: Level of Stakeholder Engagement and Response

The stakeholders' reactions were notably positive. Their interest in Value Management was shown by their active engagement and the nature of their questions, which focused on the practical implementation and potential application of Value Management in real-world projects. This response suggested that the stakeholders not only understood the concepts but also recognised the practical value and potential benefits of integrating Value Management into their work processes.

Observation 2: Educational Strategy

Given the stakeholders' initial unfamiliarity with Value Management, it was decided to start from the basic foundations. This approach ensured that all participants, regardless of their prior knowledge, could grasp the fundamental principles and appreciate the methodology's significance. By explaining the common tools used in Value Management Workshops and detailing the Value Management Study process, the session prepared the stakeholders for the upcoming workshops, setting the stage for effective participation.

Observation 3: Inclusion of Practical Examples and Exercises

To further enhance understanding, practical examples from work carried out within the same environmental department were provided during the session. These examples helped illustrate the application of Value Management in real-world scenarios, making the concepts more relatable and tangible. Additionally, simple exercises were included to allow stakeholders to engage actively with the material and apply what they had learned in a hands-on manner. These exercises facilitated a deeper comprehension of Value Management principles and tools, ensuring that stakeholders were well-prepared for the workshops.

Observation 4: Overall Impact of information session

The Information Session achieved its primary goals of educating the stakeholders about Value Management and generating interest in its application. The stakeholders' willingness to engage with the concept and their questions about its real-world application indicated a successful transfer of knowledge and a readiness to adopt the methodology. This positive outcome was crucial for the subsequent phases of the study, as it ensured that the stakeholders were informed, motivated and prepared to participate effectively in the Value Management Workshops.

5.2.2 Analysis of the Case-Study Workshops.

5.2.2.1 Case Study 1 – L-Għadira s-Safra

The Case Study in question relates to the construction of a Bird Observatory including the formation of brackish water ponds for wader species. Hereunder is an analysis from the results shown in Chapter 4.

The case study, hence, examined the construction of a Bird Observatory and the formation of brackish water ponds within the protected area of L-Għadira s-Safra. Stakeholder engagement commenced during the Orientation Phase, involving key officials, engineers, and project stakeholders, facilitating informed decision-making and emphasising a collaborative approach, in line with the study's methodology.

Structured value management study phases, including Orientation, Value Management Workshop and Implementation were executed, reflecting methodological rigour. The integration of value management and value engineering mirrored the holistic problem-solving approach advocated in the research. The workshop agenda prioritised issue examination, understanding project functions and solution identification, fostering stakeholder collaboration and consensus-building, essential aspects of effective project management. The prioritisation of critical needs, such as safeguarding the protected area and promoting conservation, underscored the project's alignment with broader environmental objectives. Systematic evaluation of potential solutions, considering feasibility and cost-effectiveness, reflected the analytical framework advocated in this study.

The case study demonstrated how value management principles optimise project outcomes, mitigate risks and avoid costly rework, highlighting practical relevance. Revision of initial solutions based on expert consultation exemplified an adaptive, evidence-based approach, consistent with the study's recommendations.

Insights gleaned underscored the importance of early intervention, stakeholder collaboration and adaptive decision-making in complex project environments. Recommendations included broader adoption of value management practices and proactive stakeholder engagement, aligning with the study's emphasis on knowledge dissemination and best practices.

Overall, the case study served as a compelling illustration of how Value Management, as discussed in this study, can be applied in real-world contexts to achieve sustainable and impactful project outcomes.

5.2.2.2 Case Study 2 - Radar Station, Marfa

Analysis

The project aimed to restore and conserve the historic radar station at Marfa, Mellieħa. The neglected site's restoration presented challenges due to its historical significance and proximity to the Natura 2000 site, necessitating careful planning and stakeholder consultation.

A SWOT analysis highlighted the project's strengths, weaknesses, opportunities and threats, providing valuable insights for project planning and risk management within the context of Value Management principles. Stakeholder engagement through a Charette-style workshop facilitated collaborative decision-making and validation of project objectives, consistent with the study's emphasis on stakeholder involvement and Value Management practices.

The workshop agenda, structured to address key issues and analyse project functions, fostered a systematic approach to problem-solving and solution identification, reflecting the application of Value Management techniques advocated in the doctoral research. The Issues Analysis exercise identified critical concerns, including protecting the natural habitat and creating visitor amenities, reflecting the project's dual objectives of conservation and public engagement.

Function Analysis and FAST Diagrams provided a structured framework for evaluating needs and generating potential solutions, aligning with the analytical methodologies advocated in the research on Value Management. Stakeholder consensus on prioritising the safeguarding of the protected area underscored the project's commitment to environmental stewardship and cost-effectiveness.

The identification of feasible solutions, such as creating natural boundaries to minimise habitat disturbance and providing designated parking areas, exemplified the integration of conservation goals with Value Management principles, emphasising efficiency and optimisation of project resources.

The proposed way forward, involving further design refinement and consultation with heritage authorities, demonstrated a proactive approach to addressing project complexities and ensuring alignment with regulatory requirements, consistent with the Value Management approach advocated in the study. Recommendations for continued stakeholder engagement and adaptive management strategies resonated with the study's focus on iterative decision-making and continuous improvement within a Value Management framework.

Overall, the second case study exemplified how theoretical Value Management principles can be applied in real-world projects to achieve sustainable outcomes while preserving cultural heritage and natural ecosystems.

5.2.2.3 Case Study 3 – Buskett Public Convenience

Analysis

The Value Engineering Workshop for the Buskett Public Convenience project adhered to a meticulously structured agenda, crucial for maintaining focus and achieving the set objectives within a constrained timeframe. The agenda encompassed an introduction to the project and value management principles, an examination of key issues impacting the project, a functional analysis of the project's needs, a review of technical and detailed proposals to identify value mismatches, and a discussion on the way forward.

During the workshop, critical issues were identified, including the analysis of foundation material strength and bearing capacity for structural design, and the planning for the long-term operation and maintenance of the new facility. The issues analysis exercise underscored the importance of these factors in ensuring the project's success and sustainability.

The function analysis exercise highlighted the primary need to enhance the visitor experience by providing an accessible public convenience. Other critical needs included ensuring visual appeal and maintaining environmental sensitivity due to the site's Natura 2000 designation. This analysis was instrumental in aligning the project's objectives with the broader goals of environmental stewardship and public engagement.

Technical aspects such as substructure, mechanical and electrical systems, apertures, finishes, and sanitary ware were rigorously evaluated to ensure they met the identified functions and provided value for money. Each aspect was scrutinised to balance performance, cost, and sustainability. For instance, the substructure required a core drilling study to ensure foundation stability, which, although costly and time-consuming, was deemed essential for structural integrity. Mechanical and electrical systems were designed to enhance efficiency, despite increasing design complexity. Apertures were planned to improve accessibility and ventilation, balancing usability with potential cost impacts. Finishes were chosen for their durability and aesthetic appeal, offering long-term cost savings despite higher initial investments. Sanitary ware was selected for accessibility and hygiene, enhancing user experience while incurring higher installation costs.

The potential solutions were evaluated comprehensively, with their pros and cons discussed in detail. The most significant recommendation was to conduct a core drilling study to understand the foundations before finalising the structural design, thereby reducing building movement and ensuring long-term stability. Incorporating agreed mechanical and electrical systems was recommended to enhance system efficiency, despite the increased complexity. Designing accessible entry points was suggested to improve user

accessibility, although it might require additional resources. Using durable finishes was advised for long-term cost savings, despite higher initial investments. Installing hygienic fixtures was recommended to improve public health standards, despite higher installation costs.

The workshop's systematic approach ensured that the most appropriate and cost-effective solutions were selected, aligning with the project's emphasis on value management to achieve sustainable and efficient outcomes. This approach not only addressed the immediate technical and functional needs but also ensured long-term viability and stakeholder satisfaction.

Overall, the Value Engineering Workshop for the Buskett Public Convenience project exemplified the application of value management principles in a real-world context. By systematically identifying and addressing critical issues, optimising technical solutions, and ensuring stakeholder consensus, the project demonstrated how theoretical principles could be effectively translated into practical outcomes. The recommendations, including conducting foundational studies and integrating stakeholder-agreed technical systems, underscored the project's commitment to achieving sustainable and efficient results while enhancing user satisfaction.

5.3 Analysis of results pertaining the Post-Test Study

5.3.1: Foundational Pillars of the Framework

This section delves into the findings derived from the post-test questionnaire administered to the same cohort of 11 participants, providing crucial insights into their perceptions and experiences after engaging with the Value Management (VM) intervention. The analysis is structured around the five foundational pillars, as shown in figure 5.3 below, supporting the development of the Value Management framework, highlighting the impact of the intervention on various facets of project management.

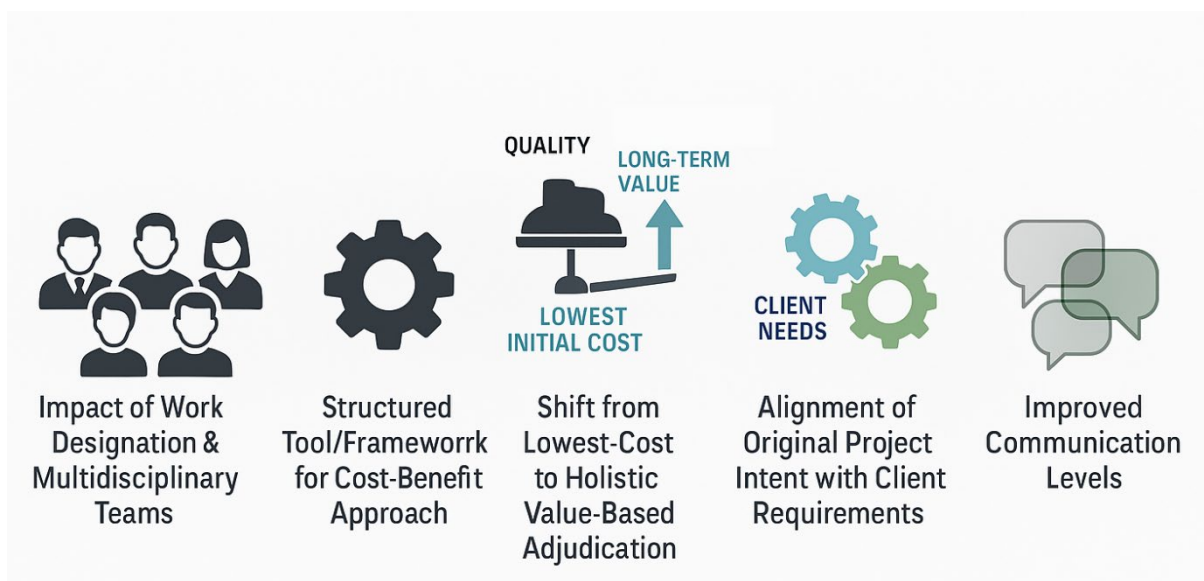


Figure 5.3: Foundational Pillars of Framework.

Pillar 1: The Impact of Work Designation

The work designation of the participants remained consistent with the pre-test phase, with **60% of respondents holding Project Management executive roles**. This robust representation of project management expertise signified a strong foundation for the effective implementation of Value Management, as these individuals possessed direct experience in project execution and oversight.

Key Insights:

- **Predominance of Project Management:** Most participants from project management backgrounds provided a strong operational perspective, crucial for understanding and applying VM principles.
- **Multidisciplinary Cooperation:** The inclusion of diverse roles—such as Client Architect (9.1%), Stakeholder (9.1%), Public Administration Headship (9.1%), and Design Office (9.1%)—ensured a **comprehensive understanding of project needs and constraints**. This diversity fostered an environment conducive to multidisciplinary cooperation, enriching discussions and decision-making by integrating technical, administrative, and user-focused concerns into the VM process.

Implications for the Value Management Framework:

- **Comprehensive Understanding:** The varied professional backgrounds of the cohort contribute to a holistic appreciation of VM's applicability across different project implementation stages.
- **Effective Communication:** The necessity for clear communication and knowledge sharing among diverse roles within the workshops supports the development of more cohesive and inclusive project planning and execution.
- **Real-World Relevance:** The representation from various sectors ensures that VM discussions and outcomes are practical and applicable to real-world scenarios, thereby enhancing the intervention's tangible impact.
- The composition of a varied and seasoned cohort is thus pivotal for the successful execution and sustainability of Value Management initiatives.

Pillar 2: The Use of a Structured Tool/Framework to Ensure a Cost-Benefit Approach When Awarding Public Contracts

Following the VM intervention, **all participants (100%) expressed a belief that a structured tool or framework would be at least useful** for ensuring a cost-benefit approach when awarding public contracts, with some specifically rating it as "very useful".

Key Insights:

- **Increased Recognition of VM Tools:** The post-test results indicated a **positive shift in perception regarding the usefulness of structured tools/frameworks**. This change

suggests that the intervention effectively demonstrated the practical benefits and applicability of VM tools in project management.

- **Enhanced Understanding:** Practical exposure and hands-on experience during the VM workshops likely contributed to participants' heightened appreciation for structured methodologies in achieving cost-effective project outcomes. The intervention reinforced theoretical knowledge with practical examples, making the advantages of a structured framework more evident. This aligns with the "ppt" which highlighted "Unanimous Agreement" on the utility of such tools.
- **Foundation for Adoption:** The consistent belief in the utility of a structured tool/framework, observed in both pre-test and post-test phases, underscores a fundamental understanding among participants that structured approaches are beneficial, and the intervention reinforced this conviction.

This positive response suggests a strong readiness among stakeholders to adopt structured VM tools and frameworks in future projects, indicating a promising future for enhancing project efficiency and effectiveness through VM.

Pillar 3: Adjudication - Awarding Tenders by Lowest Cost Criteria as a Measure of Good Quality

The question concerning "awarding tenders based on the lowest cost criteria as a measure of good quality" was **intentionally omitted from the post-test questionnaire**. This strategic decision reflected a deliberate shift in the study's focus, moving beyond traditional cost-centric evaluation methods towards a more holistic understanding of value.

Rationale for Omission:

- **Shift to Holistic Value:** The VM framework, as applied during the case studies, emphasised prioritising factors such as **stakeholder communication, project scope alignment, and life-cycle cost efficiency** over narrow short-term financial savings.
- **Focus on VM Outcomes:** The post-test aimed to evaluate the practical impact of VM on enhanced decision-making and overall project quality. By omitting the lowest-cost tendering question, the analysis could concentrate on the broader benefits of VM, such as improved communication, increased stakeholder engagement, and better alignment with project goals. The "ppt" noted that pre-test results highlighted concerns about lowest-cost tendering compromising quality, and post-test insights emphasised cost-effectiveness for purpose, aligning with VM's core principles.

This omission allowed for a more focused assessment of how VM principles can transform project outcomes and decision-making processes by emphasising value-based criteria.

Pillar 4: The Need for Original Intent (or need) of Project Aligned to Client Requests

Following the intervention, participants' perceptions regarding the alignment of the project's original intent with client requirements showed promising results. **54.5% of**

respondents believed that the VM framework successfully ensured this alignment, while 45.5% felt it was only partially tested.

Key Insights into Effectiveness:

- **Majority Agreement:** The slight majority indicated that the VM workshops effectively facilitated a thorough examination and validation process for aligning project intent with client needs. This finding is supported by the "ppt" which indicated that **81.8% of stakeholders agreed or strongly agreed that project objectives were achieved** after the VM intervention.
- **Client-Centric Approach:** This feedback underscores the VM framework's utility in refining and validating project objectives, thereby enhancing project relevance and ensuring client satisfaction.

Areas for Improvement:

- **Enhanced Testing Mechanisms:** The partial validation noted by some participants suggests a need for more comprehensive or detailed testing methods within the VM framework, potentially involving iterative feedback loops or additional validation sessions.
- **Increased Stakeholder Involvement:** More active engagement of stakeholders to fully integrate their concerns and insights into the testing process could further improve the perceived thoroughness of intent validation.

In summary, the VM workshops were largely effective in aligning project intent with client requirements, but there remains an opportunity to enhance the comprehensiveness of the testing process and deepen stakeholder involvement to meet client needs more robustly.

Pillar 4 (Continued): Project Need Tested by Using a Tool or Technique Prior to a Tender Being Issued

A strong consensus emerged in the post-test regarding the effectiveness of the Value Management framework in testing technical solutions. **81.8% of participants agreed that the technical solution to the project need was effectively tested using the VM framework.**

Key Insights into Effectiveness:

- **Strong Endorsement:** This high level of agreement indicates robust confidence in the utility and reliability of the tools and techniques employed within the VM framework for technical validation. This is a particularly strong finding, as paired t-test analysis revealed a **statistically significant difference (p-value 0.046)** between pre-test and post-test means, demonstrating the substantial impact of the intervention in enhancing technical solution testing. The "ppt" highlights this as a key finding.

Areas for Improvement:

- **Minority Disagreement:** The 18.2% of participants who disagreed suggest potential gaps in implementation or perception that could be addressed by enhancing transparency and clarity in documenting the testing process.
- **Additional Training:** Offering further training and support on VM tools and techniques could bolster participants' confidence in the framework's efficacy for technical solutions.
- Future VM workshops should prioritise demonstrating the effectiveness of these tools through successful case studies and engaging participants in hands-on exercises to solidify their understanding and acceptance.

Pillar 4 (Continued): Project's Objectives Relating to Project Need (Scope) Achieved

Regarding the achievement of project objectives in relation to project scope, **72.7% of respondents agreed, and 9.1% strongly agreed, that the VM framework helped achieve these objectives** (a combined total of 81.8% positive response). This signifies a broad consensus on VM's effectiveness in aligning project outcomes with predefined objectives.

Key Insights:

- **Strong Endorsement:** The high percentage of agreement indicates strong support for the VM framework as an effective tool for meeting project objectives within the defined scope.
- **Neutral Responses:** The 18.2% of neutral responses suggest a need for further clarification and communication regarding how the VM framework specifically contributes to achieving project objectives. This neutrality may stem from limited experience with the framework or varying project complexities.

Areas for Improvement:

- **Increased Engagement & Evidence:** Deeper stakeholder engagement in the VM process and the provision of clear evidence of success (e.g., case studies, quantitative data) can help shift neutral responses towards agreement.
- **Outcome-Based Focus:** Future workshops should emphasise the direct impact of VM activities on achieving specific project goals through interactive sessions.
- While the paired t-test for this area did not show a statistically significant difference, a **positive trend towards better achievement of project objectives** was observed, with a moderate effect size, highlighting VM's potential for improvement in this domain.

Pillar 5: Communication Levels Within Project Team and Stakeholders

The post-test results indicated a universal perception of improvement in communication levels within project teams and among stakeholders following the VM intervention, with **no respondents indicating "no improvement". The majority of participants (36.4%) reported a considerable improvement** in communication.

Key Insights:

- **Unanimous Positive Impact:** All participants acknowledged some positive impact of the VM framework on communication, ranging from slight to great improvement.
- **Addressing Pre-Test Concerns:** This positive shift is particularly noteworthy given that 30% of participants had rated communication as "poor" in the pre-test. The VM intervention effectively addressed these previously identified communication gaps. The "ppt" also highlighted "Enhanced stakeholder communication & collaboration" as a key post-test theme.
- **Core Benefit:** Improved communication should be highlighted as a core benefit of adopting VM in project management, supported by success stories and examples.

Although the paired t-test did not show a statistically significant difference in communication improvement, the slight decrease in the mean score could imply that participants became more critical in their assessment post-intervention. This heightened critical awareness is a valuable outcome, setting the stage for targeted efforts to further enhance communication within project teams.

Problems as a Result of Awarding Projects on the Basis of the Lowest Cost Criteria (Post-Test Exclusion)

The question regarding "problems arising from awarding projects on the basis of the lowest cost criteria" was deliberately excluded from the post-test. This decision was made to **align the post-test more closely with the strategic objectives of the Value Management framework**, which emphasises achieving long-term value and optimising project outcomes, rather than revisiting issues rooted in cost-centric procurement methods.

The pre-test had served to capture initial stakeholder concerns about the negative consequences of lowest-cost tendering, such as scope creep, budget overruns, and reduced project quality. However, the study's progression shifted its focus to the broader benefits of VM, including its ability to foster a more strategic, value-driven approach. By omitting this question, the post-test successfully concentrated on the positive outcomes of applying VM principles, such as **improved communication, enhanced stakeholder engagement, and better alignment with project goals**. This allowed for a more comprehensive assessment of how VM transforms project outcomes and decision-making processes by focusing on value-based criteria.

5.3.2 Section 2: Definition of Value Management

A notable shift in participants' understanding of Value Management was observed in the post-test. The preferred definition became: **"A methodical approach as a means of achieving value for money through clearly defining the objectives and establishing a technical consensus as to how to meet these objectives,"** chosen by **54.5% of participants**, a significant increase from 30% in the pre-test. This highlights a clearer understanding of the goal of using a VM framework in public projects.

The post-intervention qualitative analysis of the open-ended question "What do you understand by Value Management?" revealed that the information session was largely successful, providing participants with a clearer and more comprehensive understanding of VM.

Average Scores for Understanding VM (out of 5):

- **Definition Clarity: 4.2**
- **Understanding of Key Principles: 4.0**
- **Recognition of Benefits: 3.8**
- **Application in Projects: 3.5**

These scores indicate that while the foundational aspects of VM were well-communicated, there is still room for improvement in conveying VM's benefits more explicitly and illustrating its application in real-world projects through more practical examples and case studies. The "ppt" thematic analysis showed a **significant shift from focusing on specific problems (pre-test) to embracing core VM principles** like maximising value and efficiency and adopting a comprehensive approach to project management (post-test).

5.3.3 Knowledge or Experience of Value Management

Post-intervention, participants' knowledge and experience of Value Management, while still relatively limited, showed a **mild positive shift**. The percentage of respondents with "very poor" or "poor" knowledge decreased from 70% in the pre-test to 45.5% in the post-test. This reinforces the initial hypothesis that VM is not widely recognised or used in Malta, underscoring the ongoing need for increased VM knowledge for successful implementation. The paired t-test for knowledge of VM, though not statistically significant, did show a positive trend in participants' understanding.

Similarly, knowledge and experience of using the **Value Management Standard EN12973:2020 remained very limited**, with 63.6% reporting "very poor" knowledge. The "ppt" indicated that 90% of respondents had limited knowledge or experience of this standard. This highlights the need for integrating this standard into procurement practices to achieve higher quality and cost-effective outcomes.

Furthermore, the study confirmed the initial hypothesis that **VM is rarely, if ever, used in Malta, particularly in the public sector, with 90% of respondents indicating they had never used VM prior to the intervention**. This limited adoption is attributed to a lack of awareness, expertise, and a prevailing focus on awarding contracts based on the lowest cost rather than long-term value optimisation. This underscores the necessity for targeted training, workshops, and policy reforms to bridge the knowledge gap and promote VM integration into local procurement processes.

5.3.4 Tools Found Useful and Effective

Participants identified **Function Analysis, Issues Analysis, and FAST Diagrams** as the most useful and effective tools within the VM framework.

Utility of Key Tools:

- **Function Analysis:** This tool was crucial for identifying and prioritising project functions, leading to a clearer understanding of project objectives and requirements.
- **Issues Analysis:** Its effectiveness suggests that participants valued the structured approach to identifying and addressing project challenges and constraints.
- **FAST Diagrams:** The positive feedback on FAST Diagrams indicates that participants found visual representation helpful in analysing functions and identifying areas for improvement.

These tools align with practical project management needs, contributing significantly to clarifying objectives, identifying challenges, and facilitating decision-making processes. The "ppt" explicitly lists these tools as those used to "get the best out the project," "tackle the Issues," and "Understand the Critical Functions and their solutions".

5.3.5 Stage of the Project Life Cycle at Which to Implement Value Management

The post-test confirmed that Value Management workshops were strategically conducted during the **initiation and pre-planning/planning phases** for all three case studies.

Benefits of Early Implementation:

- **Shared Understanding and Collaboration:** Engaging stakeholders early contributed to a shared understanding of project goals and priorities, fostering collaboration and consensus-building.
- **Optimising Value:** Initiating VM during the planning phase allowed project teams to explore alternative solutions, optimise resource allocation, and identify opportunities for value enhancement.
- **Continuous Improvement:** Early VM integration sets the foundation for continuous improvement throughout the project life cycle, enabling refinement of plans, risk mitigation, and adaptation to changing circumstances.

This proactive approach to project management, focusing on value optimisation from the outset, lays a strong foundation for successful project delivery and continuous improvement. This approach is intrinsically considered a fundamental step within the design of the Standard Operating Procedure (SOP).

5.3.6 Value Management Workshops as an Integral and Useful Part of the Value Management Approach

The post-test results strongly supported the integral role of Value Management Workshops within the VM approach. **A significant majority (54.6%) considered them an integral and**

very useful part of VM, with a combined total of 79.6% expressing positive agreement. Only one respondent expressed disagreement.

Key Insights:

- **Strong Support:** This high percentage validates the workshops' effectiveness in enhancing participants' understanding and application of VM principles. The "ppt" also highlights that 79.6% of participants found these workshops integral to improving project communication and decision-making.
- **Areas for Refinement:** While overwhelmingly positive, the presence of neutral (12.5%) and negative (7.9%) responses suggests opportunities to further improve workshop stakeholder involvement, potentially through enhanced engagement strategies and tailored content to meet diverse needs.

The findings unequivocally support the inclusion of VM workshops as a key element of the Value Management process in this study, aligning with the study's commitment to continuous improvement and practical application of VM principles.

Strengths, Opportunities, and Problems Encountered During the Application of the Value Management Approach

This open-ended question was specifically included in the post-test to capture participants' reflections and insights after experiencing the VM framework in practice. It allowed for a nuanced understanding of how VM improved decision-making, stakeholder communication, and project outcomes compared to traditional cost-centric approaches.

The thematic analysis of responses revealed several key themes, encompassing both positive and challenging aspects of VM implementation:

Identified Strengths and Opportunities:

- **Collaboration and Effective Decision-Making:** VM strongly encouraged collaboration among stakeholders, leading to more effective decision-making.
- **Communication Improvement:** Participants noted that VM provided clear pathways and facilitated better project handling through enhanced communication.
- **Efficiency and Problem-Solving:** VM was perceived as a useful tool for quickly addressing problems and finding optimal solutions through collaborative sessions.
- **Challenges Anticipation:** VM's proactive nature in identifying and addressing potential hurdles during planning and execution was highlighted.
- **Detailed Discussion and Planning:** The thorough planning and idea sharing integral to VM processes were seen as beneficial for effective project execution.

Identified Problems and Challenges:

- **Conflict Resolution:** Diverse opinions among stakeholders sometimes led to difficulties in achieving consensus and resolving disputes during VM application.

- **Regulatory Compliance:** Public service procurement and financial regulations were identified as factors affecting VM application, emphasising the importance of compliance.
- **Lack of Follow-Up:** Instances where issues were not effectively followed up indicated a need for continuous monitoring throughout the project lifecycle.

These findings underscore VM's collaborative and problem-solving strengths, while also highlighting areas for continuous improvement to enhance project outcomes and achieve sustainable value.

Value Management Workshops' Impact on the Value Management Approach

Table 5.1: Value Management Workshops as an Integral and Useful Part of the Value Management Approach.

Response Category	Percentage of Respondents
Strongly Agree	54.6%
Agree	25%
Neutral	12.5%
Disagree	7.9%
Strongly Disagree	0%

Interpretation of Results (as per above Table):

- **Positive Responses (Strongly Agree and Agree):** A significant majority (79.6%) of the participants found the Value Management Workshop to be an integral and useful part of the Value Management approach. This high percentage indicates strong support and validation for the workshop's effectiveness in enhancing participants' understanding and application of Value Management principles.
- **Neutral Responses:** 12.5% of respondents were neutral, indicating that while they did not find the workshop particularly integral or useful, they also did not find it lacking. This suggests that there may be opportunities to further improve workshop stakeholder involvement.
- **Negative Responses (Disagree and Strongly Disagree):** A small minority (7.9%) disagreed with the statement, indicating that they did not find the workshop integral or useful. The absence of "Strongly Disagree" responses is positive, but the presence of any negative feedback suggests areas where the workshop could be improved or better tailored to meet all participants' needs.

Implications for the Study

The results indicate a generally positive reception of the Value Management Workshop, highlighting its role as a critical component of the Value Management process. However, the feedback also points to areas for improvement:

1. **Enhanced Engagement Strategies:** For the 12.5% who were neutral, additional engagement strategies such as interactive elements or hands-on activities could help in making the workshop more relevant and impactful.
2. **Addressing Negative Feedback:** Understanding the reasons behind the 7.9% negative responses could provide insights into specific aspects of the workshop that may need refinement.

The analysis of the responses indicates that the Value Management Workshop is largely seen as an integral and useful component of the Value Management approach, with most participants expressing strong agreement. The findings support the inclusion of the workshop as a key element of the Value Management process in the study.

However, to maximise the workshop's effectiveness and address the needs of all participants, it is important to consider strategies for enhancing engagement, addressing negative feedback and tailoring content to better meet diverse needs. This approach aligns with the study's commitment to continuous improvement and practical application of Value Management principles.

5.3.7 Strengths, Opportunities, and Problems Encountered During the Application of the Value Management Approach

This open-ended question was specifically included in the post-test to capture participants' reflections and insights after experiencing the VM framework in practice. It allowed for a nuanced understanding of how VM improved decision-making, stakeholder communication, and project outcomes compared to traditional cost-centric approaches.

The thematic analysis of responses revealed several key themes, encompassing both positive and challenging aspects of VM implementation:

Identified Strengths and Opportunities:

- **Collaboration and Effective Decision-Making:** VM strongly encouraged collaboration among stakeholders, leading to more effective decision-making.
- **Communication Improvement:** Participants noted that VM provided clear pathways and facilitated better project handling through enhanced communication.
- **Efficiency and Problem-Solving:** VM was perceived as a useful tool for quickly addressing problems and finding optimal solutions through collaborative sessions.
- **Challenges Anticipation:** VM's proactive nature in identifying and addressing potential hurdles during planning and execution was highlighted.
- **Detailed Discussion and Planning:** The thorough planning and idea sharing integral to VM processes were seen as beneficial for effective project execution.

Identified Problems and Challenges:

- **Conflict Resolution:** Diverse opinions among stakeholders sometimes led to difficulties in achieving consensus and resolving disputes during VM application.

- **Regulatory Compliance:** Public service procurement and financial regulations were identified as factors affecting VM application, emphasising the importance of compliance.
- **Lack of Follow-Up:** Instances where issues were not effectively followed up indicated a need for continuous monitoring throughout the project lifecycle.

These findings underscore VM's collaborative and problem-solving strengths, while also highlighting areas for continuous improvement to enhance project outcomes and achieve sustainable value.

5.3.8 Drivers for Value Management Q15:

What are the drivers to use Value Management?

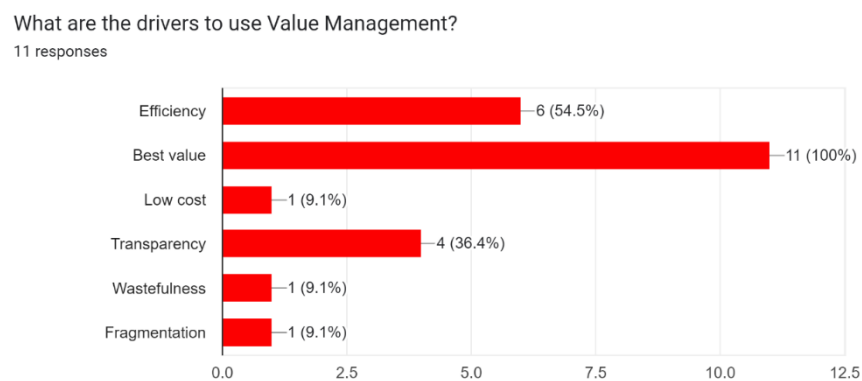


Figure 5.4: Drivers for the Use of the Value Management Approach.

Questions 15 to 21 dealt with the Project Drivers to use Value Management. The first question deals with the general drivers to use Value Management. The main predominant driver was Best Value with 100% of respondents marking this as a driver to use Value Management. This is similar to the pre-test when Best Value was earmarked as the predominant driver to use Value Management with 90% of respondents marking it as such. Another two important drivers, which were marked as critical drivers to use Value Management, were efficiency and transparency that scored 54.5% and 36.4%, respectively. The shift towards transparency as a driver for value management after the intervention once more highlights the soft benefits that can be generated by Value Management when implemented in projects. Transparency is of special importance especially when dealing with government/public funded projects as was the case for the three projects tested in the case studies. Another important point was that Low Cost was only considered as a driver to use Value Management by one participant.

Analysis of Statements Regarding the Following as Extracted from the Literature

- Do you agree with the below statements regarding Efficiency as driver to use Value Management?
- Do you agree with the below statements regarding Best Value as driver to use Value Management?
- Do you agree with the below statements regarding Lowering Cost as driver to use Value Management?
- Do you agree with the below statements regarding Transparency as driver to use Value Management?
- Do you agree with the below statements regarding Reducing wastefulness as driver to use Value Management?
- Do you agree with the below statements regarding Reducing fragmentation as driver to use Value Management?

Do you agree with the below statements regarding Efficiency as driver to use Value Management?

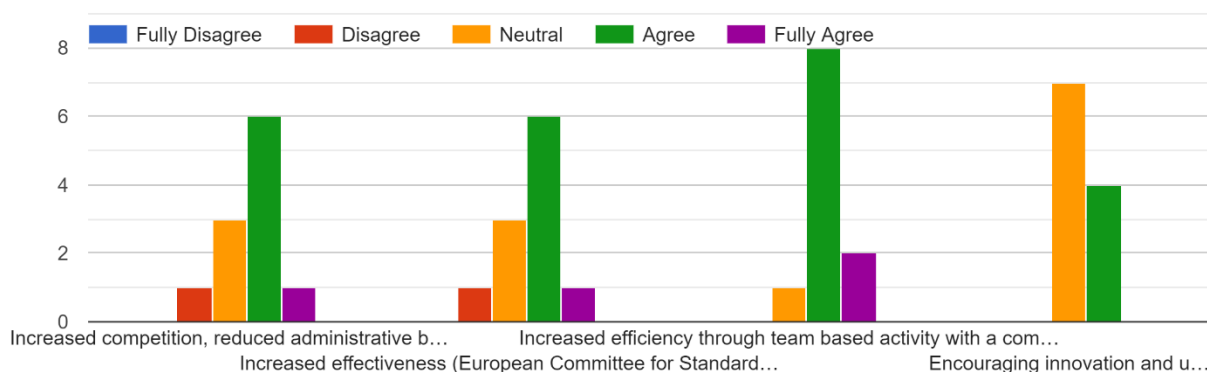


Figure 5.5: Efficiency as Driver to Use Value Management.

From the responses above one can analyse that whilst there is agreement with most of the statements, the most popular agreement was for the following statement:

“Increased efficiency through team-based activity with a common focus (Institute of Value Management, 2014).”

This is an interesting statement, as, once more, the respondents have shown importance to having better teamwork and that this, in turn, provides better efficiency which was one of the most important drivers for the use of Value Management.

When it comes to Best Value as a driver for Value Management, this was deemed as the most critical driver for the use of Value Management by all respondents. It was also evident, from the responses above, that the two statements that the respondents agree with most with regards to Best Value were the following:

“Prioritising and satisfying the customers/users real needs; (European Committee for Standardisation (CEN), 2020)”

and

“Ensures all aspects of the design are cost effective for their required purpose. (Smith, 2007)”

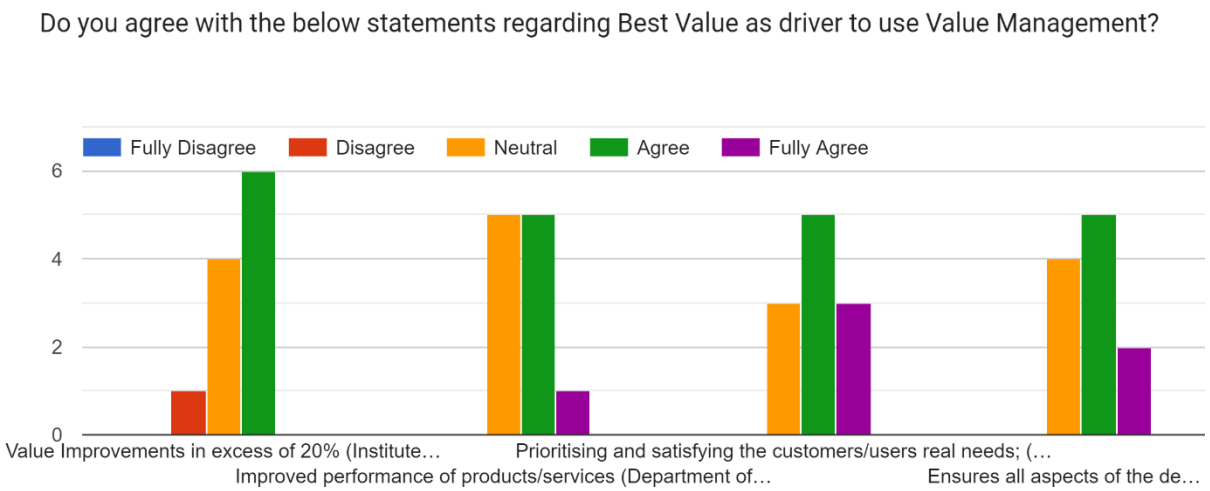


Figure 5.6: Best Value as a Driver for Value Management.

The first statement had five respondents in agreement and three fully agreeing that Best Value as a driver for Value Management prioritises and satisfies the customers/users real needs. The second statement focuses on Value Management acting in order to ensure that all aspects of the design are cost effective for their required purpose and, hence, delivering best value.

The statement best defining Lowering Cost as a driver for Value Management as per the participants responses in the post-test study was once more: *“Ensures all aspects of the design are cost effective for their required purpose (Smith, 2007).”*

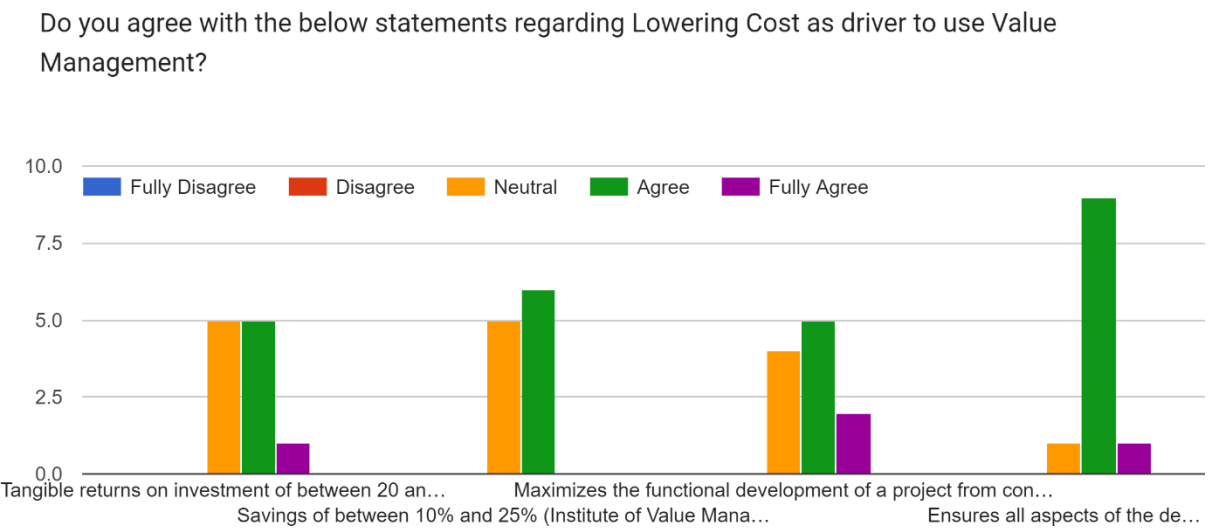


Figure 5.7: Lowering Cost as a Driver for Value Management.

This statement elevates Lowering Cost to include being effective for their required purpose, thereby ensuring best value in the process. Hence, agreement with such a statement can be said to imply that the participants do not consider lowering cost as the objective and prime target that one should consider as a driver but the cost effectiveness in meeting the purpose and, hence, Lowering Cost would be a driver for Value Management.

Transparency was considered by the respondents as a considerable driver for Value Management with 36.4% of respondents marking it as such.

Do you agree with the below statements regarding Transparency as driver to use Value Management?

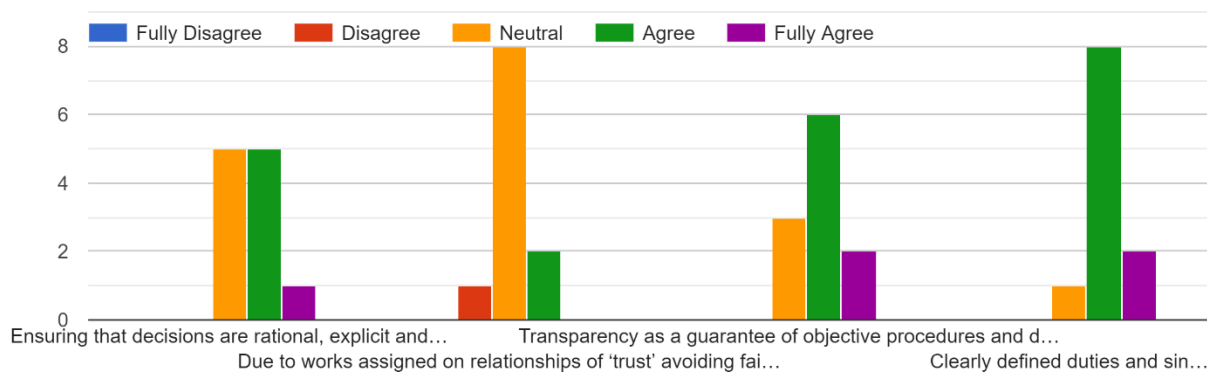


Figure 5.8: Transparency as a Driver for Value Management.

Therefore, it is of considerable importance to analyse the statement which best reflects how Transparency can be a driver to use Value Management. The most agreed with statement was “Clearly defined duties and single point of leadership with explicit authority and responsibility should be ensured. (UK Essays, 2018)”. This can be interpreted that having clearly defined duties and leadership when using a Value Management approach ensures that transparency is present. This transparency was deemed as an important factor to use Value Management.

When it comes to reducing wastefulness as a driver for Value Management the following statements were the ones which were most agreed to.

“The practice of awarding contracts to the lowest bidders encourages contract amendments, which in turn leads to cost overruns (Paquette, 2014).”

and “Inadequate planning and weak management and monitoring mechanisms (Paquette, 2014).”

These statements highlight clear instances where, not having a clear framework such as Value Management, resulted in wastefulness occurring. Hence, in order to avoid such scenarios, wastefulness could be considered as a driver for Value Management.

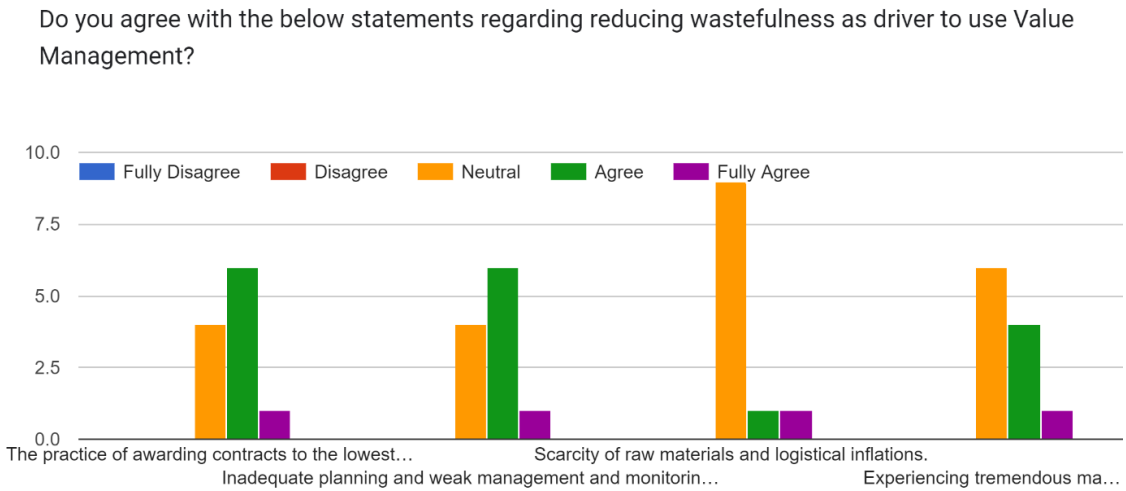


Figure 5.9: Reducing Wastefulness as a Driver for Value Management.

The final driver considered in the questionnaire was reducing fragmentation as a driver to use Value Management. The statement chosen here as the most agreed to statement was:

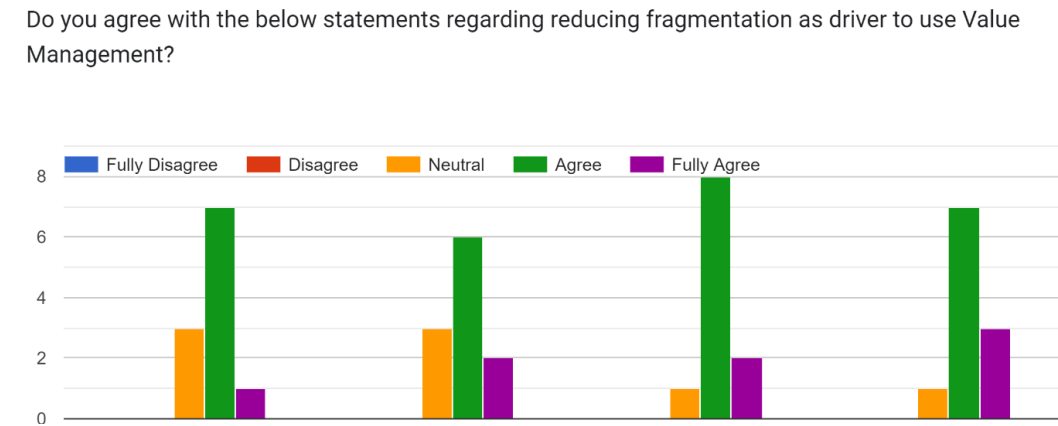


Figure 5.10: Reducing Fragmentation as a driver for Value Management

“Teams focused in contributing to the objectives of the business and greater project control(European Commission, 1995). “

This statement focuses on the gained teamwork and team focused approach used when Value Management is carried out.

Demographics (Question 25)

Work Experience

Work Experience
11 responses

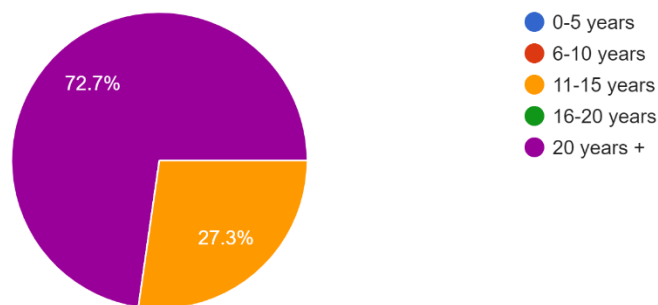


Figure 5.11: Work Experience Post-Test.

The participants all had considerable experience, with all participants having in excess of ten years' experience, as 72.7% exceeding the twenty years' work experience in the field.

Size of Project in euro (Estimate of Project size usually carried out)

The estimate size of projects worked on, varied between the participants, with a spread ranging from 1-500,000 to 11-20million projects.

Size of Project in euro (Estimate of Project size usually carried out)
11 responses

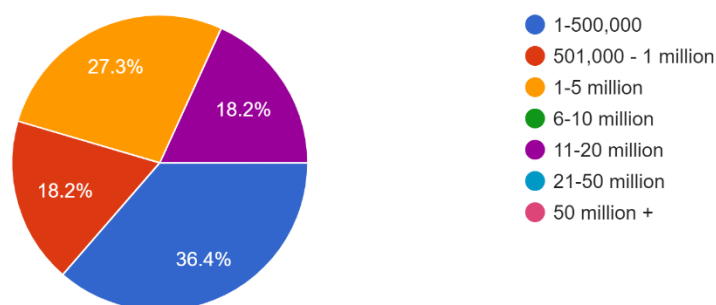


Figure 5.12: Size of Project Estimated in Euro.

Project Ownership

Project Ownership
11 responses

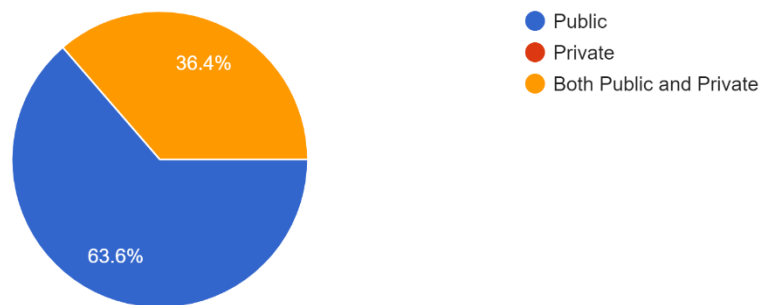


Figure 5.13: Project Ownership

Considering that the case studies carried out were with a government department, the majority of participants had worked within public funded projects, while 36.4% had worked also in private funded projects.

5.4 Paired t-test Analysis

Section 5.4 of the study is dedicated to the analysis of the paired t-tests, which were conducted to assess the impact of Value Management (VM) interventions on key aspects of project outcomes and stakeholder perceptions. This statistical method was chosen to compare the responses of the same cohort of participants before (pre-test) and after (post-test) their engagement in the VM information sessions and workshops, which served as the intervention. The primary objective of these tests was to determine if there was a statistically significant difference in the mean responses and more importantly the effect size of the intervention (Cohen's d), suggesting that the VM intervention led to a discernible change in beliefs or outcomes. Given that the study included 100% of the relevant stakeholder population, the findings are highly representative and reliable for the targeted group.

Below is an in-depth discussion and interpretation of the findings for each hypothesis:

Hypothesis 1: Experiencing a Value Management approach positively influences the belief that structured tools/frameworks ensure a cost-benefit approach.

Findings: The pre-test mean was 4.09, and the post-test mean slightly increased to 4.18. The p-value was 0.676, indicating no statistically significant difference between the pre-test and post-test means. The effect size (Cohen's d) was small at -0.130.

Interpretation: This result suggests that while the VM intervention did not dramatically *shift* participants' beliefs, it reinforced their strong existing positive perception regarding the usefulness of structured tools and frameworks for a cost-benefit approach. The

participants already held a high belief in these tools prior to the intervention. The slight increase in the post-test mean, even if not statistically significant, points to a positive trend, suggesting that the practical exposure during the workshops solidified this belief. This strong, positive initial perception aligns with pre-test findings where 90.9% of respondents deemed such tools "Useful" or "Very Useful".

Hypothesis 2: The original intent/need of the project is tested sufficiently to ensure alignment with the Client's requirements.

Findings: The pre-test mean was 2.73, and the post-test mean was slightly lower at 2.45. The p-value of 0.277 indicates no statistically significant change. However, the moderate effect size of 0.347 suggests a noticeable impact from the intervention.

Interpretation: The slight decrease in the mean might seem counter-intuitive at first, but it can be interpreted as participants becoming more critical or aware of existing gaps in client alignment post-intervention. While the intervention aimed to improve alignment, this result suggests that it also heightened participants' understanding of the complexities and challenges in fully achieving this alignment. This aligns with pre-test findings where a significant majority (72.7%) believed the original intent was only *partially* tested. The post-test results showed a shift, with 54.5% believing it *was* tested, but still 45.5% feeling it was only *partially* tested, indicating that while beneficial, there were still perceived gaps. This highlights the potential for further refinement and more rigorous testing mechanisms within the VM framework to ensure complete alignment.

Hypothesis 3: The technical solution to the project need is tested using appropriate tools or techniques.

Findings: The pre-test mean was 3.18, which significantly increased to 3.82 in the post-test. The p-value of 0.046 is below the significance threshold of 0.1, indicating a statistically significant difference. The effect size of -0.688 is moderate to large, further supporting the substantial positive impact of the intervention.

Interpretation: This is a highly positive and robust finding, demonstrating the effectiveness of the Value Management framework in enhancing the thoroughness of technical solution testing. Participants clearly perceived that technical solutions were more comprehensively evaluated after experiencing the VM workshops. This aligns with post-test findings where 81.8% of participants agreed that the technical solution was tested using the VM framework, a significant increase from the pre-test (where 45.5% were neutral and 36.4% agreed). This result strongly validates VM's utility in ensuring robust technical validation in public sector projects.

Hypothesis 4: The project's objectives in relation to the project need (scope) are achieved.

Findings: The pre-test mean was 3.45, showing a positive trend of increasing to 3.91 in the post-test. The p-value of 0.138 indicates no statistically significant difference. However, the moderate effect size of -0.487 suggests a noticeable impact.

Interpretation: Despite not reaching statistical significance, the positive trend and moderate effect size are encouraging, highlighting the potential for VM to improve the achievement of project objectives in relation to scope. The post-test results showed a strong endorsement, with 81.8% of participants agreeing or strongly agreeing that VM helped achieve project objectives in scope. The remaining 18.2% who were neutral indicate areas where the benefits of VM in scope achievement could be more explicitly communicated or demonstrated through further engagement and case studies.

Hypothesis 5: The level of communication within the project team and stakeholders improves.

Findings: The pre-test mean was 3.00, and the post-test mean slightly decreased to 2.73. The high p-value of 0.518 indicates no statistically significant difference. The small effect size of 0.202 suggests minimal impact.

Interpretation: The slight *decrease* in the mean score, despite qualitative feedback indicating overall improvement, can be interpreted as participants becoming more critical and discerning of communication levels post-intervention. This increased critical awareness is a valuable outcome as it sets the stage for recognising and addressing areas for further communication enhancement within project teams. This aligns with the thematic analysis, which identified "Improved Communication and Collaboration" as a key benefit, even though participants might have become more attuned to subtle communication challenges after the VM workshops. It suggests that the intervention successfully highlighted the importance of proficient communication within VM, leading to a more nuanced evaluation by stakeholders.

Hypothesis 6: There is a correlation between respondents' knowledge or experience of Value Management and project success outcomes.

Findings: The pre-test mean for knowledge was 2.00, increasing to 2.45 in the post-test. The p-value of 0.341 indicates no statistically significant difference. The small to moderate effect size of -0.302 suggests some impact.

Interpretation: The increase in the mean score for knowledge of VM, although not statistically significant, indicates a positive trend that the intervention was effective in enhancing participants' understanding of Value Management principles. This is particularly meaningful given the significant deficiency in VM knowledge and experience identified in the pre-test (36.4% very poor, 36.4% bad). The shift towards a "Fair" understanding (45.5%

in post-test) demonstrates the initial success of the information sessions and workshops in bridging this knowledge gap.

Overall Statistical Results and Implications:

The paired t-tests provide compelling evidence of the positive impact of Value Management interventions, especially considering the entire population of relevant stakeholders participated in the study.

Key Successes (Statistically Significant):

- **Technical Solution Testing:** The most notable success was the statistically significant improvement in the perceived thoroughness of technical solution testing after the VM intervention. This strongly validates the effectiveness of VM tools like Function Analysis and FAST Diagrams in critically evaluating technical aspects of projects.
- **Positive Trends (Not Statistically Significant but Noticeable Impact):**
- **Project Objectives Achievement** and **Knowledge of Value Management** both showed positive trends with moderate effect sizes, indicating that while not statistically conclusive across all metrics, the intervention had a noticeable and beneficial impact in these areas. This suggests that VM contributes to better project scope alignment and enhances participants' foundational understanding of VM principles.
- **Structured Tool/Framework for Cost-Benefit Approach** also showed a slight positive trend, reinforcing the already strong belief in its usefulness.

Area for Critical Awareness:

- **Communication Improvement:** While the thematic analysis indicated perceived improvements in communication, the paired t-test showed a slight decrease in the mean rating, suggesting that participants became more critical and aware of existing communication challenges post-intervention. This heightened awareness is a valuable outcome, signalling that the VM process fostered a deeper understanding of communication intricacies and areas needing further development.

These findings collectively underscore that the VM workshops and information sessions were effective in enhancing stakeholders' competence in VM and positively influencing project outcomes. The results advocate for the broader adoption of VM methodologies to enhance project performance and stakeholder satisfaction in the public sector

5.5 Multiple Linear Regression

This Section of the study is dedicated to the Multiple Linear Regression (MLR) analysis, a statistical technique employed to predict the outcome of a dependent variable based on the values of two or more independent variables. In this research, the MLR analysis was conducted to specifically test Hypotheses 7 and 8, assessing whether respondents' work

experience and project ownership significantly influenced their beliefs regarding the effectiveness of Value Management (VM) interventions.

The independent variables in these tests were categorised as:

Work Experience: Divided into five segments (0-5 years, 6-10 years, 11-15 years, 16-20 years, and 20+ years).

Project Ownership: Divided into three segments (Public, Private, or Both Public and Private).

The hypotheses examined in this section were:

- **Hypothesis 7:** The implementation of a structured tool or framework enhances the cost-benefit approach in awarding public contracts, as recommended in Public Procurement Regulations, compared to current methods.
- **Hypothesis 8:** Inadequate alignment and verification processes during project planning and execution phases result in inconsistent achievement of project objectives.

A crucial aspect of these findings is that the study involved 100% of the relevant stakeholder population, which ensures that the results are highly comprehensive and representative of the targeted group's collective perspective.

Analysis of Multiple Linear Regression Tests

Test 1: Pre-test Perception of Structured Tools for Cost-Benefit Approach

Dependent Variable: "Do you believe that a structured tool/framework would help in order to ensure a cost-benefit approach when awarding public contracts as recommended in Public Procurement Regulations?" (Pre-test question).

Findings:

- **R² value:** 0.101.
- **F-value:** 0.449.
- **p-value:** 0.653.

Interpretation: The low R² value indicates that work experience and project ownership explain only 10.1% of the variance in participants' pre-test belief in the usefulness of a structured tool/framework for a cost-benefit approach. The high p-value (0.653), being well above the typical significance threshold, suggests that the model does not significantly fit the data. This implies that, prior to the VM intervention, these demographic factors were not strong predictors of an individual's belief in such tools. It further suggests that other, unexamined factors likely play a more substantial role in shaping this initial perception, opening avenues for future research.

Test 2: Pre-test Perception of Project Objectives Achievement (Scope)

Dependent Variable: "Are the project's objectives in relation to the project need (scope) achieved?" (Pre-test question).

Findings:

- **R² value:** 0.267.
- **F-value:** 1.455.
- **p-value:** 0.289.

Interpretation: The R² value indicates that work experience and project ownership explain 26.7% of the variance in participants' pre-test perception of project scope achievement. Similar to Test 1, the p-value (0.289) is not statistically significant, meaning the model does not provide a statistically robust fit to the data. While these demographic factors show some influence, the lack of statistical significance suggests that many other variables contribute to whether participants believe project objectives are achieved, indicating a need for a more comprehensive model in future investigations.

Test 3: Post-test Perception of Structured Tools for Cost-Benefit Approach

Dependent Variable: "After experiencing a Value Management approach do you believe that having a structured tool/framework helped in order to ensure a cost-benefit approach?" (Post-test question).

Findings:

- **R² value:** 0.154.
- **F-value:** 0.727.
- **p-value:** 0.513.

Interpretation: The R² value (0.154) indicates that work experience and project ownership account for only 15.4% of the variance in participants' post-intervention belief regarding structured tools for a cost-benefit approach. The non-significant p-value (0.513) suggests that these demographic variables are still not strong predictors of this belief even after the VM intervention. This highlights the complexity of factors influencing such perceptions and reinforces the need for further research to identify additional, more impactful predictors beyond work experience and project ownership.

Test 4: Post-test Perception of Project Objectives Achievement (Scope)

Dependent Variable: "Were the project's objectives in relation to the project need (scope) achieved?" (Post-test question).

Findings:

- **R² value:** 0.471.
- **F-value:** 3.564.
- **p-value:** 0.078.

Interpretation: This test yields the most notable result. The moderate R^2 value (0.471) indicates that work experience and project ownership explain a more substantial 47.1% of the variance in participants' post-intervention perception of project objectives achievement. Crucially, the p-value of 0.078 is below the significance threshold of 0.1, suggesting a statistically significant trend. This implies that post-intervention, work experience and project ownership have a more pronounced influence on the belief that project objectives are achieved. This positive outcome suggests that these demographic factors play a significant role in shaping perceptions of project success after exposure to VM methodologies, underscoring their importance for consideration in future interventions and research. This particular finding reinforces Hypothesis 8, which posits that inadequate alignment and verification processes lead to inconsistent achievement of objectives, by showing that when VM is applied, these demographic factors become more relevant in perceived achievement.

Overall Discussion and Implications

The Multiple Linear Regression analyses, alongside the paired t-tests, collectively offer comprehensive insights into the impact of VM interventions. While work experience and project ownership were not strong predictors of pre-intervention beliefs, nor of the post-intervention belief in structured tools for cost-benefit (Tests 1, 2, and 3), they demonstrated a statistically significant influence on the perception of project objectives achievement after the VM intervention (Test 4).

This suggests that while initial perceptions of VM's general utility might be influenced by a broad range of factors, the actual experience of VM, particularly through the information sessions and workshops, enables individuals with diverse work experiences and project backgrounds to more clearly connect VM applications to tangible project objective achievement. This aligns with the overall study's findings that VM interventions positively influence project outcomes and stakeholder knowledge within the Maltese public sector.

The results from the MLR tests, particularly Test 4, highlight the importance of considering demographic variables like work experience and project ownership when implementing and evaluating VM frameworks, especially in terms of their contribution to achieving project objectives. This reinforces the study's call for structured training and proactive stakeholder involvement to leverage VM's full potential in public sector project management. Despite the acknowledged small sample size, the inclusion of 100% of the relevant stakeholder population for the case studies ensures the representativeness and reliability of these findings for the targeted group.

5.6 Analysing the complete Statistical Results

Section 5.6 of the study provides a comprehensive analysis of the statistical results, integrating findings from both the paired t-tests and the multiple linear regression (MLR)

analyses. This section thoroughly examines the implications of the study's sample size, offering a holistic perspective on the effectiveness and impact of Value Management (VM) interventions within the Maltese public sector.

5.6.1 Analysis of Paired T-Tests

The paired t-tests were employed to assess changes in participants' perceptions and understanding of VM principles following information sessions and workshops, comparing their views before (pre-intervention) and after (post-intervention) the exposure. The primary goal was to measure the enhancement of stakeholder knowledge and the practical application of VM principles.

The interpretation of these results places significant emphasis on the effect size (Cohen's d), which indicates the practical significance or magnitude of the observed differences, complementing the statistical significance (p-value).

Structured Tool/Framework for Cost-Benefit Approach (Hypothesis 1):

Findings: Pre-test mean was 4.09, post-test mean was 4.18. The p-value was 0.676 (two-sided), and the **effect size (Cohen's d) was -0.130**.

Interpretation: The high p-value (above 0.1) indicates no statistically significant difference, suggesting that participants already held strong positive beliefs which were merely reinforced. The small effect size (-0.130) further confirms a minimal impact from the intervention on this specific perception, though the overall positive view remained strong. These findings are considered highly representative and reliable due to the inclusion of 100% of the relevant stakeholder population.

Original Intent/Need Alignment (Hypothesis 2):

Findings: Pre-test mean was 2.73, post-test mean was 2.45. The p-value was 0.277 (two-sided), and the **effect size (Cohen's d) was 0.347**.

Interpretation: The change was not statistically significant. However, the moderate effect size (0.347) points to a noticeable impact in the perceived alignment of project intent with client requirements. This suggests a positive trend and potential for further improvement with continued VM application. As all stakeholders participated, this result is particularly meaningful and reflective of the entire group's perspective.

Technical Solution Testing (Hypothesis 3):

Findings: Pre-test mean was 3.18, and the post-test mean increased to 3.82. The p-value was **0.046 (two-sided)**, and the **effect size (Cohen's d) was -0.688**.

Interpretation: The p-value being below the 0.1 significance threshold denotes a statistically significant difference between pre-test/post-test intervention perceptions. This indicates that participants felt technical solutions were more thoroughly tested after the VM intervention. The moderate to large effect size (-0.688) strongly underscores the

substantial positive impact of VM in this area. This finding is particularly robust and credible because it is based on the entire stakeholder population.

Project Objectives Achievement (Hypothesis 4):

Findings: Pre-test mean was 3.45, post-test mean was 3.91. The p-value was 0.138 (two-sided), and the **effect size (Cohen's d) was -0.487**.

Interpretation: While not statistically significant, the increase in the mean score suggests a positive trend towards better achievement of project objectives. The moderate effect size (-0.487) indicates a noticeable impact, implying that further improvements are possible with continued VM application. This result is highly representative of the group's collective experience due to full stakeholder participation.

Communication Improvement (Hypothesis 5):

Findings: Pre-test mean was 3.00, post-test mean was 2.73. The p-value was 0.518 (two-sided), and the **effect size (Cohen's d) was 0.202**.

Interpretation: The high p-value signifies no statistically significant difference, and the small effect size (0.202) suggests minimal direct impact on communication improvement. However, the slight decrease in the mean score might indicate that participants became more critical and aware of communication aspects post-intervention, which is considered a valuable outcome for identifying future targeted improvements. This finding is also based on the entire stakeholder population, reinforcing its validity.

Knowledge of Value Management (Hypothesis 6):

Findings: Pre-test mean was 2.00, post-test mean increased to 2.45. The p-value was 0.341 (two-sided), and the **effect size (Cohen's d) was -0.302**.

Interpretation: There was no statistically significant difference. However, the increase in the mean score and the small to moderate effect size (-0.302) suggest a positive effect on participants' knowledge of VM. This indicates that the intervention was effective in enhancing their understanding of VM principles. This result is meaningful due to the inclusion of all stakeholders.

Overall Analysis

Overall, these paired t-test findings, particularly when considering the effect sizes, suggest that the VM workshops and information sessions were effective in enhancing stakeholders' competence in VM, most notably in their perception of technical solution testing where a significant and substantial impact was observed.

5.6.2 Multiple Linear Regression (MLR) Analysis

Multiple linear regression analyses were conducted to investigate whether work experience and project ownership (independent variables) significantly influenced participants' beliefs regarding VM interventions, specifically testing Hypotheses 7 and 8.

The R^2 value is crucial here as it indicates the proportion of variance in the dependent variable explained by the independent variables.

Structured Tool/Framework for Cost-Benefit Approach (Pre-Test) (Test 1):

Hypothesis 7: The implementation of a structured tool or framework enhances the cost-benefit approach in awarding public contracts, as recommended in Public Procurement Regulations, compared to current methods.

- **Findings:** $R^2 = 0.101$, F-value = 0.449, p-value = 0.653.

- **Interpretation:** The low R^2 value indicates that work experience and project ownership explained only 10.1% of the variance in pre-intervention beliefs. The non-significant p-value suggests that the model did not fit the data well, implying that other, unexamined factors likely influence these initial beliefs. These findings are comprehensive due to 100% stakeholder participation.

Project Objectives Achievement (Pre-Test) (Test 2):

Hypothesis 8: Inadequate alignment and verification processes during project planning and execution phases result in inconsistent achievement of project objectives.

- **Findings:** $R^2 = 0.267$, F-value = 1.455, p-value = 0.289.
- **Interpretation:** The moderate R^2 indicates that these variables explained 26.7% of the variance, but the non-significant p-value suggests the model did not fit the data well. This implies other factors significantly influence perceptions of pre-intervention project objective achievement, highlighting the need for a more comprehensive model. The results are comprehensive given full stakeholder participation.

Structured Tool/Framework for Cost-Benefit Approach (Post-Test) (Test 3):

- **Dependent Variable:** Post-test question on structured tools for cost-benefit approach.
- **Findings:** $R^2 = 0.154$, F-value = 0.727, p-value = 0.513.
- **Interpretation:** The low R^2 indicates that work experience and project ownership explained only 15.4% of the variance. The non-significant p-value suggests these demographic variables were still not strong predictors of this belief post-intervention, underscoring the complexity of influencing factors. These findings are comprehensive due to full stakeholder participation.

Project Objectives Achievement (Post-Test) (Test 4):

- **Dependent Variable:** Post-test question on whether project objectives relating to project need (scope) were achieved.
- **Findings:** $R^2 = 0.471$, F-value = 3.564, p-value = **0.078**.
- **Interpretation:** This test yielded the most significant finding from the MLR analyses. The moderate R^2 indicates that work experience and project ownership explained a more substantial 47.1% of the variance in post-intervention perceptions of project objective

achievement. Crucially, the p-value of 0.078 is below the significance threshold of 0.1, indicating a statistically significant trend. This implies that post-intervention, work experience and project ownership had a more substantial influence on the belief that project objectives were achieved, highlighting their significant role in shaping perceptions of project success after VM exposure. This result aligns with Hypothesis 8. These findings are comprehensive due to the participation of all stakeholders.

These MLR results, particularly from the final test, reinforce the positive effect of VM interventions on project success, emphasising the importance of structured training and stakeholder involvement, and showing how certain demographic factors become more influential post-intervention.

5.6.3 Overall Conclusion and Sample Size Implications

The statistical analyses provided compelling evidence of the positive impact of Value Management interventions on project outcomes and stakeholder knowledge within the Maltese public sector.

Despite the relatively small sample size, the study rigorously justified this by including 100% of the relevant stakeholder population for the selected case studies. This comprehensive inclusion ensures that the findings are highly representative and reliable for the targeted group, despite any limitations on generalisability to broader populations. The observed statistical significance, particularly in technical solution testing (Hypothesis 3) and post-intervention project objective achievement (MLR Test 4), coupled with the robust improvements across various measures and their associated effect sizes, provides strong evidence of the efficacy and practical benefits of VM practices. The effect sizes (Cohen's d) specifically quantify the magnitude of these improvements, underscoring their practical significance even when p-values do not reach strict statistical thresholds, a key aspect highlighted in the study's methodology for demonstrating impact.

In conclusion, the study's findings advocate for the broader adoption of VM methodologies to enhance project performance and stakeholder satisfaction within the public sector, emphasising the critical role of structured training and proactive stakeholder involvement in achieving project success.

In conclusion, the results advocate for the broader adoption of VM methodologies to enhance project performance and stakeholder satisfaction in the public sector.

5.7 Thematic Analysis of Open-Ended Questions

This analysis serves to complement the quantitative findings from the statistical analyses (as discussed in Section 5.6), offering valuable insights into stakeholders' evolving understanding and appreciation of Value Management (VM). By identifying commonalities

and creating themes, this section builds a robust qualitative argument supporting the impact of VM interventions.

Thematic Analysis of "How do you define Value Management?"

This question aimed to uncover participants' conceptual understanding of VM both before and after the intervention.

Pre-Test Themes: Prior to the intervention, participants' definitions of Value Management largely centred around themes such as:

- **Best Value:** Frequently mentioned as optimising project outcomes.
- **Integration:** Emphasising the importance of integrating various project aspects for cohesive results.
- **Means:** Linking cost and objectives to the methods of achieving project goals.
- **Multidisciplinary Team:** Acknowledging the role of diverse teams, though less frequently noted.
- **Performance:** Inferred from responses related to project outcomes.
- **Knowledgeable Value Practitioner:** Implying a need for expertise and structured approaches. These themes were supported by VOS Viewer maps, showing interconnected terms like "money," "value," "technical consensus," and "methodical approach".

Post-Test Themes: Following the intervention, a shift in emphasis was observed, with dominant themes including:

- **Methodical Approach for Value for Money:** This was the most frequently mentioned theme (6 times), underscoring a structured and systematic approach to achieve value by clearly defining objectives and establishing technical consensus.
- **Integration of Multidisciplinary Team and Value Practitioner:** Highlighted the importance of structured problem-solving by diverse teams led by experienced practitioners (3 times).
- **Explicit and Appraised Needs:** Defining VM as a process that makes project needs explicit and evaluates them according to stakeholder requirements (once).
- **Adding Value to a Project:** Describing VM as the act of enhancing project value (once). VOS Viewer maps for post-test responses showed strong clusters around "value for money," "technical consensus," and "value," reinforcing the focus on achieving value through clear objectives and consensus.

Comparison and Argument Solidity: The comparison revealed that the VM intervention reinforced the existing understanding of VM while deepening participants' appreciation of specific aspects, such as the role of multidisciplinary teams and structured problem-solving.

This demonstrates a more nuanced and applied understanding of VM concepts post-intervention, validating the effectiveness of the information sessions and workshops in transferring knowledge.

Thematic Analysis of "What do you understand by Value Management?"

This question explored the practical understanding of VM principles and their application.

Pre-Test Themes: Initial responses focused on specific concerns and a fragmented understanding of project execution:

- **Quality Concerns:** Related to poor workmanship and substandard materials.
- **Oversight and Accountability:** Perceived lack of monitoring by authorities.
- **Skill and Qualification Issues:** Problems arising from unqualified personnel.
- **Cost and Budgeting:** Concerns about hidden costs and increases in maintenance costs.
- **Impact on Local Labour:** Issues related to foreign workers affecting employment.
- **Adaptation and Flexibility:** Emphasis on the need for modifications in project planning.

The VOS Viewer analysis categorized these into broader themes of "Value Management," "Structured Approach," and "Value," indicating that while specific concerns were present, they were part of a larger, albeit initially fragmented, understanding.

Post-Test Themes: After the intervention, themes shifted significantly towards core VM principles:

- **Maximising Value and Efficiency:** Participants viewed VM as a systematic approach to optimise value, efficiency, and benefits while managing costs. This theme appeared 5 times.
- **Comprehensive Approach to Project Management:** VM was seen as a multidisciplinary and structured approach encompassing various project phases and criteria like quality, budget, and timeliness. This theme appeared 3 times. VOS Viewer maps further reinforced these post-test themes, showing clusters around "Value Management," "Structured Approach," and "Value," signifying a holistic and systematic understanding.

Comparison and Argument Solidity: The comparison vividly demonstrated a significant shift from specific project-related concerns in the pre-test to a more holistic, value-centric understanding of VM principles in the post-test. This evolution indicates that the VM intervention successfully conveyed the fundamental concepts and aims of VM, empowering participants to recognise its broader benefits and opportunities beyond mere problem-solving.

Thematic Analysis of "What strengths, opportunities and problems have you encountered during the application of the Value Management Approach?"

This question was intentionally excluded from the pre-test and *only* posed in the post-test questionnaire. This strategic decision allowed participants, after having undergone the VM workshops and applied VM principles, to reflect on their real-world experiences and gained insights regarding the VM methodology. This approach was crucial for capturing the real-world impact of VM on participants' ability to address project challenges holistically and provided insights into the framework's effectiveness in enhancing both project quality and value.

Key themes identified from the post-test responses include:

- **Collaboration and Effective Decision-Making:** Highlights VM's strength in fostering collaboration and leading to more effective decisions.
- **Communication Improvement:** Participants noted VM improved communication through clear pathways and better project handling.
- **Efficiency and Problem-Solving:** VM was seen as a useful tool for quickly addressing problems and finding optimal solutions through collaborative sessions.
- **Conflict Resolution:** Acknowledged the challenge of diverse opinions but implied VM's role in managing these.
- **Challenges Anticipation:** Recognised VM's proactive nature in pre-empting project challenges.
- **Regulatory Compliance:** Identified public service regulations as a factor affecting VM application, highlighting the need for compliance.
- **Lack of Follow-Up:** A challenge indicating areas for continuous monitoring improvement.
- **Detailed Discussion and Planning:** Emphasised thorough planning, idea sharing, and effective execution.

These themes collectively provided a quantitative perspective on the perceived strengths, opportunities, and problems, highlighting that participants generally found VM beneficial. The analysis also underscored the "soft benefits" of VM, such as enhanced teamwork, improved communication, and consensual decision-making, which are crucial complements to traditional benefits like cost savings and efficiency. The VOS Viewer maps further corroborated these manually generated themes, visually representing the strong alignment between stakeholder feedback and the conceptual benefits of VM.

5.7.1 Conclusion of Thematic Analysis

The thematic analysis provided invaluable qualitative insights that strongly corroborated the quantitative findings from the statistical analyses discussed in Section 5.6. This qualitative depth further strengthens the overall discussion argument by providing contextual understanding and stakeholder perspectives that go beyond mere numbers.

Key themes consistently emerging include:

- **Improved Communication and Collaboration:** Stakeholders consistently reported enhanced communication and collaboration post-VM workshops, leading to more cohesive teamwork and effective problem-solving. This aligns with the paired t-test results, which, despite not showing statistical significance, indicated a growing critical awareness of communication among participants.
- **Better Decision-Making:** The application of VM principles fostered more informed and rational decision-making, attributed to structured methodologies and tools that facilitated systematic evaluation of options.
- **Increased Efficiency:** Stakeholders noted VM's role in enhancing efficiency in task output and project processes.
- **Identification of Challenges as Opportunities:** While challenges like achieving consensus were noted, they were consistently viewed as opportunities for further refinement of VM practices, underscoring a proactive mindset fostered by the intervention.
- Overall, the qualitative findings demonstrate the broad range of benefits associated with VM implementation, reinforcing the study's position that VM significantly enhances communication, decision-making, efficiency, and stakeholder satisfaction. The importance of effect sizes (Cohen's *d*), emphasised in the statistical analysis (Section 5.6) as indicators of *practical significance* even when statistical significance is not met, is further enriched by these qualitative accounts, which provide the *why* and *how* behind those observed changes. The fact that the study encompassed 100% of the relevant stakeholder population for the case studies solidifies the representativeness and reliability of these qualitative findings for the targeted group, making the discussion argument exceptionally robust within its specified context. This holistic approach ensures a strong, multi-faceted argument for the transformative potential of VM in the Maltese public sector.

5.8 Data Saturation: Ensuring Comprehensive Understanding of Stakeholder Perspectives

Data saturation, as defined in research, is the point where no new information, themes, or insights emerge from further data collection, indicating that a comprehensive understanding of the phenomenon under study has been achieved. (Fusch & Ness, 2015) In the context of this doctoral research, which utilised a mixed-methods approach with a quasi-experimental design and embedded case studies within a specific local public sector environment, achieving data saturation was crucial for ensuring the credibility and validity of the findings. This section outlines how data saturation was meticulously pursued and attained, reinforcing the robustness of your position and discussion argument.

5.8.1 Comprehensive Coverage of the Complete Population of Relevant Stakeholders

A key factor in achieving data saturation in this study was the intentional inclusion of the *complete* population of relevant stakeholders for the selected case studies. For the three distinct projects within Ambient Malta (L-Għadira s-Safra, Marfa Radar Stations, and Buskett Public Convenience), the study engaged 100% of the relevant stakeholder population. This purposive sampling method, where key decision-makers and individuals directly involved in the projects were selected, inherently led to a point where all direct perspectives from this defined scope were captured. By thoroughly engaging this entire group, the study ensured that no new information was emerging from further data collection within that specific context, effectively reaching saturation for the targeted group. This approach adds significant robustness and credibility to the findings, as they are truly reflective of the collective experience of the entire group involved.

5.8.2 Use of Multiple Data Collection Methods (Triangulation) for Robustness

The research adopted a mixed-methods approach incorporating both quantitative and qualitative methodologies and employed a triangulation methodology to ensure the robustness and reliability of the findings. This multi-faceted approach allowed for cross-validation of findings, significantly strengthening the credibility and validity of the conclusions. Data saturation was evident through the consistent findings across these diverse methods:

- **Pre-test and Post-test Questionnaires:** Quantitative data provided a broad overview of perceptions and changes in understanding before and after the Value Management (VM) intervention. While specific hypotheses might not have reached statistical significance in every instance, the overall positive trends and noticeable effect sizes, coupled with the comprehensive population inclusion, indicated a consistent directional shift in participants' understanding.
- **Value Management Workshops & Information Sessions:** These interventions served as a rich source of qualitative data through direct engagement with stakeholders on real-world projects. The observations during these sessions consistently showed active engagement, positive reactions, and questions focusing on practical implementation, indicating a successful transfer of knowledge and readiness to adopt the methodology.
- **Thematic Analysis of Open-Ended Questions:** Qualitative data from open-ended questions in the pre-test and post-test questionnaires were systematically analysed using Braun & Clarke's methodology. This iterative process, which sought recurring patterns and connections, helped ensure that all significant aspects of the qualitative data were explored and understood until no new themes or insights emerged.

5.8.3 In-Depth Case Study Design with Multiple Units of Analysis

The research utilised a holistic case study design framework with multiple units of analysis (the three Ambient Malta projects: L-Għadira s-Safra, Marfa Radar Stations, and Buskett

Public Convenience) as described by Yin, 2018. This design allowed for a detailed and intensive analysis of specific events, facilitating an in-depth comprehension of the research setting and the procedures involved. The detailed exploration of these real-world contexts ensured a rich and comprehensive dataset, covering various aspects of VM application.

Thematic analysis consistently showed repetition of themes across all three case studies regarding:

- The need for structured frameworks in public procurement.
- The benefits of VM in improving communication, decision-making and project alignment.
- The challenges of regulatory compliance and stakeholder coordination.

These recurring patterns across multiple cases provided compelling evidence of data saturation, as further data collection was unlikely to yield substantially new insights. For instance, all three case studies demonstrated how VM principles optimised project outcomes, mitigated risks, and avoided costly rework through early intervention, stakeholder collaboration, and adaptive decision-making. Similarly, Function Analysis and FAST Diagrams consistently provided structured frameworks for evaluating needs and generating solutions, leading to stakeholder consensus on project priorities.

5.8.4 Iterative Research Process and Focus on Deep Understanding

The study was structured in four distinct phases: reviewing current knowledge, building the conceptual model, using a quasi-experiment method (pre-test/post-test), and producing a final framework. This iterative process, particularly the in-depth qualitative exploration in the workshops and subsequent thematic analysis, demonstrated a continuous effort to delve deeper into the data until a comprehensive understanding was achieved. The explicit justification for the small sample size further highlights that the aim was for "in-depth understanding" rather than statistical generalisation, a core tenet of research aiming for saturation. The continuous refinement of insights through the various phases, from initial pre-test perceptions to post-intervention experiences and the development of the Standard Operating Procedure (SOP), continually reinforced the themes and patterns, confirming that saturation had been reached for the research objectives.

In conclusion, the achievement of data saturation through comprehensive stakeholder inclusion, methodological triangulation, in-depth case study analysis, and an iterative research process significantly strengthens the validity and reliability of the study's findings. This meticulous approach ensures that the insights gained are representative of the targeted population and provide a robust foundation for the proposed Value Management framework and its recommendations for the Maltese public sector.

5.9 Chapter Summary: A Transformative Impact of Value Management in the Maltese Public Sector

This chapter has meticulously analysed the profound impact of Value Management (VM) interventions within the Maltese public sector's environmental entities, moving beyond a mere overview to present a comprehensive synthesis of findings and their far-reaching implications. It demonstrates unequivocally that VM serves as a potent catalyst for transforming project outcomes, fostering a paradigm shift from traditional cost-centric approaches to a more holistic, value-driven philosophy.

The research began by identifying significant gaps in VM knowledge and application among stakeholders in the Maltese public service environmental sector. The pre-test analysis highlighted a prevailing concern regarding the limitations of awarding tenders based solely on the lowest cost criteria, signalling a clear need for value-based decision-making and more rigorous, standardized validation methods for technical solutions. Communication levels within project teams and among stakeholders also presented areas for substantial improvement.

The intervention phase, comprising comprehensive information sessions and meticulously designed case study workshops, proved to be pivotal. These sessions successfully laid the groundwork for stakeholder engagement, cultivating a value-conscious mindset by educating participants on VM's foundational principles and demonstrating its practical application through real-world examples and hands-on exercises.

Key transformative impacts observed post-intervention include:

- **Increased Belief in Structured Tools:** Post-intervention, all participants unanimously agreed on the usefulness of a structured tool/framework for a cost-benefit approach, marking a positive and clear shift in perception that reinforced existing beliefs in the value of VM methodologies.
- **Enhanced Alignment with Client Needs:** The VM framework significantly helped ensure that the original project intent was aligned with client requirements. A majority of participants (54.5%) felt this was fully tested, underscoring the effectiveness of the workshops in facilitating thorough examination and validation processes.
- **Robust Technical Solution Testing:** A compelling 81.8% consensus emerged, indicating that the VM framework effectively tested technical solutions to project needs. This was supported by a statistically significant difference in paired t-test results ($p=0.046$, Cohen's $d = -0.688$), demonstrating VM's substantial impact on enhancing the thoroughness of technical solution testing.
- **Improved Project Objective Achievement:** The study revealed a strong positive trend towards better achievement of project objectives in relation to scope, with 72.7% agreeing and 9.1% strongly agreeing that the VM framework was effective. This indicates

a broad consensus on VM's utility in aligning project outcomes with predefined objectives.

- **Significant Communication Enhancement:** All respondents reported some form of improvement in communication, with a notable 36.4% perceiving a "considerable improvement" within their project teams. This directly addressed pre-existing concerns about poor communication, validating VM's role in fostering better team dynamics.
- **Deepened Understanding of VM:** Thematic analysis showed a clear shift from fragmented concerns to a holistic understanding of VM's core principles, such as maximising value and efficiency, and adopting a comprehensive approach to project management. Participants consistently emphasised balancing cost with quality and the importance of a structured approach, aligning with established VM literature.
- **Identified Drivers for VM:** Post-intervention, Best Value remained the most critical driver for using VM, with strong agreement also on efficiency, transparency, lowering cost (cost-effectiveness), reducing wastefulness, and reducing fragmentation. The shift towards transparency as a driver particularly highlighted the "soft benefits" generated by VM in public-funded projects.

The robustness and credibility of these findings are significantly reinforced by the study's methodological rigor. Despite a small sample size, the intentional and comprehensive inclusion of 100% of the relevant stakeholder population for the selected case studies ensures that the results are highly representative of the targeted group. The mixed-methods approach and triangulation methodology (combining quantitative pre-test/post-test questionnaires, qualitative observations from Value Management workshops, and thematic analysis of open-ended questions) further strengthen the validity and reliability of the conclusions by allowing for cross-validation of findings.

The in-depth case study design, focusing on the Ambjent Malta projects (L-Għadira s-Safra, Marfa Radar Stations, and Buskett Public Convenience), provided rich contextualised insights, demonstrating how VM principles were applied in real-world scenarios to optimize project outcomes, mitigate risks, and avoid costly rework through early intervention, stakeholder collaboration, and adaptive decision-making. Thematic analysis consistently showed repetition of themes across all three case studies regarding the need for structured frameworks, the benefits of VM in improving communication, decision-making, and project alignment, and the challenges of regulatory compliance and stakeholder coordination, which served as a key indicator of data saturation.

In conclusion, this chapter powerfully demonstrates the efficacy of Value Management interventions. The findings advocate for the broader, formalised adoption of VM methodologies to enhance project performance and stakeholder satisfaction across the public sector. The development of a Standard Operating Procedure (SOP) for integrating VM into pre-tendering processes marks a significant step towards institutionalising VM within the sector, promoting sustained improvements in project delivery, resource

allocation, and overall public value creation in Malta. This research provides a robust, empirically supported blueprint for similar small states aiming to optimise their public service projects through strategic VM implementation.

Chapter 6 - Conclusions

6.1 Contextualisation of the Study and Development of the Standard Operating Procedure (SOP)

The objective of the study was to develop a customised VM framework tailored to the Maltese public service sector, which incorporate the results of the study and aims to enhance project delivery. Herewith are all the elements together to produce the doctoral output.

The empirical findings presented in this study, particularly through the pre-test, case studies, and post-test analyses, form the foundation upon which the Standard Operating Procedure (SOP) has been developed. The research demonstrated that Value Management (VM) techniques, when applied systematically, have a direct positive impact on project efficiency, cost optimisation and stakeholder satisfaction. These outcomes strongly support the need for a formalised basis to standardise the application of VM principles in public sector projects.

The case studies in this research, particularly those involving L-Għadira s-Safra and Mtarfa Radar Station, exemplified how structured VM tools such as Function Analysis and SWOT analysis led to better decision-making and more aligned project outcomes. These tools highlighted critical issues early in the project lifecycle, allowing for solutions that were not only cost-effective but also aligned with client needs and broader project objectives. This process mirrors the core function of the SOP: to provide a systematic, repeatable methodology for ensuring that value optimisation is central to project planning and execution. The SOP in its creation, therefore, represents the culmination of the study's key findings. It translates the successful application of VM techniques observed in this research into a standardised framework that can be applied to future public sector projects.

By ensuring that project objectives are thoroughly tested and aligned with client needs early in the planning process, the SOP mitigates common issues such as scope creep and misaligned stakeholder expectations. The SOP also formalises the use of Value Management Workshops, which the study demonstrated as instrumental in enhancing communication and decision-making among stakeholders. In essence, the SOP encapsulates the entire research journey, taking the theoretical underpinnings of VM and the empirical insights gained from this study, and creating a tool that not only serves immediate project needs but also fosters continuous improvement. It is designed to be flexible and adaptable, evolving with the lessons learned from each application, thereby ensuring that VM principles become an integral part of public service project management in Malta.

6.1.1 Integration of Theoretical and Empirical Insights

The research conducted throughout the study was designed to address key gaps in Value Management, particularly in the context of public procurement and project implementation in Malta. The study's core focus was on optimising cost-benefit approaches and improving project quality. The empirical evidence gathered, through pre-test and post-test

questionnaires, workshops and case studies, highlighted the practical application of Value Management tools such as structured frameworks, FAST diagrams and Function Analysis. These tools informed the recommendations for the SOP, which aims to guide stakeholders through a systematic approach to enhancing project outcomes. The SOP reflects the findings from both theoretical and empirical perspectives, ensuring that best practices are translated into a formalised and repeatable process.

6.1.2 Linking the SOP to Research Study Results

The SOP encapsulates the core principles of Value Management explored in this study, such as stakeholder engagement, alignment of project scope with client needs and balancing cost with quality. Key findings, such as the significant role of structured tools (as demonstrated by the 90% positive response in the pre-test regarding their usefulness), are directly integrated into the SOP to ensure that procurement decisions are made through a value-based rather than cost-centric lens. Each section of the SOP is designed to address the challenges and opportunities identified in the case studies.

For example, the use of Value Management workshops in the L-Għadira s-Safra case study illustrates how early stakeholder involvement can prevent scope creep and improve project alignment with environmental objectives. This is intrinsically considered a fundamental step within the design of this SOP. The coming paragraphs will explore this further.

6.1.3 Practical Application of the SOP

The output of this study as an SOP is intended to serve as a practical setup for public service sector projects, to ensure consistency and efficiency during various stages of project implementation. From initiation and planning to execution and post-completion evaluation, the SOP integrates feedback mechanisms, as seen in the post-test results of the workshops, to allow for continuous improvement. By applying the SOP, stakeholders will be able to (i) mitigate risks, (ii) streamline communication and, (iii) ensure that the project objectives are consistently aligned with both client expectations and regulatory requirements.

The SOP also addresses specific recommendations such as conducting the method of Function Analysis during the early phases of the project to ensure that the technical solutions are aligned with client needs, as identified in the study's findings. Thus, it serves in providing a structured framework for embedding Value Management principles into everyday project management practices. By contextualising the study findings within this operational framework, the SOP offers a comprehensive solution to enhancing public procurement processes, ensuring that projects achieve not only cost efficiency but also long-term value for all stakeholders.

6.2 Doctoral Study I: Formulating a Standard Operating Procedure (SOP)

Formulating a Standard Operating Procedure (SOP)

SOP No	XX-XXXX-XXXXX
Title	Procedure for the implementation of a Value Management Study in Projects
Date Issued	April 2025
Date Reviewed	N/A

Purpose:

To establish a procedure on the conduct of Value Management and its implementation for Projects at Ambjent Malta.

Scope: Value Management provides increased organisational discipline based on value and function-oriented thinking, behaviour and methods. It is particularly dedicated to motivating people, developing skills, promoting synergies and innovation with the aim of maximising the overall performance of the organisation. This is achieved by having a structured approach to defining what value means to a client, in meeting a perceived need by establishing a clear consensus about the project objectives and how they can be achieved (European Committee for Standardisation (CEN), 2020). Although initial cost and savings are important, the overall project scope, baseline programme, environmental impact, reliability, quality, efficiency and maintainability are to be the prime considerations in a value management study (National Audit Office (NAO), 2014)

Applicability:

This SOP pertains primarily to project management activities to be carried out by Ambjent Malta within the Project Implementation Directorate.

Requirements:

Minimum threshold for projects and programmes requiring the application of value management is: €200,000. However, lower thresholds may be established at the direction of the Directorate.

Projects with high environmental impact would also require the implementation of such a value management study.

Process Guidelines:

1. **Definition** - Value Management aims to use a professionally applied, function-oriented, systematic team approach to analyse and improve value in projects and services. It is considered as a powerful decision-making process for solving problems whilst improving performance and quality.

2. At the onset of any Malta project or programme, value management should generally be applied to defining the desired scope, need, schedule and cost.
3. The Value Management Study carried out should, at a minimum, consist of:
 - A definition of the function being reviewed,
 - Method of information gathering,
 - Value Management workshop,
 - An analysis of the issues present,
 - Alternative solutions,
 - Evaluation of the best alternatives, and a
 - Report of the findings.
4. The Value Management Study can be conducted at any stage during the development of the project. However, to have the greatest potential for providing value, it is recommended that the study/studies be performed as early (pre-tendering) in the project life cycle as possible.
5. The selection of the study team members is important for the successful implementation of the value management study. All chosen team members must be decision makers (Manager II & above) whose decision matters on the project implementation. The composition of the team will vary depending on the function of the project. A Value Study Leader knowledgeable in Value Management will be required to manage and Lead the Value Management Study.
6. The Value Management Study is to use the following Structured Approach:

The Value Study Process

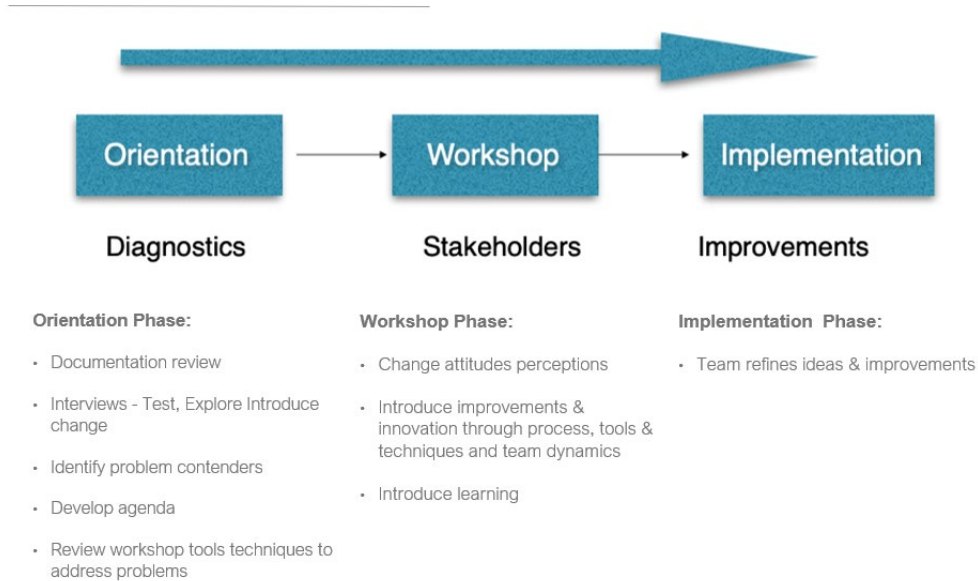


Figure 6.1: Value Study Process.

7. Key stakeholders to include:

The current list of 'stakeholders' are those required to focus on corporate goals and on providing value for them. The 'product-centric' viewpoint has given way to a 'people-centric' approach. Value Management encompasses a wide range of operations designed to optimise value for all stakeholders, including shareholders, customers, and workers. Because stakeholder expectations are diverse and ever-changing, creating value requires the collaborative efforts of the whole operation. It should address the desire and dedication of workers at all levels. Clients, operational teammates, suppliers, and community members in processing and adjudicating tenders. Each group has unique interests and expectations.

8. The Workshop Process shall consist of the following. A diagrammatic portrayal is depicted herewith:

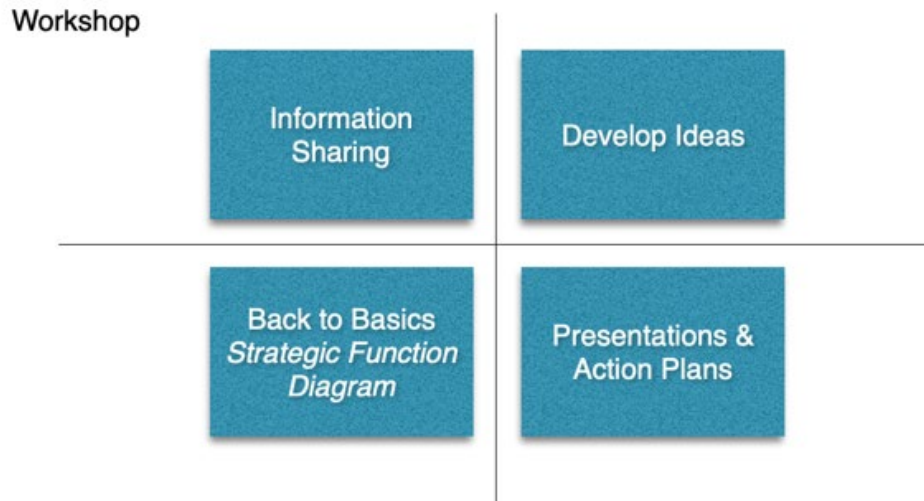


Figure 6.2: VM Workshop Process.

The figure hereunder portrays an example of VM tools that can be used for each stage:



Figure 6.3: Workshop Tools.

9. Although initial cost and savings are important, the overall project scope, baseline programme, reliability, quality, efficiency and maintainability are to be the prime considerations in a value management study.
10. The Value Management Study and Action Report recommended during the Value Management Study are to be maintained as part of the project.

6.3 Doctoral Output II: Implementation Methods to Incorporate into the Framework

Research Question

Can Value Management techniques be used to achieve best value in the local public service sector environment and improve the quality of the public service?

The utilisation of VM practices in Maltese public sector projects, was linked to the hypothesis that experiencing a VM approach positively influences the belief that structured tools or frameworks ensure a cost-benefit approach. A thorough evaluation of existing practices and their comparison with global standards formed an intrinsic part in answering this research question. VM practices were rarely in use and they were not consistently applied across projects, thus leading to varied outcomes. Key to note that the benchmarking of local practices against international best practices (Kelly, Male , & Drummond, 2015) revealed significant gaps in implementation, particularly in aligning project outcomes with best value and quality standards.

In terms of implementation measures for future advancement, the integration of VM techniques can help achieve better product value and improve the quality of public service projects, when applied systematically. The development of the framework to fulfil the objectives of this study, is supported by the data showing that VM frameworks can help optimise resource allocation and improve project alignment with stakeholder needs, thus confirming **Hypothesis 1**. Moreover, **Hypothesis 7** stating ‘that a structured VM tool enhances cost-benefit decision-making’ was validated by the study’s findings, with the outline improving both the quality and efficiency of the project pre-tendering process. Hence for purposes of decision-taking, the insertion of a structured tool in public procurement processes may help the government achieve its economic development and recovery objectives. The Ministry of Finance and Employment's Department of Contracts (DOC) with its aim to seek improving the efficiency of its public procurement system via strengthened regulatory functions, could benefit from this practice, resulting in more value for money.

Research Question

Do Value Management methods improve project efficiency and quality in the public sector? If so, how?

In supporting implementation methods for public procurement processes, this question focused on evaluating the benefits of VM interventions in improving project efficiency and quality. This inquiry was also tied to several hypotheses, particularly those concerning the alignment of project objectives with client requirements (**Hypothesis 2**), the testing of technical solutions using appropriate tools (**Hypothesis 3**) and the correlation between VM knowledge and project success (**Hypothesis 6**).

The study demonstrated that VM significantly improves both project efficiency and quality by fostering better communication, ensuring early-stage alignment of project goals and utilising

structured decision-making tools. Furthermore, quantitative analyses revealed a marked improvement in the project process, particularly in efficiency. Qualitative feedback from stakeholders supported these findings, with participants noting how VM workshops and tools such as Function Analysis and SWOT helped clarify project objectives and eliminate inefficiencies. The results confirmed **Hypotheses 2, 3, and 4**, showing that VM helps ensure alignment with client needs, properly tests technical solutions and achieves project objectives within scope.

Implementation and Customised Value Management Framework

In developing a customised VM framework tailored to the Maltese public service sector, which incorporates the results of the study to enhance project delivery, one must recognise that currently the public procurement processes, focuses on: i) the organisational framework of the public procurement system, ii) internal procedures for executing public procurement, iii) the procurement procedures, iv) the implementation of a risk-based approach in procurement activities, v) the strategic utilisation of public procurement, vi) the professionalisation of the procurement workforce, and vii) the establishment of key performance indicators alongside data-driven methodologies supported by key findings in the OECD Report 2023. This suggests that the formalised method for using a Standard Operating Procedure (SOP), to allow continuous improvement based on project feedback and evolving best practices is a solution for core and supplementary procurement functions mostly addressed in Malta.

The SOP, developed in collaboration with Ambjent Malta, is intended to serve as a practical and educational tool for improving pre-tendering practices and project management. The SOP's structure ensures that VM principles are embedded into project lifecycles, confirming **Hypothesis 5**, which predicted improved communication within project teams and stakeholders through the implementation of a structured VM framework. Additionally, the study confirms that structured alignment and verification processes during the planning and execution phases prevented the inconsistencies in project outcomes predicted by **Hypothesis 8**. Key to highlight is its contribution towards optimising vetting procedures by; i) standardizing and minimising the layers involved, ii) enhancing the training capabilities of vetting officials to provide consistent input, and iii) establishing minimum and maximum thresholds for vetting processes. Results in this study support formulating the comprehensive legal foundation for public procurement by applying the relevant laws, as well as the regulations officially enacted by the government to facilitate the application of main legislation.

6.4 The Value Management Framework for Enhancing Pre-Tendering Practices Across Public Service Projects

The development of the Standard Operating Procedure (SOP) as a framework for Value Management (VM), introduced in this study, provides a structured, replicable framework aimed at improving project outcomes across multiple public service sectors in Malta. While

VM principles are well-established internationally, particularly in enhancing project quality, cost efficiency and stakeholder engagement (Kelly, Male , & Drummond, 2015), their formal adoption within Malta's public sector has remained limited. This gap is addressed through the guideline presented earlier in this chapter that can be tailored to a variety of project types, including construction, environmental and social service initiatives. A key strength of this procedure lies in its adaptability. It provides a systematic approach applicable to the pre-tendering phases of a broad range of projects, ensuring that stakeholders make informed decisions grounded in value rather than cost alone. The formalisation of the steps required to conduct a Value Management Study prior to tendering ensures alignment between project goals and stakeholder needs, thereby optimising value throughout the project lifecycle. This structured approach mitigates common issues such as cost overruns and scope creep, which have historically plagued major Maltese public sector projects (Mifsud, 2024).

The classification of various contracting authorities within each Schedule is determined by the procurement capabilities of each respective authority. Nevertheless, no specific criteria have been conveyed through time, which means that several contracting agencies say that a situation may arise were a state of misunderstanding happens as they are using their own procurement standards. The SOP suggests that in counter-mitigating such matters, systematic alignment and verification procedures throughout the planning and execution stages prevents the variations in project results to arise. The key aspect to emphasise herewith is that process optimisation and functional needs require standardising and reducing the layers required. This can be achieved once the team applies the management methods in their capability to fulfil all obligations.

6.4.1 The Educational Role of the SOP in Pre-Tendering Practices

One of the most significant contributions of this SOP is its role in the educational development of stakeholders involved in public service projects. By embedding VM principles at the pre-tendering stage, the SOP acts as a foundational tool for educating project teams on balancing cost, quality and functionality, which is essential for project success. The study revealed a striking lack of familiarity with the Value Management Standard EN12973:2020, with 90% of respondents indicating limited knowledge or experience. This gap highlights the importance of integrating structured frameworks like the SOP into training and capacity-building initiatives. International literature supports the notion that structured, process-driven approaches like SOPs are essential in improving public sector project outcomes (Langford & Male, 2001). By following the SOP, public sector project managers and stakeholders can gain hands-on experience with VM tools such as Function Analysis, Life Cycle Costing and SWOT Analysis. This educational component not only enhances technical understanding but also improves the ability to align projects with long-term national priorities, particularly in terms of environmental sustainability (Office of Government Commerce, 2007). Thus, the SOP fosters a culture of continuous learning and improvement, which is crucial for public sector projects where accountability and transparency are paramount.

6.4.2 Enhancing Pre-Tendering Efficiency and Quality Through the SOP Framework

The SOP's structured approach to pre-tendering decisions plays a pivotal role in enhancing both efficiency and quality in public service projects. The study found that 90% of respondents recognised the limitations of awarding tenders based on the lowest cost criteria, acknowledging that this practice often compromises project quality (Mifsud, 2024). By adhering to the SOP, which mandates a comprehensive analysis of project functions, alternatives and long-term value, decision-makers can shift focus from cost minimisation to achieving the best overall value for public resources.

This approach aligns with the findings of Kelly *et al.* (2015), who argue that Value Management enables project stakeholders to identify optimal solutions that balance cost, quality and performance (Kelly *et al.*, 2015). The SOP ensures that these principles are systematically applied in the pre-tendering phase, helping to eliminate inefficiencies and prevent common pitfalls associated with poorly defined project scopes. As a result, the SOP not only ensures that the most appropriate solutions are identified but also enhances project outcomes, contributing to the long-term sustainability and efficiency of public service projects in Malta.

6.4.3 Linking the SOP to Study Findings: Strengths, Opportunities and Challenges

The introduction of the question, *"What strengths, opportunities, and problems have you encountered during the application of the Value Management approach?"* in the post-test allowed participants to reflect on their real-world experiences with VM. The structured nature of the SOP provides a framework through which these reflections can be systematically addressed, offering opportunities for continuous improvement in future projects.

For example, the SOP's requirement for Value Management Workshops aligns with the study's findings that 79.6% of participants found these workshops integral to improving project communication and decision-making. The workshops facilitated by the SOP create an educational environment where stakeholder feedback is continuously incorporated, ensuring that the VM process evolves alongside project needs. This structured feedback mechanism is critical for refining project approaches, particularly in dynamic sectors such as environmental management, where project goals may shift due to regulatory or ecological factors.

6.4.4 Implications for Future Projects and Education

The adoption of the framework as a standard practice across Malta's public service sector has significant implications for both future projects and stakeholder education. The SOP formalises a process through which stakeholders can engage with VM principles in a hands-on, systematic manner, thereby reinforcing the educational aspects of pre-tendering. This aligns with the study's findings, which showed that 81.8% of respondents believed that the VM framework effectively tested technical solutions and added value to project outcomes.

Moving forward, integrating the SOP into training and professional development programmes for project managers, engineers and decision-makers is crucial. As Male *et al.* (2016) suggest, structured training in Value Management is essential for building the technical expertise

necessary to manage complex public sector projects (Male *et al.*, 2016). Incorporating the SOP into these training programmes will help address the current knowledge gap identified in this study and ensure that VM principles become a standard part of pre-tendering practices across Malta's public service sector. The framework for Value Management developed in this study offers a structured, systematic approach that enhances the pre-tendering phase of public service projects. By formalising the steps required for conducting a Value Management Study, the SOP not only educates stakeholders on VM principles but also ensures that these principles are applied in a consistent and methodical manner. The adoption of the SOP in pre-tendering phases can help address the knowledge gaps identified in this study, while also improving the overall quality and efficiency of public sector projects in Malta. As the study suggests, integrating this SOP into training and development programmes will be instrumental in building the capacity needed to deliver sustainable, cost-effective and high-quality public sector projects.

6.5 Further Recommendations

The study underscored the critical need for a standardised VM framework across the Maltese public sector. This framework, developed in collaboration with Ambjent Malta, the Environmental Government department, integrated specific environmental considerations essential to public projects. It provided comprehensive guidelines for VM processes, including stakeholder engagement strategies, sustainability assessments and project scope management. A primary suggestion is the creation and execution of the standardised VM framework as an intrinsic part of all procurement routes. This framework will integrate best practices as seen through international standardisation, while being customised to the Maltese scenario. It would guarantee the incorporation of explicit criteria for incorporating environmental factors, especially in projects overseen by the Environmental Department. The creation of this framework was guided by a comprehensive methodology, integrating literature studies, statistical and thematic analysis, and stakeholder input to guarantee its relevance and application (Langford & Male, 2008).

Another recommendation is the enhancement of training and capacity building in VM. The study called for the implementation of structured training programmes designed to bolster the understanding and skills of public sector employees and stakeholders in VM practices. These programmes should be integrated into the existing professional development structures of departments like Ambjent Malta, encompassing both theoretical knowledge and practical applications. Regular updates and workshops were recommended to keep abreast of new developments and best practices in VM (Male, Kelly, & Gronqvist, 2007). The research also highlighted the necessity of formally integrating VM methodologies into public procurement policies. This recommendation was founded on empirical evidence demonstrating that VM practices yielded better project outcomes, particularly in terms of resource allocation and sustainability. Incorporating VM principles into procurement

frameworks would enable the Maltese government to institutionalise these benefits, ensuring consistency and maximising the value derived from public projects (Green & Popper, 2010). Moreover, the establishment of continuous improvement mechanisms within the VM framework was recommended. This includes the creation of feedback loops and regular updates to the Standard Operating Procedure (SOP) developed with Ambjent Malta, informed by lessons learned from completed projects. This iterative process is deemed essential for refining VM practices, making them more adaptable to the dynamic needs of the public sector and ensuring alignment with evolving best practices (Olawale & Sun, 2010).

Finally, the developed framework is designed for scalability and universal applicability across multiple public service sectors in Malta, tailored to suit a variety of project types including construction, environmental conservation, and social service initiatives, and serves as a model for other departments aiming to enhance project delivery and mitigate issues like scope creep and misalignment of objectives.

6.6 International Contribution to Knowledge

This study has aimed towards an international contribution to the global discourse on Value Management (VM) by exploring its application within the specific context of Malta's public sector. Internationally, VM has been implemented in varied forms across different sectors and economies, with countries like the UK, the USA, and Japan leading in both theory and practice (Male et al., 2016). However, there remains a gap in tailored VM frameworks that address the unique constraints of small states with limited resources and specific environmental and regulatory demands. This research fills that gap, adapting VM principles to a small-state context and illustrating how VM can be effectively applied to enhance efficiency, cost management, and stakeholder alignment in public projects. A major contribution of this study is its adaptation of established VM practices, traditionally applied in larger economies, to Malta's distinct public sector needs. Drawing on the European Standard EN12973:2020, the research customises these international guidelines to support Maltese projects, demonstrating that VM can offer scalable solutions that address small-state challenges. This adaptation provides a model for other regional governments and small states seeking to implement VM with a focus on both compliance and practicality in constrained environments. The study's findings are consistent with global research on VM's role in optimising project efficiency and quality while managing costs and improving stakeholder communication (Kelly, Male & Graham, 2015). Through empirical analysis, including pre- and post-test studies, case studies, and statistical evaluation, this research substantiates VM's capacity to mitigate issues like scope creep and misalignment of objectives, challenges that are universally relevant in project management. This evidence strengthens the argument for VM's universal applicability, expanding its credibility beyond large-scale economies and public service contexts. The Standard Operating Procedure (SOP) developed here offers a structured, replicable VM framework that, while tailored for Malta's public sector, is versatile enough to

apply internationally. This SOP, aligned with global best practices, provides a template for embedding VM principles in pre-tendering processes and stakeholder engagement strategies. It serves as a resource for other governments seeking to formalise VM with a practical, adaptable approach that balances cost, quality, and long-term project value.

This research identifies a significant gap in VM training within Malta, echoing international findings on the critical role of skilled practitioners in VM's successful implementation (Langford & Male, 2008). The study's recommendation for targeted training and development programmes underscores the importance of building VM capacity at all levels. By prioritising structured training and practical workshops, this research contributes to the international conversation on education's role in sustaining VM's effectiveness across diverse environments. Finally, this study identifies opportunities for further international research, particularly regarding VM's long-term impacts on public sector efficiency in small states. The findings suggest that adapting VM to diverse regulatory and economic contexts enhances its flexibility and relevance. Future studies could expand on this work by exploring cultural and regulatory nuances in VM application, thereby enriching the global understanding of its potential across different regions and contexts.

It significantly enhances the understanding of VM in the public sector and contributes both towards academic and practical discourse by demonstrating how VM practices could be tailored to address the unique challenges faced by small states, such as limited resources and distinct environmental considerations. Sorrell (2003) and Abidin and Pasquire (2005) specifically mention 'value management' as a means to address sustainability. It is suggested that sustainable practices are integrated into the design in the early stages and then 'proactively value managed' (Bartlett and Howard, 2000). Value management focuses on eliminating waste and examining the whole life costs of the facility to ensure the best value option is selected based on the values important to the client. Van Bueren and Priemus (2002) emphasise the improvement of communication between players which is evidently something that value management could address. Finally, the research identified avenues for future exploration, such as investigating the long-term impacts of VM training and understanding the role of cultural factors in the adoption of VM practices. This forward-looking perspective ensures that the study's contributions will continue to influence the field long after its immediate findings.

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Appendix 1: Pre-Test Study Results

As explained in the Methodology Chapter, the Initial Pre-test Questionnaire was sent to eleven (11) respondents. All respondents replied to the pre-test study. These were all primary stakeholders and key decision makers who took part in the case studies throughout the process.

Demographics – Work designation

It was noted that from the eleven respondents, 11 replies were received, seven respondents (63.6%) came from a Project Management works designation. Whilst the others consisted of one Client Architect, one Stakeholder, one Public Administration Headship position and another from the Design Office. The respondents answered the questions denoted in the sections below on their perception and current use of Value Management.

Section 1 - Understanding the perception and current use of Value Management: Question 1

Work Designation
11 responses

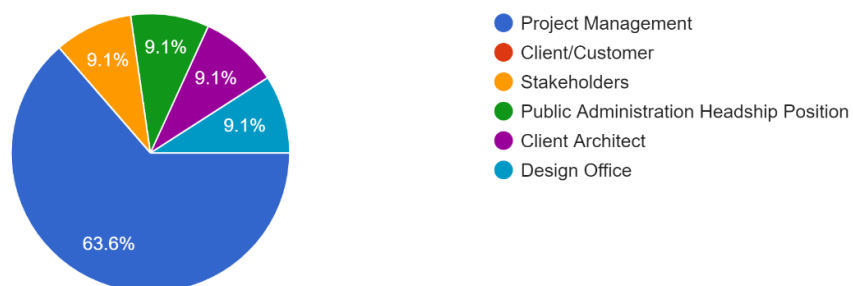


Figure A1.1: Work Designation Pie Chart.

Do you believe that a structured tool/framework would help in order to ensure a cost-benefit approach when awarding public contracts as recommended in Public Procurement Regulations?

Eight respondents (72.7%) ticked the number four (useful) regarding the potential benefit of having a structured tool/framework. One respondent (9.1%) was Neutral, marking a three.

Do you believe that a structured tool/framework would help in order to ensure a cost-benefit approach when awarding public contracts as recommended in Public Procurement Regulations?
11 responses

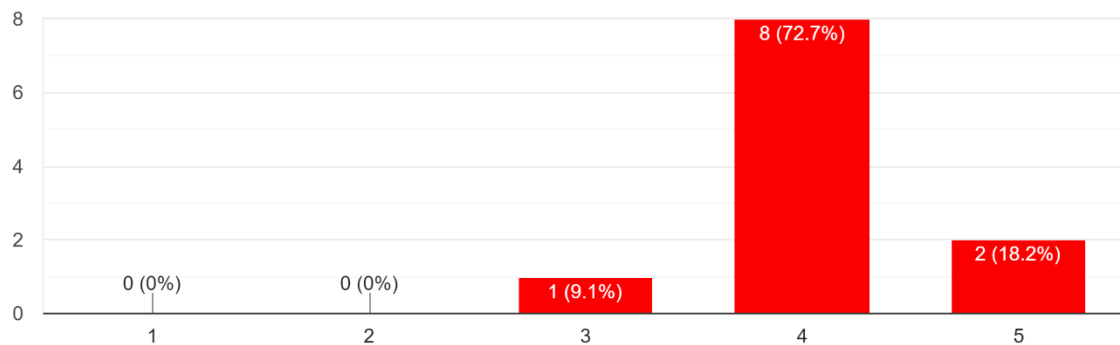


Figure A1.2: Initial Pre-test Questionnaire: Section 1 Q1.

Whilst 18.2% (Two respondents) believe that having a structured tool/framework would be very useful.

Section 1 - Understanding the perception and current use of Value Management: Question 2

To what extent do you feel that awarding tenders by lowest cost criteria is a measure of good quality?

To what extent do you feel that awarding tenders by lowest cost criteria is a measure of good quality?
11 responses

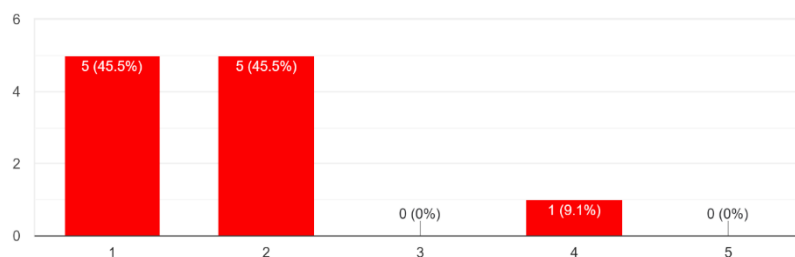


Figure A1.3: Initial Pre-test Questionnaire: Section 1 Q2.

The large majority of respondents, 91% believe that awarding tenders by the lowest cost-criteria is not a measure of good quality.

Section 1 - Understanding the perception and current use of Value Management: Question 3

Is the original intent/need of the project tested enough in order to ensure that it is aligned to what is required by the Client?

72.7% of respondents believe that the original intent/need of the project is currently only partially being tested in order to ensure it is aligned to what is required by the client. However, 27.3% believe that this is being met.

Is the original intent/need of the project tested enough in order to ensure that it is aligned to what is required by the Client?
11 responses

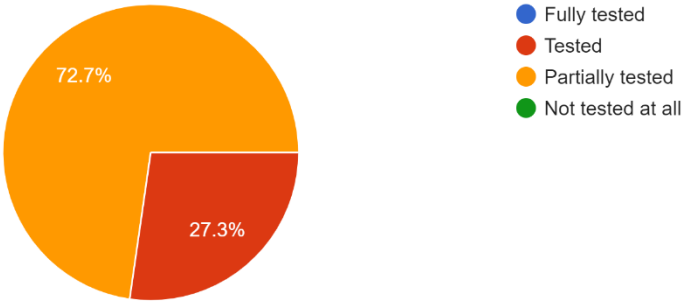


Figure A1.4: Initial Pre-test Questionnaire: Section 1 Q3

Section 1 - Understanding the perception and current use of Value Management: Question 4

Is the technical solution to the above question, (project need) tested by using a tool or technique prior to a tender being issued?

Is the technical solution to the above question, (Project need) tested by using a tool or technique prior to a tender being issued?
11 responses

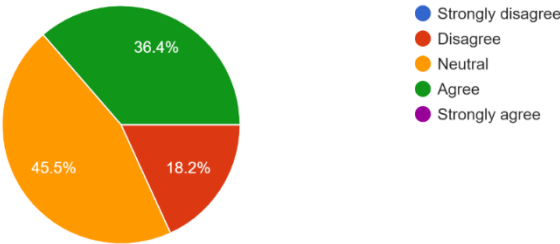


Figure A1.5: Initial Pre-test Questionnaire: Section 1 Q4.

45.5% of the respondents were neutral with regards to this with 36.4% agreeing and 18.2% disagreeing.

Section 1 - Understanding the perception and current use of Value Management: Question 5

Are the project's objectives in relation to the project need (scope) achieved?

Are the project's objectives in relation to the project need (scope) achieved?
11 responses

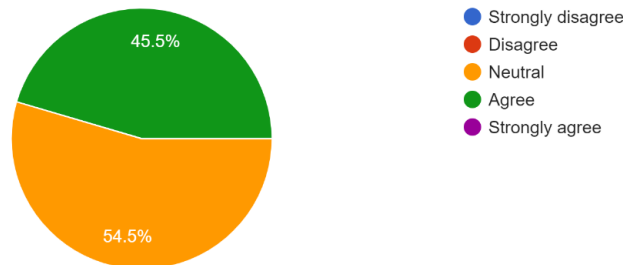


Figure A1.6: Initial Pre-test Questionnaire: Section 1 Q5.

Regarding achievement of the project need, it seems that 45.5% believe that the Project Scope is being achieved whilst the other 54.5% have a neutral unsure position regarding this.

Section 1 - Understanding the perception and current use of Value Management: Question 6

How do you rate the current level of communication within your project team and stakeholders?

How do you rate the current level of communication within your project team and stakeholders?
11 responses

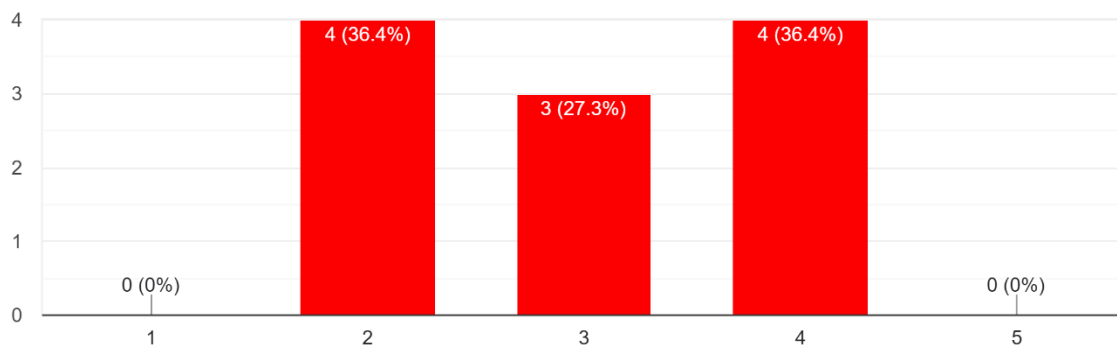


Figure A1.7: Initial Pre-test Questionnaire: Section 1 Q6.

The current level of communication ranged from poor to very good with 36.4% replying Very Good, 27.3% Neutral and 36.4% Poor.

Section 1 - Understanding the perception and current use of Value Management: Question 7

What problems arise as a result of awarding projects on the basis of the lowest cost criteria?

What problems arise as a result of awarding projects on the basis of the lowest cost criteria?

11 responses

poor quality / unexperienced workers/ lack of professionalism

Projects or parts of, are not followed up by the authorities.

Unqualified personnel, skills lack.

possibility of modifications to achieve desired output

Contractors use poor quality supplies although specifications would still be met

In certain instances, quality is compromised.

Poor quality; Delay in completion of works

Hidden costs and many extra over item/Lump sum items which still end up raising the cost. Sometimes lower rates are due to inferior material and cost cutting by contractor which will cost more in making good for lack of experience.

Subsequent increased current and maintenance costs.

Mostly the "sena u arti" that we as Maltese Citizens used to execute in the past due to influx of foreign workers

Costs increase at a later stage with numerous variations being requested from the Contractor. Quality is also very often less than desired.

The replies for the above question, a snapshot of which is depicted below, show a clear indication that the biggest loser when it comes to awarding tenders by lowest cost criteria is quality. Loss of quality was mentioned by the majority of the respondents and is a common theme throughout the responses. This will be further discussed later in the Discussion chapter.

Section 2 – Definition of Value Management: Question 1

How do you define Value Management?

How do you define Value Management?

11 responses

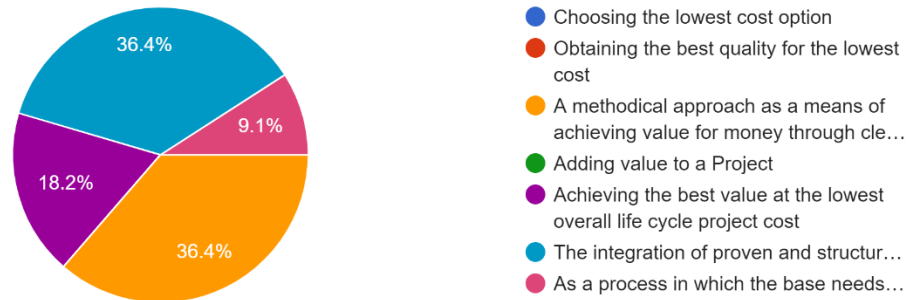


Figure A1.8: Initial Pre-test Questionnaire: Section 2 Q1.

From the responses received one can link to the definition provided in the Literature and mentioned earlier in the study that the definition of Value Management is, in fact, a tapestry of definitions that together give us an ideal of what Value Management should be.

Section 2 – Definition of Value Management: Question 2

What do you understand by Value Management?

All replies received in response to the above question, a snapshot of which is depicted below, highlighted at least the basic understanding of the meaning of Value Management.

11 responses

the actual value that one can really obtain, which is not all about costs
Value Management is a structured approach based on a well defined work plan. It should be guided by scientific data (not political) .Leadership, communication ,motivating & developing skills and finding a balance between the needs and wants of stakeholders .
The creation of sustainable value to a project
analytical approach in planning process aiming for better results and/or output
Obtain value for money in the execution of the projects
In my opinion, this is an extension to the Best Price Quality Ratio implemented in, particularly, the procurement of services. The project is value managed even during the implementation stage.
Achieving the best possible outcome with the least possible costs for all those involved in the process
The budget required for a project is managed carefully in order to obtain the client's predicted idea/vision
Project management oriented towards obtain augmented value of funds invested in a project.
The execution of a project for a long term value to the public including the structured approach during the implementation.
Obtaining best value and saving costs when doing projects

Section 2 – Definition of Value Management: Question 3

What is your knowledge or experience of Value Management?

What is your knowledge or experience of Value Management?

11 responses

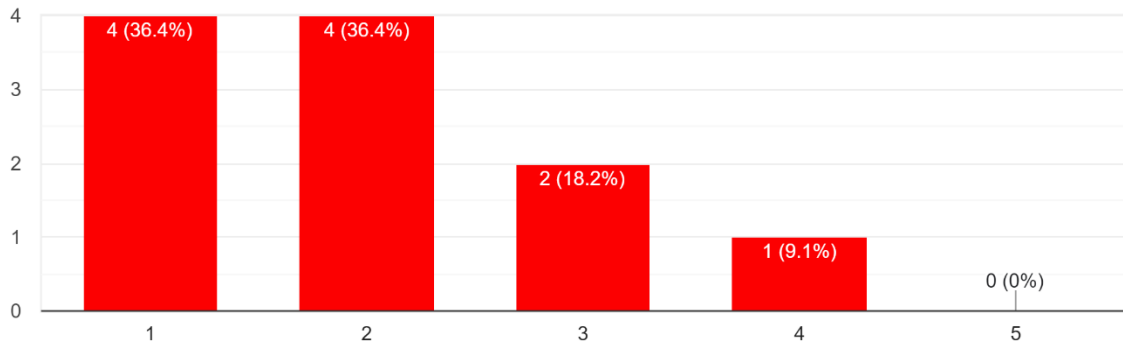


Figure A1.9: Initial Pre-test Questionnaire: Section 2 Q3.

From the replies received, it was noted that knowledge and/or experience of value management is poor and limited, with 36.4% stating that it is very poor and 36.4% stating

that it is poor and 18.2% neutral. Only 9.1% of respondents (which is one respondent) replied that they have good knowledge or experience of Value Management.

Section 2 – Definition of Value Management: Question 4

What is your knowledge or experience of using the Value Management Standard EN12973:2020?

What is your knowledge or experience of using the Value Management Standard EN12973:2020?

11 responses

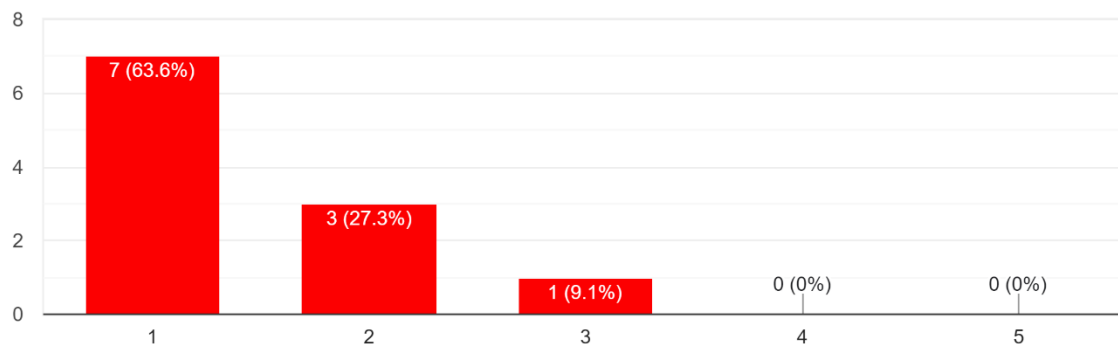


Figure A1.10: Initial Pre-test Questionnaire: Section 2 Q4.

Once more it is clear that knowledge of the Value Management Standard is very limited with 63.6% and 27.3% replying that they have very poor and poor knowledge and/or experience of the standard, respectively. No respondents answered as having good or excellent knowledge of the same aforementioned standard.

Section 2 – Definition of Value Management: Question 5

Have you ever used Value Management in your work?

Have you ever used Value Management in your work?

11 responses

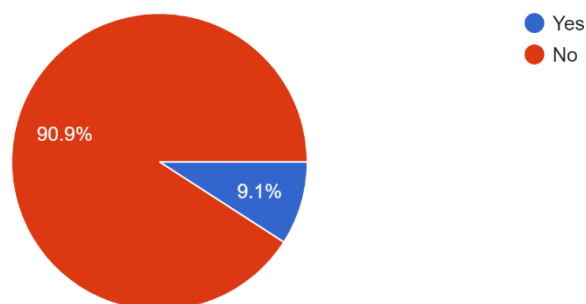


Figure A1.11: Initial Pre-test Questionnaire: Section 2 Q5.

90.9% of the respondents replied in the negative and have never used Value Management prior this research study.

Section 3 - Use of Value Management: Question 1

Indicate the industry where Value Management was applied to:

Indicate the industry where Value Management was applied to.

1 response

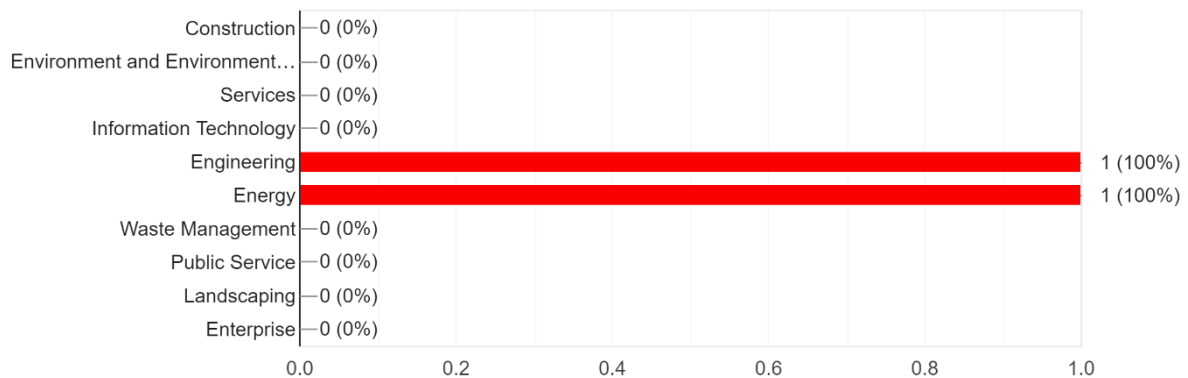


Figure A1.12: Initial Pre-test Questionnaire: Section 3 Q1.

The respondent/user who answered favourably was then asked to indicate which sectors benefitted from the application of Value Management techniques. The user marked the Energy and Engineering sectors.

Section 3 - Use of Value Management: Question 2

Which tools have you found most effective?

Which tools have you found most effective?

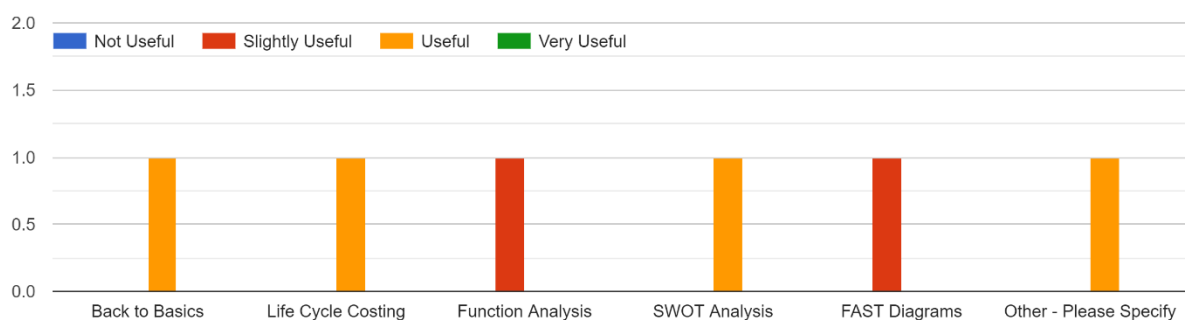


Figure A1.13: Initial Pre-test Questionnaire: Section 3 Q2.

Regarding the tools used the single respondent who has experience of using Value Management encountered various useful tools most notably Back to Basics, Life Cycle Costing and SWOT Analysis. It is interesting that Function Analysis/FAST, which are classified as predominantly the most important tool when using the Value Management Approach, was not deemed as very useful by the respondent.

Section 3 - Use of Value Management: Question 3

At what stage of the Project Life Cycle do you implement Value Management?

At what stage of the Project Life Cycle do you implement Value Management?

1 response

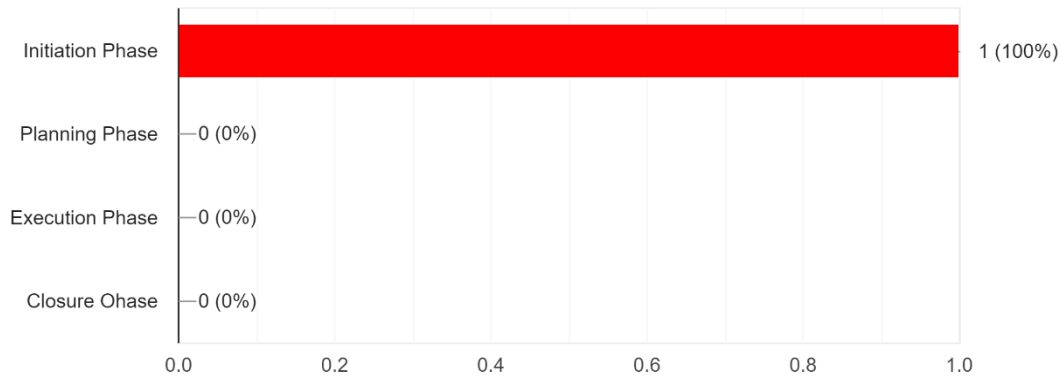


Figure A1.14: Initial Pre-test Questionnaire: Section 3 Q3.

The single respondent with experience of using Value Management used Value Management in the Initiation Phase which is considered the most effective phase to get the most out of Value Management.

Section 3 - Use of Value Management: Question 4

Do you find Value Management Workshops an integral and useful part of your Value Management Approach?

Do you find Value Management Workshops an integral and useful part of your Value Management Approach?

1 response

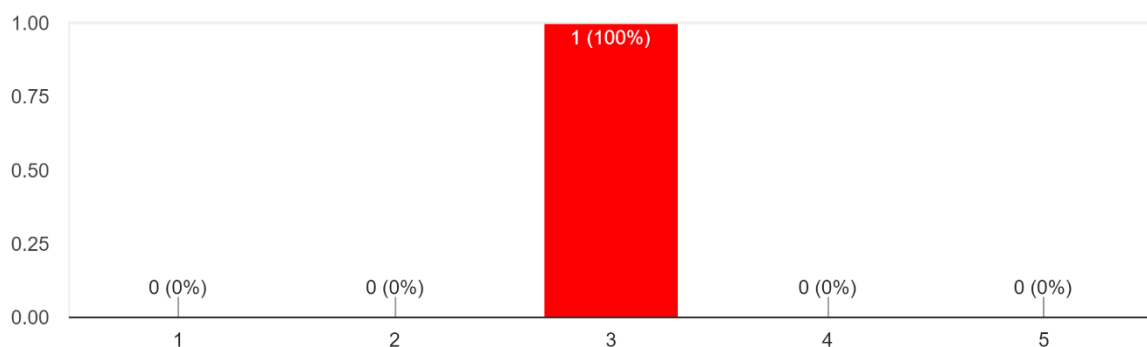


Figure A1.15: Initial Pre-test Questionnaire: Section 3 Q4.

The same respondent was also undecided regarding the usefulness of the Value Management Workshop as part of the Value Management approach. This raises doubts about the quality of the Value Management Approach undertaken by the respondent as

Value Management Workshops are an integral part of the Value Management Approach and cannot appropriately function without them.

Section 4 - Drivers of Value Management: Question 1

What are the drivers to use Value Management?

What are the drivers to use Value Management?

11 responses

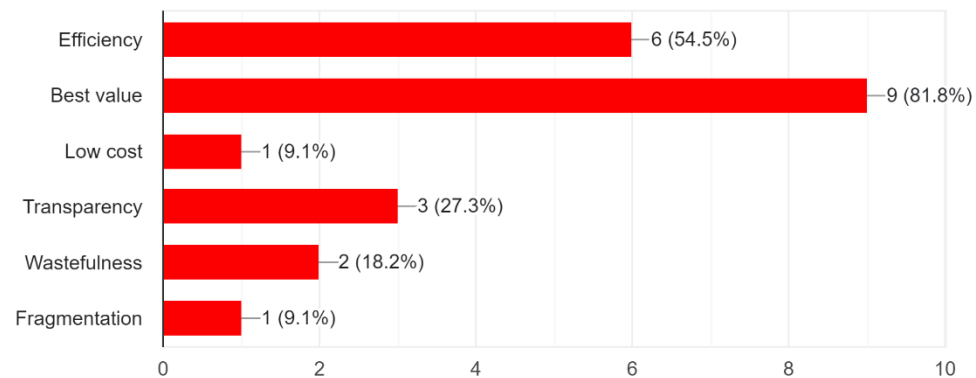


Figure A1.16: Initial Pre-test Questionnaire: Section 4 Q1.

From Question 1 of Section 4, i.e., Question 18, the focus of questions was once again for all respondents of the Pre-Study Questionnaire. Questions 18 to 24 deal with the Project Drivers to use Value Management. The first question deals with the general drivers to use Value Management. The main predominate driver was best Value with 81.8% of respondents marking this as the main driver to use Value Management.

Section 4 - Drivers of Value Management: Question 2

Do you agree with the below statements regarding Efficiency as driver to use Value Management?

Do you agree with the below statements regarding Efficiency as driver to use Value Management?

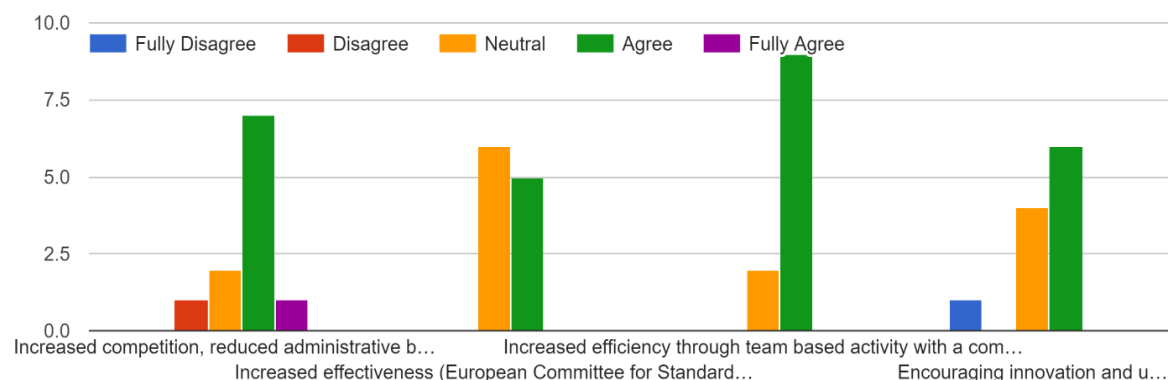


Figure A1.17: Initial Pre-test Questionnaire: Section 4 Q2.

This question laid out a number of statements found in the literature which highlight efficiency as a driver for Value Management. The statement which had the most boxes ticked for the “Agreed” score was “Increased efficiency through team-based activity with a common focus” (Institute of Value Management, 2014).

Section 4 - Drivers of Value Management: Question 3

Do you agree with the below statements regarding Best Value as driver to use Value Management?

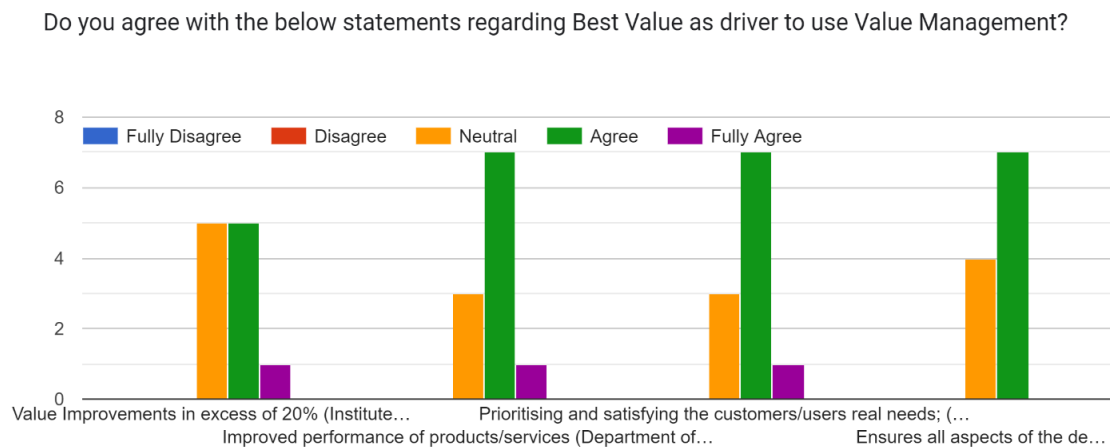


Figure A1.18: Initial Pre-test Questionnaire: Section 4 Q3.

This question asked the stakeholders regarding Best Value as a driver for Value Management. The majority of respondents agreed with all statements regarding Value Management.

Section 4 - Drivers of Value Management: Question 4

Do you agree with the below statements regarding Lowering Cost as driver to use Value Management?

Do you agree with the below statements regarding Lowering Cost as driver to use Value Management?

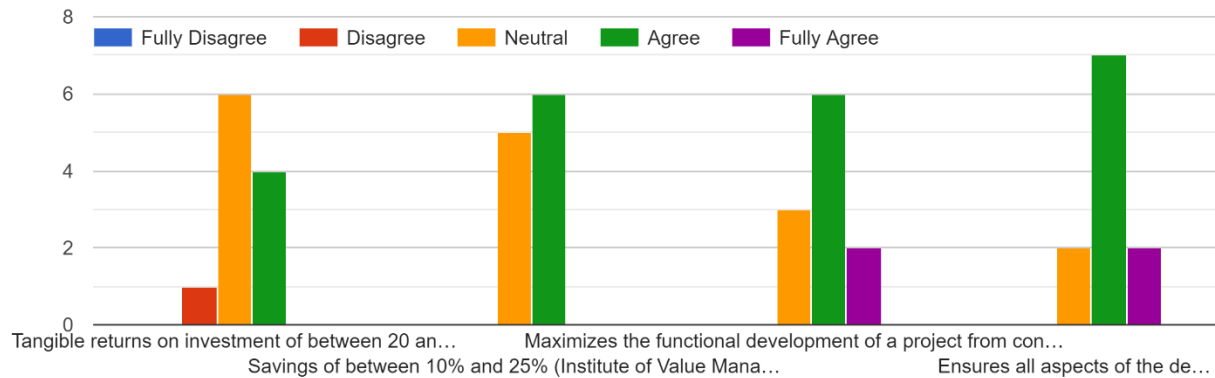


Figure A1.19: Initial Pre-test Questionnaire: Section 4 Q4.

This question dealt with Lowering Cost as a driver to use Value Management. From the responses received, the statement “Ensures all aspects of the design are cost effective for their required purpose” was deemed as the most agreed to statement, as there were 80% (70% Agree and 20% Fully Agree) of respondents agreeing with this statement as the best one which defines Lowering Cost as a driver to Value Management.

Section 4 - Drivers of Value Management: Question 5

Do you agree with the below statements regarding Transparency as driver to use Value Management?

Do you agree with the below statements regarding Transparency as driver to use Value Management?

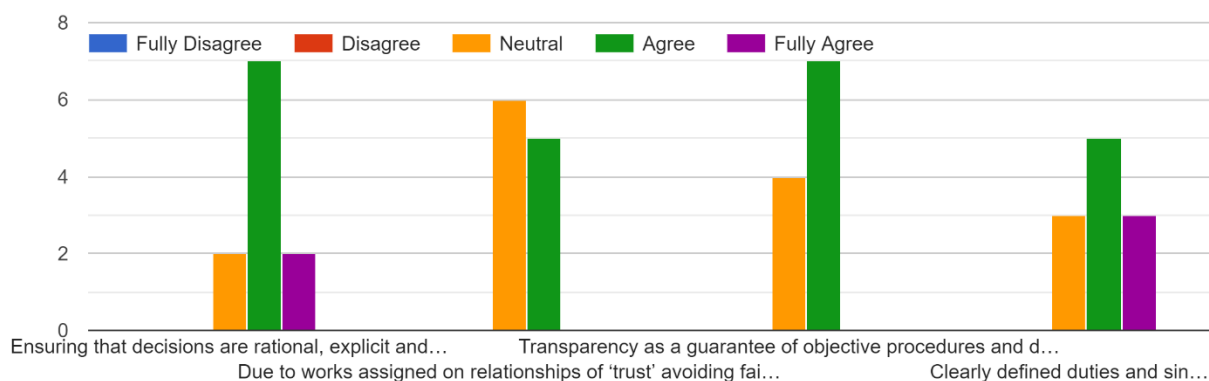


Figure A1.20: Initial Pre-test Questionnaire: Section 4 Q5.

This question generated several “agree responses” for all statements. However, when combined with the ‘fully agree’ response the first statement that of ‘Ensuring that decisions

are rational, explicit and countable’ had 90% respondents in agreement that this statement was the best definition for Transparency as a driver for Value Management.

Section 4 - Drivers of Value Management: Question 6

Do you agree with the below statements regarding reducing wastefulness as driver to use Value Management?

The next question focussed on reducing wastefulness. Here the statement that was included in the questionnaire, ‘The practice of awarding contracts to the lowest bidders encourages contract amendments, which in turn leads to cost overruns’ (Paquette, 2014) was deemed by the absolute majority of respondents to be a key statement which emphasises Reducing Wastefulness as a key driver for implementing a Value Management approach.

Do you agree with the below statements regarding reducing wastefulness as driver to use Value Management?

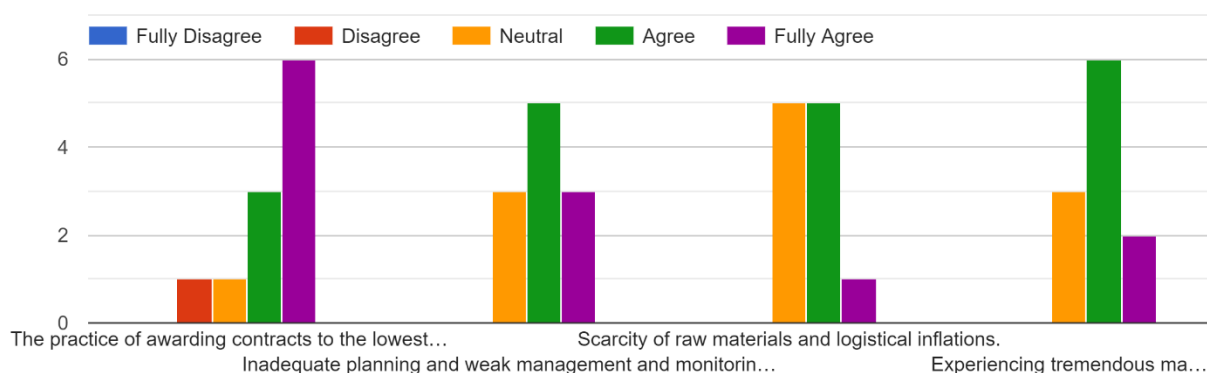


Figure A1.21: Initial Pre-test Questionnaire: Section 4 Q6.

Section 4 - Drivers of Value Management Question 7

Do you agree with the below statements regarding reducing fragmentation as driver to use Value Management?

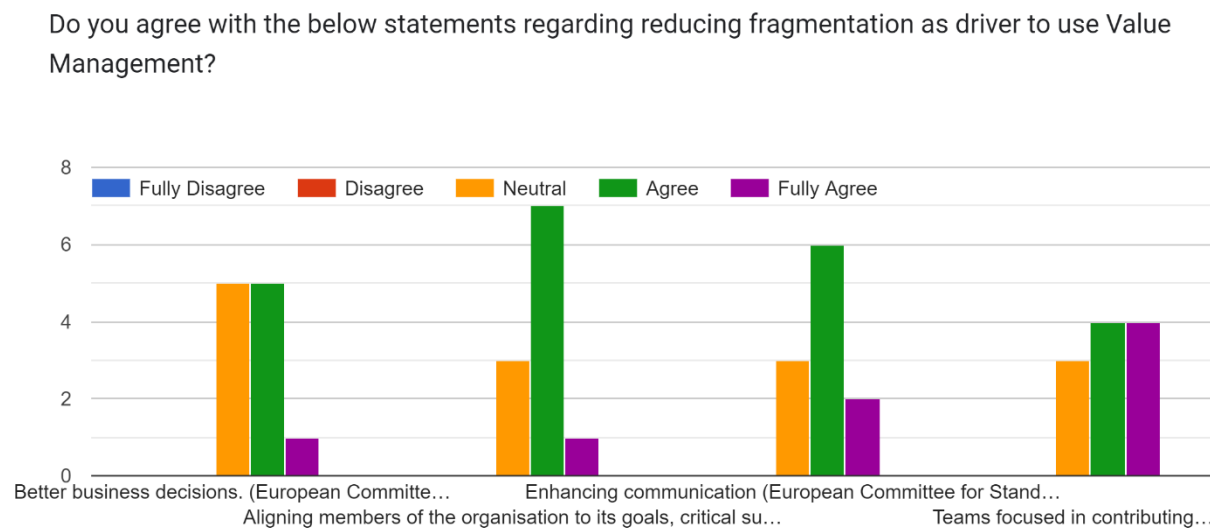


Figure A1.22: Initial Pre-test Questionnaire: Section 4 Q7.

Whilst only one respondent considers fragmentation as a useful driver for Value Management, it was interesting to note that, when it came to answering this question, respondents agreed that aligning members to the goals, critical success factors and enhancing communication could be considered useful in order to consider reducing fragmentation as a driver to use Value Management.

Demographics

Work Experience

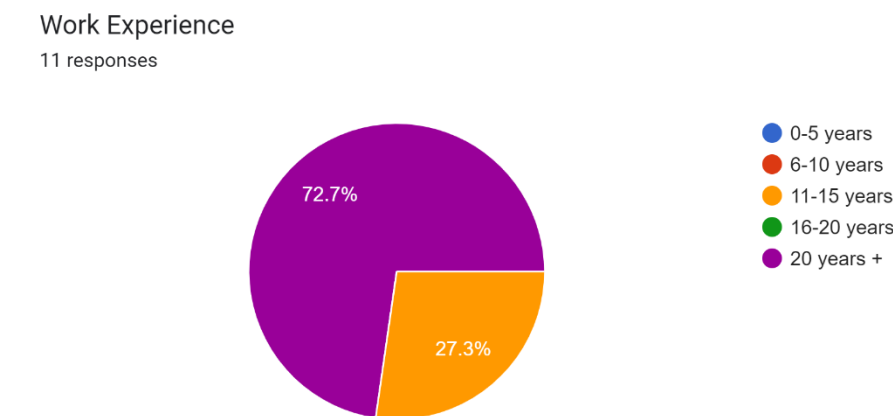


Figure A1.23: Work Experience.

From the demographic in question, it was noted that the majority of the participants taking part in the study had vast experience, with all participants eclipsing the 10-years'

experience and 72.7% of them having 20 years plus work experience. A multiple Linear Regression using this demographic was carried out.

Demographics

Size of project in euro (Estimate of project size usually carried out).

Size of Project in euro (Estimate of Project size usually carried out)

11 responses

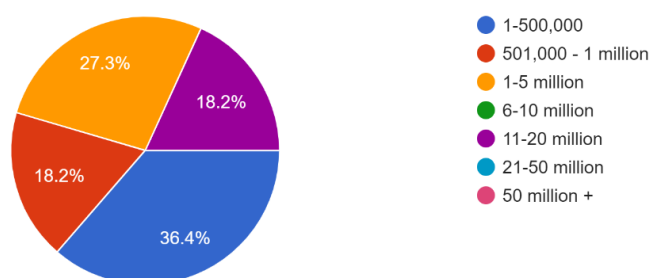


Figure A1.24: Project Size by Estimated Cost.

This question related to the approximate project size, in terms of value, the participants have mostly encountered during their work experience. This is important in order to better understand whether the application of Value Management would have provided considerable gain had it been implemented. From the data gathered, the majority of the participants dealt with projects ranging from 1-500,000 euro and 1-5million euro projects.

Demographics

Project Ownership

Project Ownership

11 responses

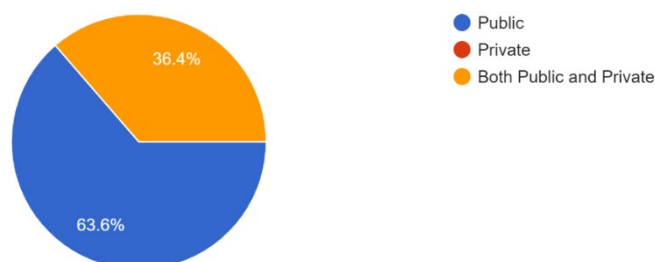


Figure A1.25: Project Ownership.

This question was asked to the participants in order to understand whether the work experience was mostly in public funded projects, private funded projects or both. The majority of participants had experience working in public funded projects. This was expected considering that a number of the stakeholders participating in the study are government entity employees.

Appendix 2: Post-Test Study Results

The post-test questionnaire was sent to the same participants taking part in the study and, therefore, also the Pre-test and Intervention. These were all primary stakeholders as per below and as indicated earlier in the methodology chapter:

- Director General Ambjent Malta,
- Director Project Implementation Ambjent Malta,
- Director Finance Ambjent Malta,
- Senior Manager Project Implementation Ambjent Malta,
- Project Architect Ambjent Malta,
- Mechanical Engineer Ambjent Malta,
- Electrical Engineer Ambjent Malta,
- Quantity Surveyor Ambjent Malta,
- Environmental Resources Authority,
- Project Architect – Client, and the
- Client.

All participants replied to the questionnaire received. Hereunder is a brief overview of the responses received and general comments.

Demographics – Work Designation

Work Designation

Work Designation

11 responses

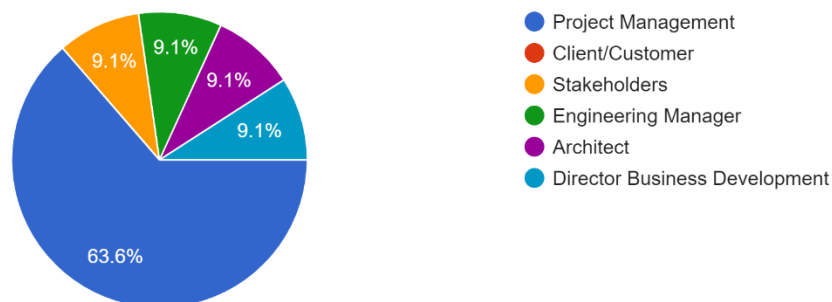


Figure A2.1: Demographics – Work designation

It was noted that from the eleven respondents, six respondents (60%) came from a Project Management works designation, whilst the others consisted of one Client Architect, one Stakeholder, one Public Administration Headship position, an Engineering Manager and another from the Design Office.

Section 1 - Understanding the perception and current use of Value Management: Question 1

After experiencing a Value Management approach do you believe that having a structured tool/framework helped in order to ensure a cost-benefit approach?

After experiencing a Value Management approach do you believe that having a structured tool/framework helped in order to ensure a cost-benefit approach ?

11 responses

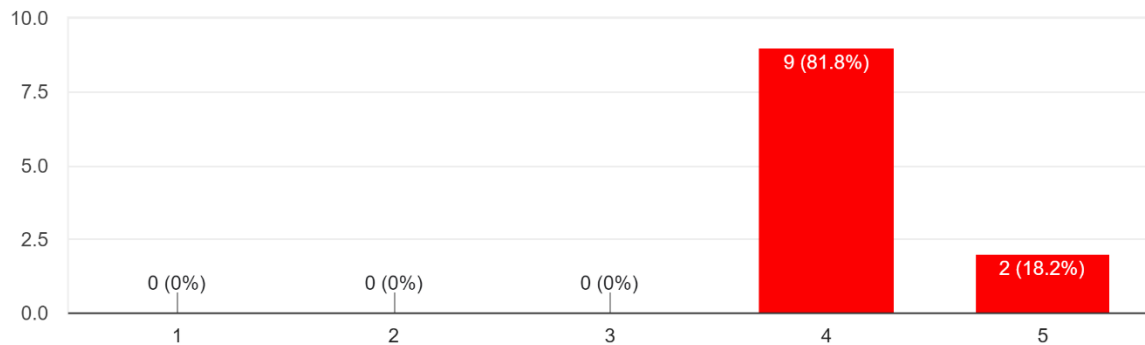


Figure A2.2: Post-Test Questionnaire Section 1 Q1.

All participants, after undergoing the intervention, believed that having a structured tool/framework would be at least useful with two participants believing that it would be very useful.

Section 1 - Understanding the perception and current use of Value Management: Question 2

Was the original intent/need of the project tested during the Workshops in order to ensure that it is aligned to what is required by the Client?

Was the original intent/need of the project tested during the Workshops in order to ensure that it is aligned to what is required by the Client?

11 responses

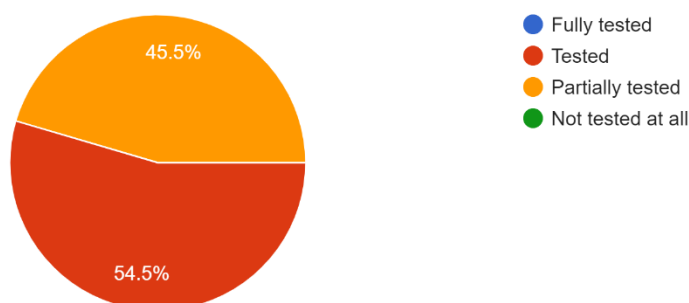


Figure A2.3: Post-Test Questionnaire Section 1 Q2.

Following the post-test questionnaire, 45.5% of participants believed that this was partially tested, whilst the rest, 54.5%, believed that this was tested, i.e., none were of the belief that this was either fully tested or not tested at all.

Section 1 - Understanding the perception and current use of Value Management: Question 3

Was the technical solution to the above question, (Project need) tested by using a tool or technique?

Was the technical solution to the above question, (Project need) tested by using a tool or technique ?

11 responses

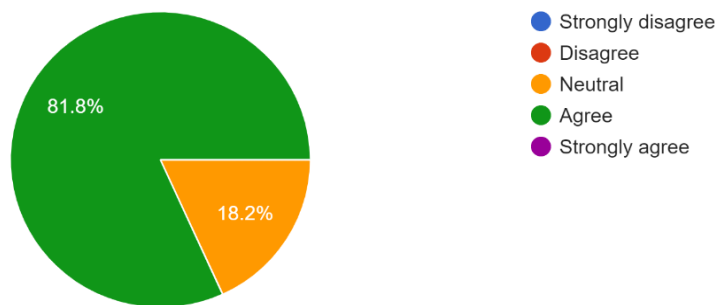


Figure A2.4: Post-Test Questionnaire Section 1 Q3.

The majority of respondents felt that, after the Intervention, the technical solution was tested by using a Value Management Framework. This was highlighted by 81.8% of the participants taking part in the study agreeing to the question asked.

Section 1 - Understanding the perception and current use of Value Management: Question 4

Were the project's objectives in relation to the project need (scope) achieved?

Were the project's objectives in relation to the project need (scope) achieved?

11 responses

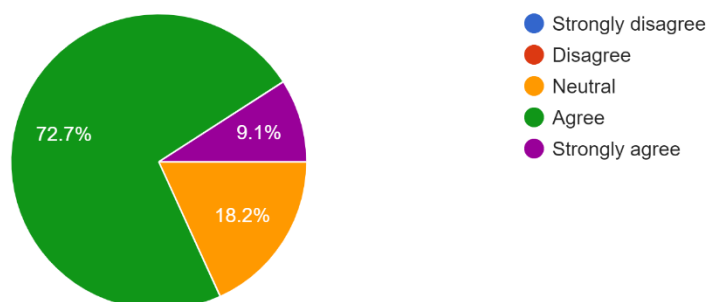


Figure A2.5: Post-Test Questionnaire Section 1 Q4.

This question challenged the participants as to whether Value Management helped in order to ensure that the project's objectives in relation to the project scope were achieved. 72.7% of respondents agreed that the project's objectives were achieved, 9.1% strongly agreed whilst only 18.2% replied in the neutral to this statement.

Section 1 - Understanding the perception and current use of Value Management: Question 5

How do you rate that the level of communication improved within your project team and stakeholders?

How do you rate that the level of communication improved within your project team and stakeholders?

11 responses

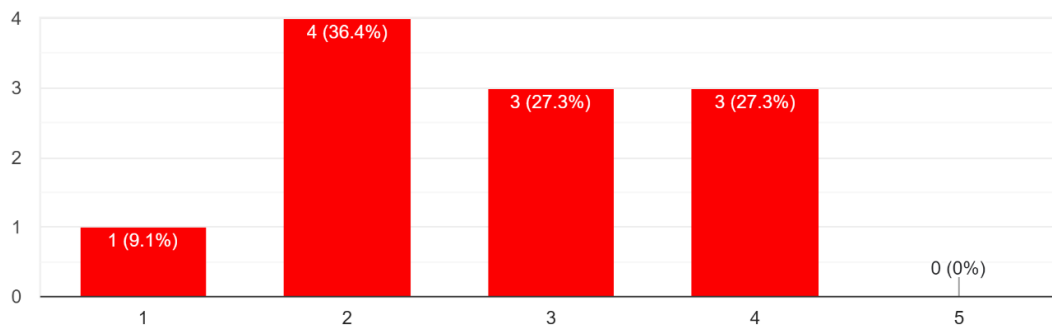


Figure A2.6: Post-Test Questionnaire Section 1 Q5.

This question generated a mixed spread of responses from the participants, although no replies were present for “no improvement”. Hence, it can be stated that all respondents felt that Value Management generated a form of improvement in communication within the project team from a slight improvement to a great improvement. The majority of participants, 36.4%, found a considerable improvement to communication within the team when using Value Management.

Section 2 – Definition of Value Management: Question 1

How do you define Value Management?

How do you define Value Management?

11 responses

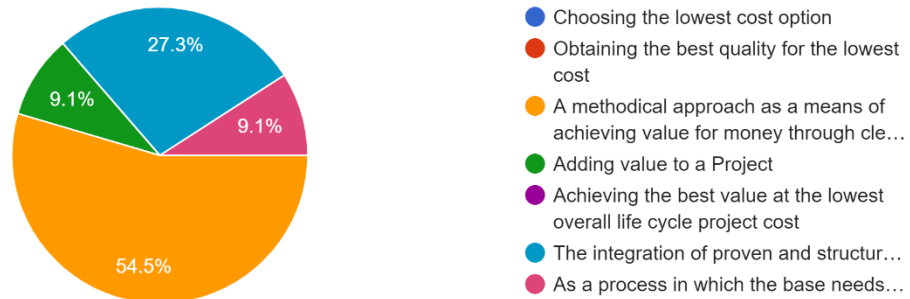


Figure A2.7: Post-Test Questionnaire Section 2 Q1.

54.5 % of participants chose the following as the preferred definition: “A methodical approach as a means of achieving value for money through clearly defining the objectives and establishing a technical consensus as to how to meet these objectives”.

Section 2 – Definition of Value Management: Question 2

What do you understand by Value Management?

What do you understand by Value Management?

11 responses

value management is the process of identifying ways to increase your budget of your project, without affecting the quality or time of your project.

is a systematic and organized approach that aims to maximize the value of a product or service

A methodical approach as a means of achieving value for money through clearly defining the objectives and establishing a technical consensus as to how to meet these objectives

A structured approach creating sustainable value for a project or process.

Getting the proper value from the investment in it.

Multidisciplinary and structured approach for the procuring of services, works and goods and project management

VM has to do with sustainable value at all parts/phases of a project or process.

The value of the overall project for long term

Value management encompasses the three cardinal main criteria of quality (material & works performance standards, H&S), budget, and timeliness.

Section 2 – Definition of Value Management: Question 3

What is your knowledge or experience of Value Management?

What is your knowledge or experience of Value Management?

11 responses

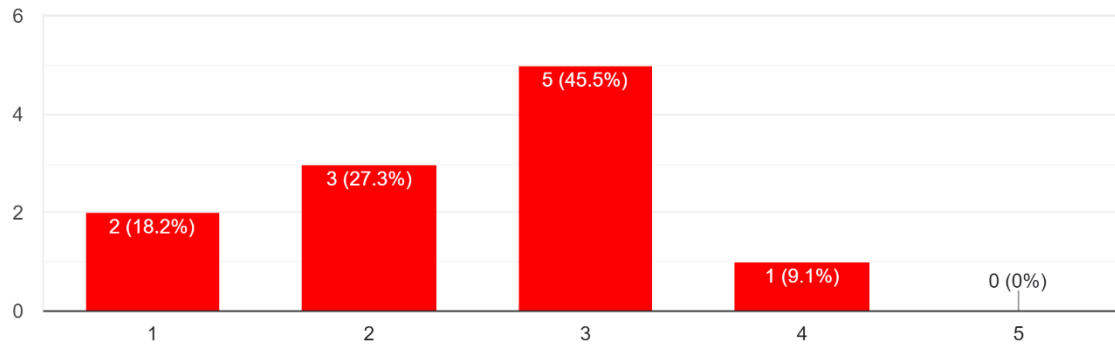


Figure A2.8: Post-Test Questionnaire Section 2 Q3.

The range for this question ranged from Very Poor to Excellent with 45.5% of participants selecting the mid-range term, Fair, as their response.

Section 3 – Use of Value Management: Question 1

Indicate the industry where Value Management was applied to.

Indicate the industry where Value Management was applied to.

11 responses

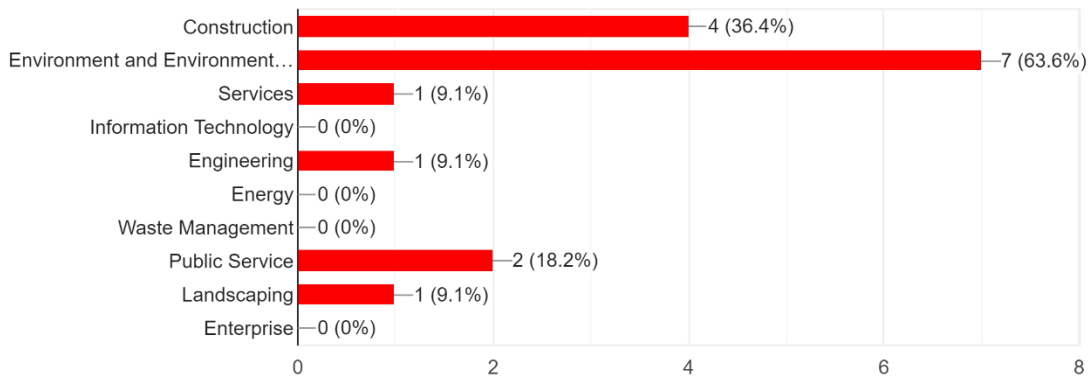


Figure A2.9: Post-Test Questionnaire Section 3 Q1.

This question highlighted the industries for which Value Management was applied to with the industry related to the environment emerging as the area in which Value Management has been applied the most to date as per the participants' knowledge.

Section 3 – Use of Value Management: Question 2.

Which tools have you found most effective?

Which tools have you found most effective?

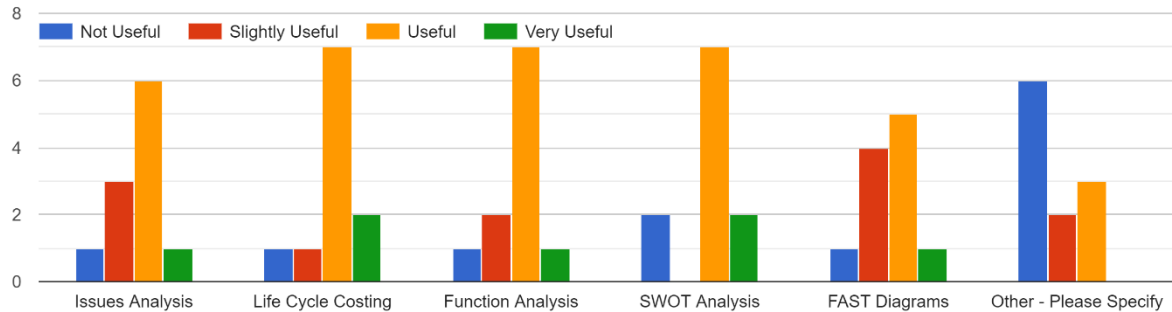


Figure A2.10: Post-Test Questionnaire Section 3 Q2.

Based on the replies received from the participants following the Intervention it seems that the Function Analysis, Issues Analysis and FAST Diagrams were found useful and effective.

Section 3 – Use of Value Management: Question 3.

At what stage of the Project Life Cycle did you implement Value Management?

At what stage of the Project Life Cycle did you implement Value Management?

11 responses

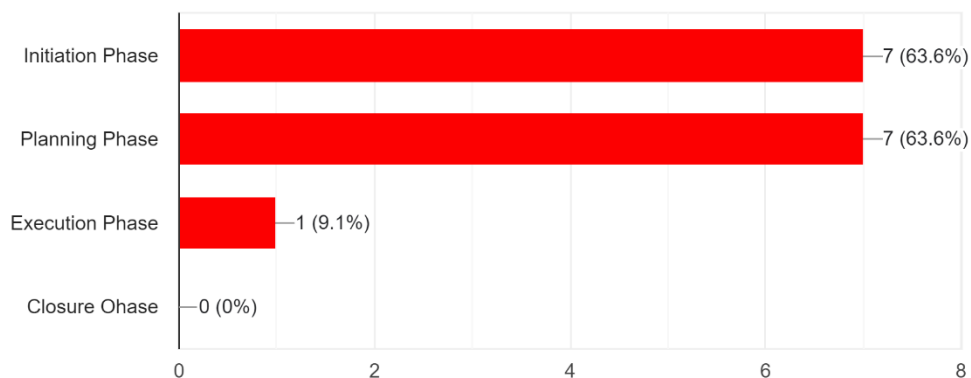


Figure A2.11: Post-Test Questionnaire Section 3 Q3.

Once more this question tested the understanding of what was delivered during the Information Session. It appears that Value Management was mostly and equally implemented during both the Initiation and Planning Phase by 63.6% of respondent in each scenario.

Section 3 – Use of Value Management: Question 4

Did you consider the Value Management Workshop an integral and useful part of your Value Management Approach?

Did you consider the Value Management Workshop an integral and useful part of your Value Management Approach?

11 responses

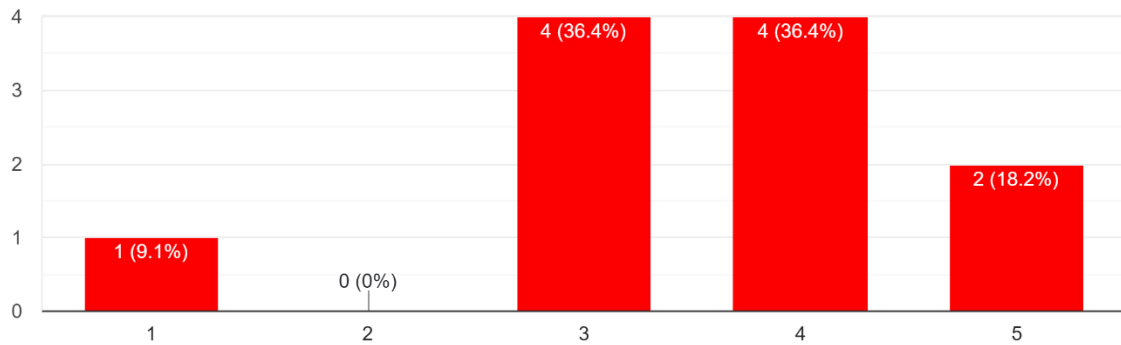


Figure A2.12: Post-Test Questionnaire Section 3 Q4.

From the responses generated, it can be noted that the majority, 54.6%, considered the Value Management Workshop an integral and very useful part of Value Management. Whilst one respondent only disagreed and considered it not useful.

Section 3 – Use of Value Management: Question 5

What strengths, opportunities and problems have you encountered during the application of the Value Management Approach?

What strengths, opportunities and problems have you encountered during the application of the Value Management Approach?

11 responses

n/a
It encourages collaboration among stakeholders leading to more effective decision-making
that other participants might have found this approach as not necessary and lengthy - strength it improves communication
Strengths - clear pathways; Opportunities - Better project handling; Problems - getting the clear message through.
It is a useful tool, in which in few sessions with all stakeholders, can literally trash out problems quickly and find the best solution and common between all parties involved.
Diverse opinions leading to conflict in decision making
It preempts various challenges that a project will face during planning and execution phase
The public service procurement & Financial regulations

none

Not followed up

Discussing in detail the way forward, sharing ideas and technical solutions, planning, and monitoring the effective and efficient execution of the project.

This was deemed as a very important question, which generated perspicacious responses, and will be part of the discussion of this study.

Section 4 - Drivers for Value Management: Question 1

What are the drivers to use Value Management?

What are the drivers to use Value Management?

11 responses

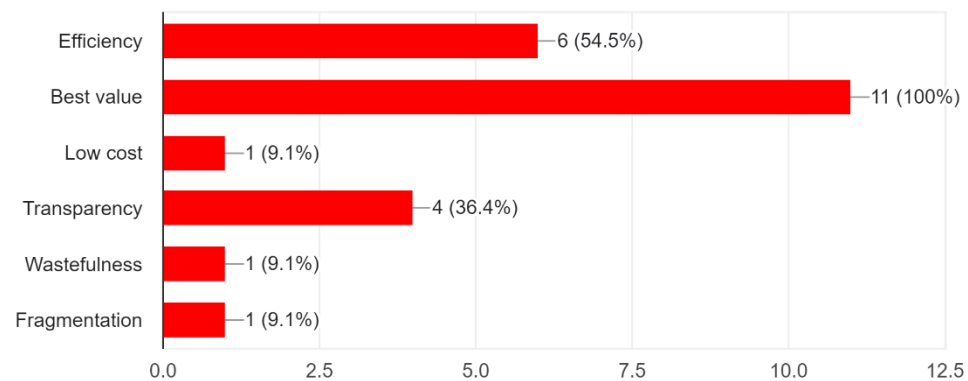


Figure A2.13: Post-Test Questionnaire Section 4 Q1.

Questions 15 to 21 (Section 4, Questions 1-7) dealt with the Project Drivers to use Value Management. The first question deals with the general drivers to use Value Management. The main predominant driver was Best Value with 100% of respondents marking this as a driver to use Value Management.

Section 4 - Drivers for Value Management: Question 2

Do you agree with the below statements regarding Efficiency as driver to use Value Management?

Do you agree with the below statements regarding Efficiency as driver to use Value Management?

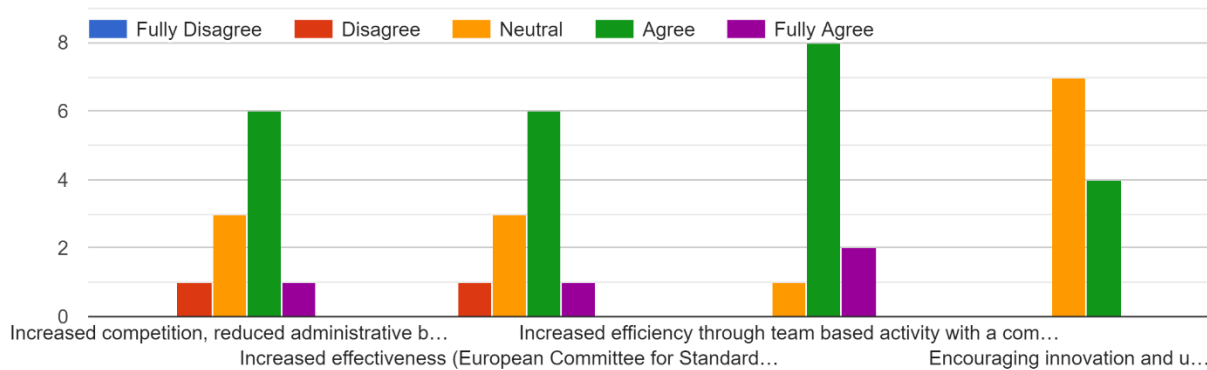


Figure A2.14: Post-Test Questionnaire Section 4 Q2.

The most popular agreement was for the following statement:

“Increased efficiency through team-based activity with a common focus (Institute of Value Management, 2014)”

Section 4 - Drivers for Value Management: Question 3

Do you agree with the below statements regarding Best Value as driver to use Value Management?

Do you agree with the below statements regarding Best Value as driver to use Value Management?

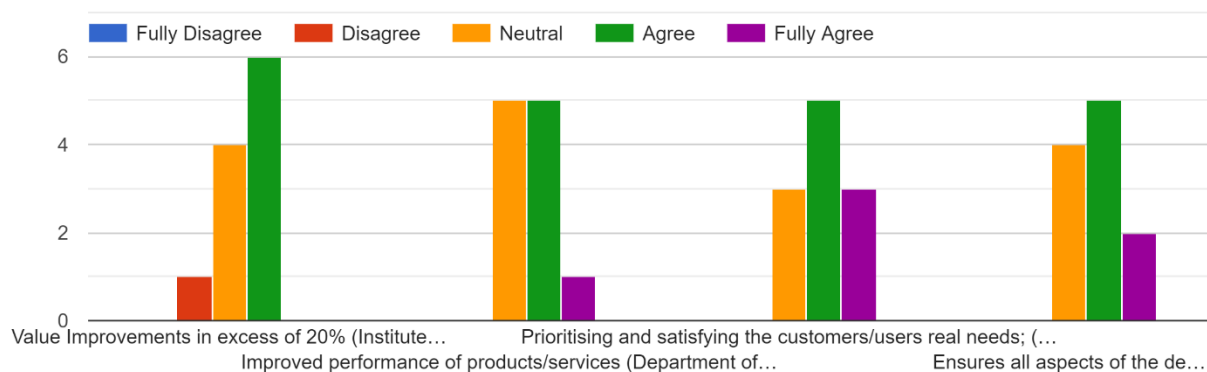


Figure A2.15: Post-Test Questionnaire Section 4 Q3.

When it comes to Best Value as a driver for Value Management, this was deemed as the most critical driver for the use of Value Management by all respondents. It was also evident from the responses above that the two statements that the respondents agree with most with regards to Best Value were the following:

“Prioritising and satisfying the customers’/users’ real needs; (European Committee for Standardisation (CEN), 2020)”

and

“Ensures all aspects of the design are cost effective for their required purpose. (Smith, 2007)”.

The first statement had five respondents in agreement and three fully agreeing that Best Value as a driver for Value Management prioritises and satisfies the customers’/users’ real needs. Whilst the second statement focuses on Value Management acting in order to ensure that all aspects of the design are cost effective for their required purpose and, hence, delivering Best Value.

Section 4 - Drivers for Value Management: Question 4

Do you agree with the below statements regarding Lowering Cost as driver to use Value Management?

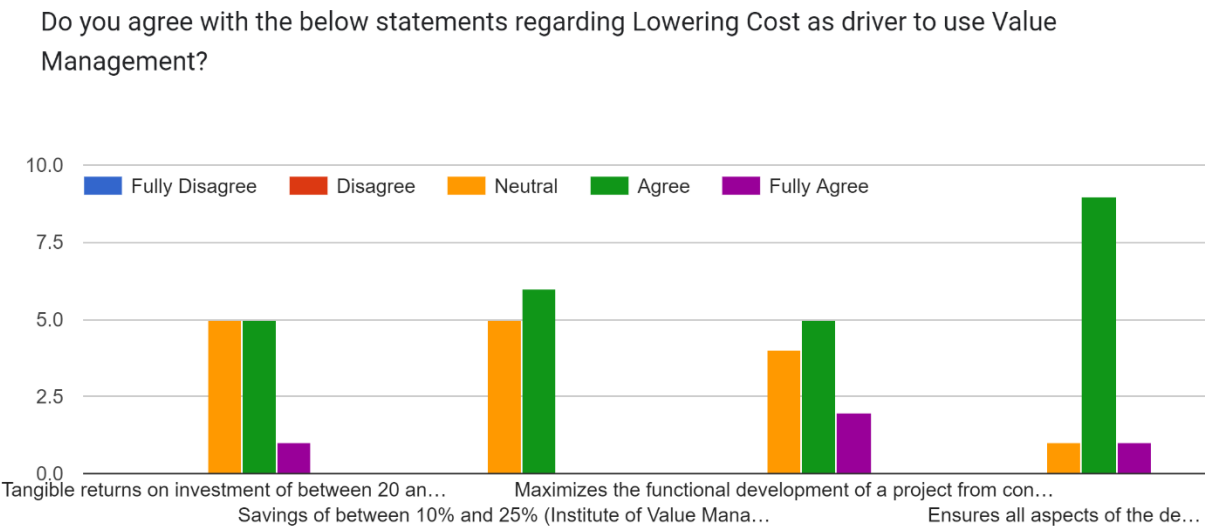


Figure A2.16: Post-Test Questionnaire Section 4 Q4.

The statement best defining Lowering Cost as a driver for Value Management as per the participants’ responses in the post-test study was once more:

“Ensures all aspects of the design are cost effective for their required purpose. (Smith, 2007)”.

Section 4 - Drivers for Value Management: Question 5

Do you agree with the below statements regarding Transparency as driver to use Value Management?

Do you agree with the below statements regarding Transparency as driver to use Value Management?

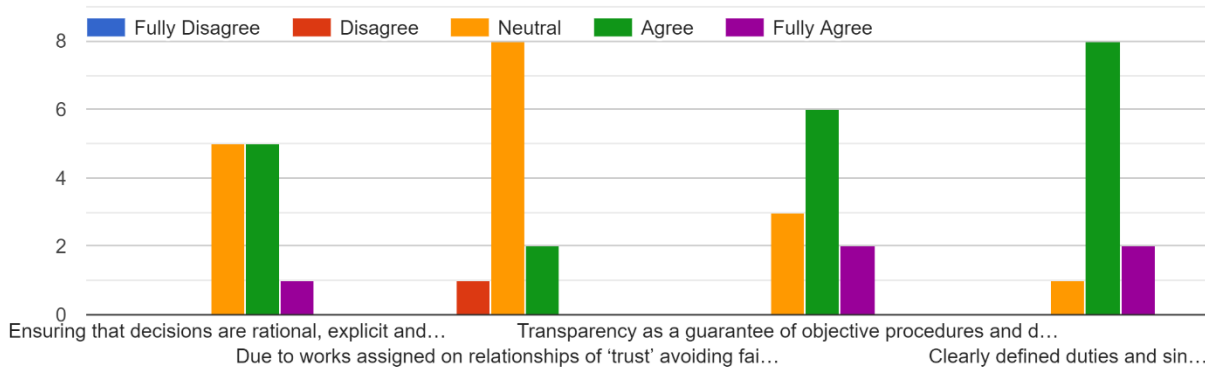


Figure A2.17: Post-Test Questionnaire Section 4 Q5.

The most agreed with statement was “Clearly defined duties and single point of leadership with explicit authority and responsibility should be ensured. (UK Essays, 2018)”.

Section 4 - Drivers for Value Management: Question 6

Do you agree with the below statements regarding reducing wastefulness as driver to use Value Management?

Do you agree with the below statements regarding reducing wastefulness as driver to use Value Management?

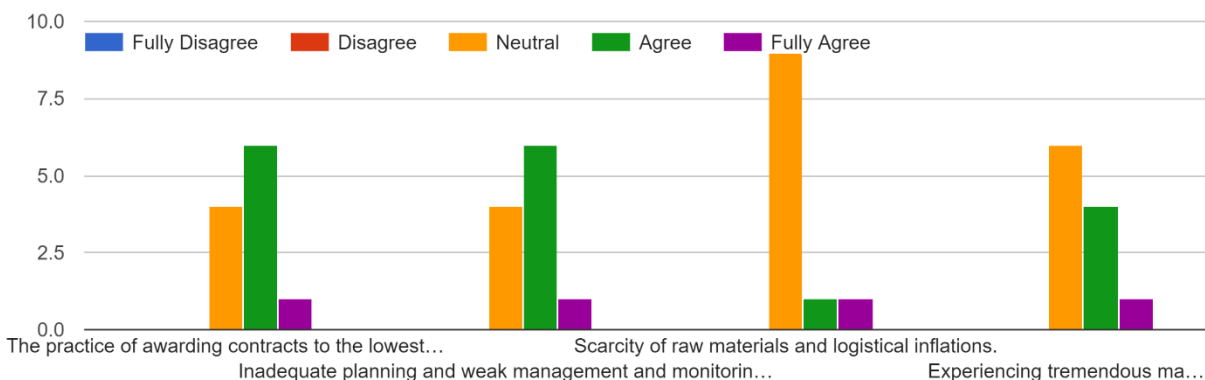


Figure 2.18: Post-Test Questionnaire Section 4 Q6.

When it comes to reducing wastefulness as a driver for Value Management the following statements were the ones which were most agreed to.

“The practice of awarding contracts to the lowest bidders encourages contract amendments, which in turn leads to cost overruns. (Paquette, 2014)”

and

“Inadequate planning and weak management and monitoring mechanisms. (Paquette, 2014)”.

Section 4 - Drivers for Value Management: Question 7

Do you agree with the below statements regarding reducing fragmentation as driver to use Value Management?

Do you agree with the below statements regarding reducing fragmentation as driver to use Value Management?

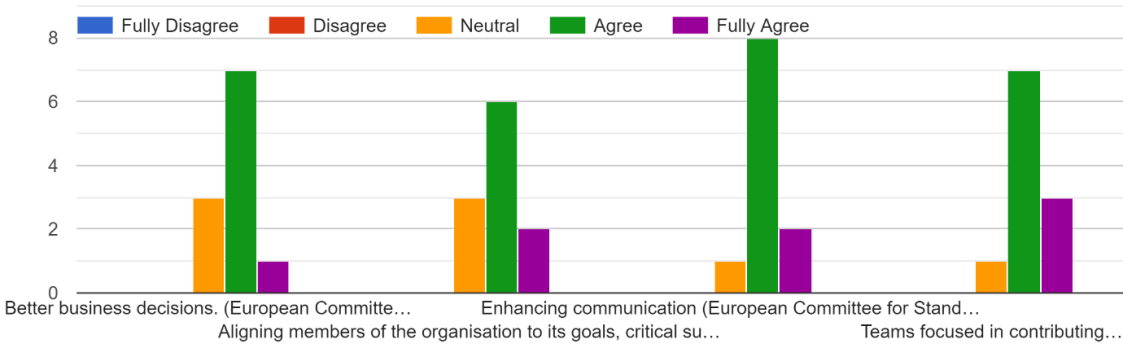


Figure A2.19: Post-Test Questionnaire Section 4 Q7.

The final driver considered in the questionnaire was reducing fragmentation as a driver to use Value Management. The statement chosen here, as the most agreed to statement, was:

“Teams focused in contributing to the objectives of the business and greater project control. (European Commission, 1995)”

This statement focuses on the gained teamwork and team focused approach used when Value Management is carried out.

Demographics:

Work Experience
11 responses

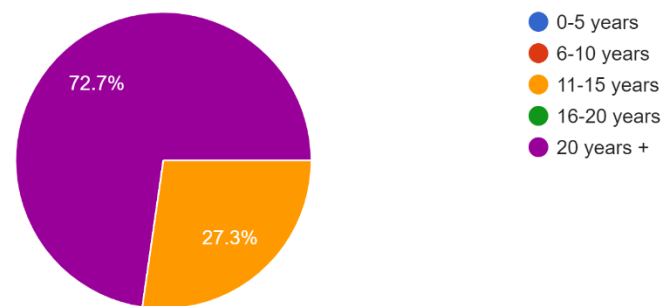


Figure A2.20: Work Experience.

The participants all had considerable work experience with all participants having in excess of ten years’ experience as 72.7% exceeding the twenty years’ work experience in the field.

Demographics:

Size of Project in euro (Estimate of project size usually carried out).

Size of Project in euro (Estimate of Project size usually carried out)
11 responses

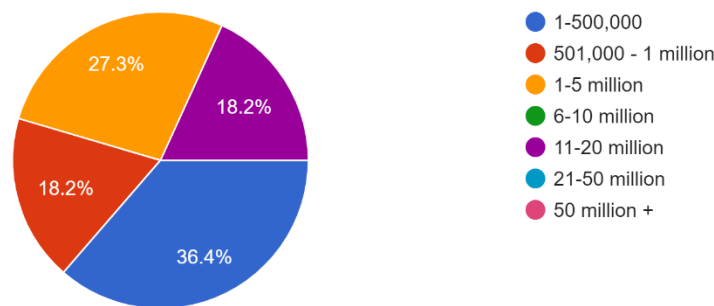


Figure A2.21: Project Size by Estimated Cost

The estimate size of projects worked on varied between the participants with a spread ranging from 1-500,000 to 11–20-million-euro projects.

Demographics:

Project Ownership

Project Ownership

11 responses

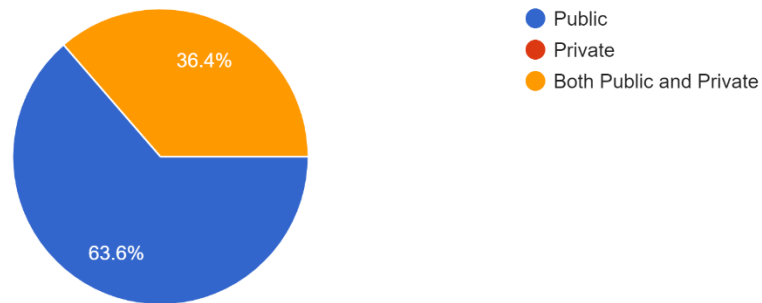


Figure A2.22: Project Ownership.

Considering that the case studies carried out were with a government department, the majority of participants worked within public funded projects with 36.4% working also in private funded projects.

Appendix 3: Hypothesis Results

Paired-T-Test Analysis

The following presents an analysis using the paired t-Test as described in the Methodology Chapter. The paired t-Test was carried out in order to measure the responses by the same individual pre and post-test carrying out the Value Management Information sessions and workshop/s, this being considered as the intervention between the before and after tests.

The purpose of this test is to determine whether there is statistical evidence that the mean difference between paired observations is significantly different to zero. The paired t-test is a parametric test.

Question 1:

Analysing the results obtained using a Paired t-test for the first question, “After experiencing a Value Management approach, do you believe that having a structured tool/framework helped in order to ensure a cost-benefit approach?”

Results:

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-Test	4.09	11	.539	.163
	Post-test	4.18	11	.405	.122

Paired Samples Correlations

		N	Correlation	Significance	
				One-Sided p	Two-Sided p
Pair 1	Pre-Test & Post-test	11	-.083	.404	.808

Paired Samples Test

		Paired Differences			95% Confidence Interval of the Difference	
		Mean	Std. Deviation	Std. Error	Lower	Upper
Pair 1	Pre-Test – Post-test	-.091	.701	.211	-.562	.380

Paired Samples Test

		Significance			
		t	df	One-Sided p	Two-Sided p
Pair 1	Pre-Test – Post-test	-.430	10	.338	.676

Paired Samples Effect Sizes

		Standardiser Point		95% Confidence Interval		
		a	Estimate	Lower	Upper	
Pair 1	Pre-Test – Post-test	Cohen's d	.701	-.130	-.720	.467
		Hedges' correction	.759	-.120	-.665	.431

b. The denominator used in estimating the effect sizes. Cohen's d uses the sample standard deviation of the mean difference. Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

Question 2:

Analysing the results obtained using a Paired t-test for the second question, “Is the original intent/need of the project tested enough in order to ensure that it is aligned to what is required by the Client?”

Results:

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-Test	2.73	11	.467	.141
	Post-test	2.45	11	.522	.157

Paired Samples Correlations

		N	Correlation	Significance	
				One-Sided p	Two-Sided p
Pair 1	Pre-Test &	11	-.261	.219	.438
	Post-test				

Paired Samples Test

		Paired Differences					95% Confidence Interval of the Difference	
		Mean	Std. Deviation	Std. Error Mean			Lower	Upper
Pair 1	Pre-Test –	.273	.786	.237			-.255	.801
	Post-test							

Paired Samples Test

		Significance			
		t	df	One-Sided p	Two-Sided p
Pair 1	Pre-Test – Post-test	1.150	10	.138	.277

Paired Samples Effect Sizes

				95% Confidence Interval		
				Standardiser Point		
				^a	Estimate	
					Lower	
					Upper	
Pair 1	Pre-Test –	Cohen's d	.786	.347	-.271	.949
	Post-test	Hedges' correction	.852	.320	-.250	.875

The denominator used in estimating the effect sizes. Cohen's d uses the sample standard deviation of the mean difference. Hedges' correction uses the sample standard deviation of the mean difference.

Question 3:

Analysing the results of the paired sample t-test for the question, “Was the technical solution to the project need tested by using a tool or technique?”:

Results:

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-Test	3.18	11	.751	.226
	Post-test	3.82	11	.405	.122

Paired Samples Correlations

			Significance			
			N	Correlation	One-Sided p	Two-Sided p
Pair 1	Pre-Test & Post-test		11	-.210	.268	.536

Paired Samples Test

		Paired Differences				
		Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference	
					Lower	Upper
Pair 1	Pre-Test – Post-test	-.636	.924	.279	-1.257	-.015

Paired Samples Test

		Significance			
		t	df	One-Sided p	Two-Sided p
Pair 1	Pre-Test – Post-test	-2.283	10	.023	.046

Paired Samples Effect Sizes

				95% Confidence Interval
Standardiser Point				Interval
a				
Estimate				Lower Upper
Pair 1	Pre-Test –	Cohen's d	.924	-.688 -1.337 -.013

	Post-test	Hedges' correction	1.002	-.635	-1.233	-.012
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The denominator used in estimating the effect sizes. Cohen's d uses the sample standard deviation of the mean difference. Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

Question 4:

Analysing the results of the paired sample t-test for the question, "Were the project's objectives in relation to the project need (scope) achieved?"

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-Test	3.45	11	.522	.157
	Post-test	3.91	11	.539	.163

Paired Samples Correlations

			Significance		
		N	Correlation	One-Sided p	Two-Sided p
Pair 1	Pre-Test & Post-test	11	-.549	.040	.080

Paired Samples Test

		Paired Differences			95% Confidence Interval of the Difference	
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper
Pair 1	Pre-Test – Post-test	-.455	.934	.282	-1.082	.173

Paired Samples Test

		Significance			
		t	df	One-Sided p	Two-Sided p
Pair 1	Pre-Test – Post-test	-1.614	10	.069	.138

Paired Samples Effect Sizes

		Standardiser Point		95% Confidence Interval	
		a	Estimate	Lower	Upper
Pair 1	Pre-Test – Post-test	Cohen's d	.934	-.487	-1.103 .151
		Hedges' correction	1.012	-.449	-1.018 .140

a. The denominator used in estimating the effect sizes. Cohen's d uses the sample standard deviation of the mean difference. Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

Question 5 - Communication:

Analysing the results of the paired sample t-test for the question "How do you rate that the level of communication improved within your project team and stakeholders?"

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-Test	3.00	11	.894	.270
	Post-test	2.73	11	1.009	.304

Paired Samples Correlations

		N	Correlation	Significance	
				One-Sided p	Two-Sided p
Pair 1	Pre-Test & Post-test	11	.000	.500	1.000

Paired Samples Test

		Paired Differences			95% Confidence Interval of the Difference	
		Mean	Std. Deviation	Std. Error	Lower	Upper
Pair 1	Pre-Test – Post-test	.273	1.348	.407	-.633	1.179

Paired Samples Test

		t	df	Significance	
				One-Sided p	Two-Sided p
Pair 1	Pre-Test – Post-test	.671	10	.259	.518

Paired Samples Effect Sizes

			Standardiser Point		95% Confidence Interval	
			a	Estimate	Lower	Upper
Pair 1	Pre-Test –	Cohen's d	1.348	.202	-.400	.795
	Post-test	Hedges' correction	1.461	.187	-.369	.733

b. The denominator used in estimating the effect sizes. Cohen's d uses the sample standard deviation of the mean difference. Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

Question 6 - Knowledge of VM:

Analysing the results of the paired sample t-test for the question, "What is your knowledge or experience of Value Management?"

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-Test	2.00	11	1.000	.302
	Post-test	2.45	11	.934	.282

Paired Samples Correlations

			Significance		
			N	Correlation	One-Sided p Two-Sided p
Pair 1	Pre-Test &		11	-.214	.264 .527
	Post-test				

Paired Samples Test

		Paired Differences				
		Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference	
					Lower	Upper
Pair 1	Pre-Test – Post-test	-.455	1.508	.455	-1.467	.558

Paired Samples Test

		Significance			
		t	df	One-Sided p	Two-Sided p
Pair 1	Pre-Test – Post-test	-1.000	10	.170	.341

Paired Samples Effect Sizes

			Standardiser Point		95% Confidence Interval
			^a	Estimate	Lower Upper
Pair 1	Pre-Test –	Cohen's d	1.508	-.302	-.900 .311
	Post-test	Hedges' correction	1.634	-.278	-.830 .287

a. The denominator used in estimating the effect sizes. Cohen's d uses the sample standard deviation of the mean difference. Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

Multiple Linear Regression Results:

Following the Paired t-test analysis on a number of questions asked in the pre-test/post-test questionnaire, a multiple linear regression analysis was carried out where "Work

Experience" and "Project Ownership" were the independent variables and the "Pre-test Question" is the dependent variable. The aim was to assess whether work experience and project ownership had a significant effect on participants' beliefs about the usefulness of a structured tool/framework in awarding public contracts.

Test 1

The first Multiple Linear Regression test consisted of testing whether the Work Experience and Project Ownership acting as Independent Variables affected the Pre-test Question:

“Do you believe that a structured tool/framework would help in order to ensure a cost-benefit approach when awarding public contracts as recommended in Public Procurement Regulations?”

The Work Experience was divided into 5 segments with:

- 0-5 years=1,
- 6-10 years =2,
- 11-15 years=3,
- 16-20 years=4,
- 20+ years=5.

Whilst Project Ownership was divided into 3 segments:

- Public = 1,
- Private = 2,
- Both Private and Public = 3

Results:

Model Summary

Model	R	R Square	Adjusted Square	R Std. Error of the Estimate
1	.318 ^a	.101	-.124	.572

a. Predictors: (Constant),
Projectownershippublic1private2both3,
WorkExperience05161021115316204205

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.294	2	.147	.449	.653 ^b
	Residual	2.615	8	.327		
	Total	2.909	10			

a. Dependent Variable: Pre-Test

c. Predictors: (Constant), Projectownershippublic1private2both3, WorkExperience05161021115316204205

Coefficients^a

Model		Unstandardised Coefficients		Standardised Coefficients		Sig.
		B	Std. Error	Beta	t	
1	(Constant)	3.192	1.121		2.847	.022
	WorkExperience05161021115316204205	.135	.210	.233	.642	.539
	Projectownershippublic1private2both3	.173	.194	.324	.891	.399

a. Dependent Variable: Pre-Test

Test 2

The second Multiple Linear Regression test consisted of testing whether the Work Experience and Project Ownership acting as Independent Variables affected the Pre-Test Question, *“Are the project's objectives in relation to the project need (scope) achieved?”*

The Work Experience was divided into 5 segments with:

- 0-5 years=1,
- 6-10 years =2,
- 11-15 years=3,
- 16-20 years=4,
- 20+ years=5.

Whilst Project Ownership was divided into 3 segments:

- Public = 1,
- Private = 2,
- Both Private and Public = 3

Results:

Model Summary

Model	R	R Square	Adjusted Square	R Std. Error of the Estimate
1	.516 ^a	.267	.083	.500

a. Predictors: (Constant),
Projectownershippublic1private2both3,
WorkExperience05161021115316204205

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.727	2	.364	1.455	.289 ^b
	Residual	2.000	8	.250		
	Total	2.727	10			

a. Dependent Variable: Pre-Test

b. Predictors: (Constant), Projectownershippublic1private2both3,
WorkExperience05161021115316204205

Coefficients^a

Model		Unstandardised Coefficients		Standardised Coefficients		Sig.
		B	Std. Error	Beta	t	
1	(Constant)	5.000	.981		5.099	<.001
	WorkExperience05161021115316204205	-.250	.183	-.447	-1.363	.210

Projectownershippublic1private2both3	-.250	.170	-.483	-1.472	.179
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Dependent Variable: Pre-Test

a.

Test 3

The third Multiple Linear Regression test consisted of testing whether the Work Experience and Project Ownership acting as Independent Variables effected the Post-Test Question:

After experiencing a Value Management approach do you believe that having a structured tool/framework helped in order to ensure a cost-benefit approach?

The Work Experience was divided into 5 segments with:

- 0-5 years=1,
- 6-10 years =2,
- 11-15 years=3,
- 16-20 years=4,
- 20+ years=5.

Whilst Project Ownership was divided into 3 segments:

- Public = 1,
- Private = 2,
- Both Private and Public = 3

Results:

Model Summary

Model	R	R Square	Adjusted Square	R Std. Error of the Estimate
1	.392 ^a	.154	-.058	.416

a. Predictors: (Constant),

Projectownershippublic1private2both3,

WorkExperience05161021115316204205PostStudy

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.252	2	.126	.727	.513 ^b
	Residual	1.385	8	.173		
	Total	1.636	10			

a. Dependent Variable: Post-test

b. Predictors: (Constant), Projectownershippublic1private2both3, WorkExperience05161021115316204205PostStudy

Coefficients^a

Model		Unstandardised Coefficients		Standardised Coefficients		Sig.
		B	Std. Error	Beta	t	
1	(Constant)	4.038	.816		4.950	.001
	WorkExperience05161021115316204205PostStudy	.077	.153	.178	.504	.628
	Projectownershippublic1private2both3	-.115	.141	-.288	-.816	.438

a. Dependent Variable: Post-test

Final test

The final Multiple Linear Regression test consisted of testing whether the Work Experience and Project Ownership acting as Independent Variables affected the Post-Test Question, “Were the project's objectives in relation to the project need (scope) achieved?”

The Work Experience was divided into 5 segments with:

- 0-5 years=1,
- 6-10 years =2,
- 11-15 years=3,
- 16-20 years=4,
- 20+ years=5.

Whilst Project Ownership was divided into 3 segments:

- Public = 1,
- Private = 2,

Both Private and Public = 3

Results:

Model Summary

Model	R	R Square	Adjusted Square	R Std. Error of the Estimate
1	.686 ^a	.471	.339	.439

a. Predictors: (Constant),
Projectownershippublic1private2both3,
WorkExperience05161021115316204205PostStudy

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.371	2	.685	3.564	.078 ^b
	Residual	1.538	8	.192		
	Total	2.909	10			

a. Dependent Variable: Post-test

b. Predictors: (Constant), Projectownershippublic1private2both3,
WorkExperience05161021115316204205PostStudy

Coefficients^a

Model		Unstandardised Coefficients		Standardised Coefficients		Sig.
		B	Std. Error	Beta	t	
1	(Constant)	2.077	.860		2.415	.042

WorkExperience051610	.404	.161	.699	2.510	.036
21115316204205PostSt					
udy					
Projectownershippublic	.019	.149	.036	.129	.900
1private2both3					

a. Dependent Variable: Post-test

Appendix 4: Thematic Analysis Data

Pre-test Analysis of Question, “How do you define Value Management?”

The following themes were generated.

The most common words from the responses included terms like "value," "project," "best," "cost," "objectives," "integration," "proven," "structured" and "problem-solving."

When the data was inserted into VOS viewer the following maps were provided.

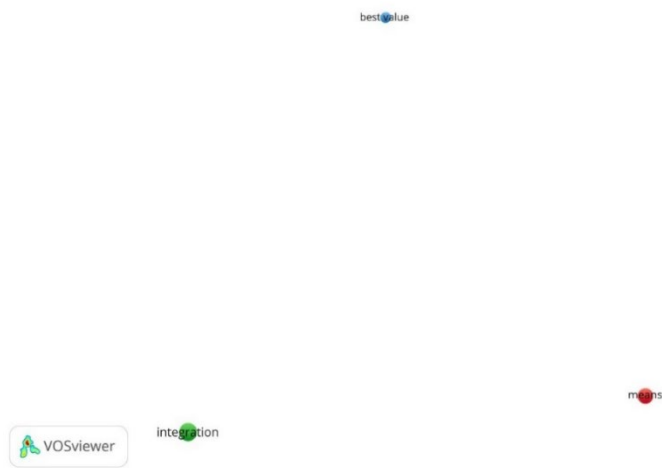


Figure A4.1: VOS Viewer Pre-test Question 1 Map.

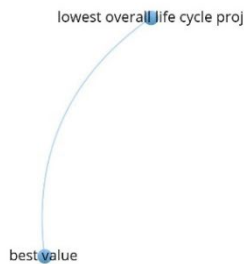


Figure A4.2: VOS Viewer Q1 Cluster 1.

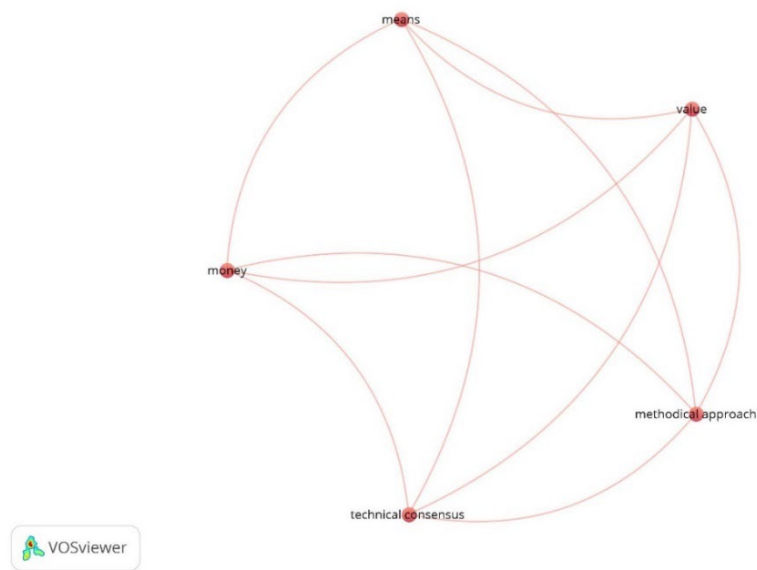


Figure A4.3: VOS Viewer Q1 Cluster 2.

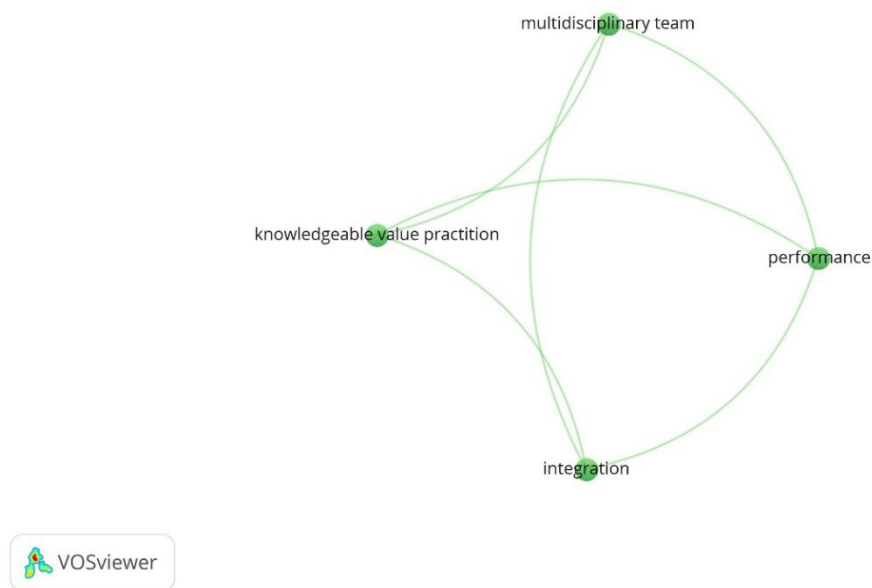


Figure A4.4: VOS Viewer Q1 Cluster 3.

The VOS Viewer maps show the following themes:

- Best Value
- Integration
- Means
- Multidisciplinary Team
- Performance
- Knowledgeable Value Practitioner

The themes generated by VOS Viewer were then compared to those previously generated manually with the following results noted:

- **Best Value:** The term "best" appears frequently, aligning with the theme "best value."
- **Integration:** The term "integration" also appears multiple times, indicating alignment with this theme.
- **Means:** While "means" is not explicitly frequent, terms like "objectives" and "cost" could be related.
- **Multidisciplinary Team:** This specific term appears twice.
- **Performance:** This term is not explicitly found in the top frequent words.
- **Knowledgeable Value Practitioner:** This specific phrase does not appear directly, but it might be inferred from terms related to expertise and structured approaches.

VOS Viewer Maps Analysis

- **Map 1:** Shows the term *means* as a key theme, with the interconnected themes being: money, means, value, technical consensus and methodical approach.
- **Map 2:** Displays interconnected terms were "best value" and "lowest over life cycle cost".
- **Map 3:** Displays interconnected terms like "multidisciplinary team," "knowledgeable value practitioner," "performance" and "integration."

The above comparison shows that while the key themes extracted from the responses do align with several themes shown in the VOS Viewer maps, particularly "integration" and "best value." Some themes like "multidisciplinary team" and "knowledgeable value practitioner" may be less directly referenced but could be inferred.

Combined Themes and Frequencies

1. Best Value

- Phrases: "Achieving Best," "Best Functional," "Best Value"
- Frequency: 1 (Achieving Best) + 1 (Best Functional) + 1 (Best Value) = 3

2. Integration

- Phrases: "Balance Cost," "Base Needs"
- Frequency: 1 (Balance Cost) + 1 (Base Needs) = 2

3. Means

- Phrases: "Approach Means," "Cost Achieving," "Cost Reliability"

- Frequency: 1 (Approach Means) + 1 (Cost Achieving) + 1 (Cost Reliability) = 3

4. Multidisciplinary Team

- Phrases: "Multidisciplinary Team"
- Frequency: 2 (Multidisciplinary Team) = 2

5. Performance

- Phrases: "Defining Objectives," "Clearly Defining"
- Frequency: 1 (Defining Objectives) + 1 (Clearly Defining) = 2

6. Knowledgeable Value Practitioner

- Phrases: "Guidance Knowledgeable," "Establishing Technical"
- Frequency: 1 (Guidance Knowledgeable) + 0 (Establishing Technical, assuming it's not in the initial list) = 1

Summary of Combined Frequencies

- Best Value: 3
- Integration: 2
- Means: 3
- Multidisciplinary Team: 2
- Performance: 2
- Knowledgeable Value Practitioner: 1

Post-test Analysis of Question: "How do you define Value Management?"

From the responses received the following themes were generated:

1. Methodical Approach for Value for Money:

- Frequency: 6

This theme emphasises a structured and systematic method to ensure value for money, focusing on clearly defining objectives and achieving technical consensus.

2. Integration of Multidisciplinary Team and Value Practitioner:

- Frequency: 3

This theme highlights the importance of using structured problem-solving techniques by a multidisciplinary team, guided by an experienced value practitioner to balance cost, reliability and performance.

3. **Explicit and Appraised Needs:**

- Frequency: 1

This theme defines value management as a process that makes the project's base needs explicit and evaluates them according to stakeholder requirements.

4. **Adding Value to a Project:**

- Frequency: 1

This theme simply describes value management as the act of adding value to a project.

Summary:

The most frequently mentioned theme is the **Methodical Approach for Value for Money** (6 times). The next significant theme is the **Integration of Multidisciplinary Team and Value Practitioner** which appeared three (3) times. On the other hand, **Explicit and Appraised Needs** and **Adding Value to a Project** each appear once.

Themes derived by VOS Viewer for the responses provided by the stakeholders' post-test:

1. **Methodical Approach for Value for Money**

- Keywords: "value for money," "clearly defining objectives," "technical consensus"

2. **Integration of Multidisciplinary Team and Value Practitioner**

- Keywords: "multidisciplinary team," "value practitioner," "structured problem-solving techniques," "balance between cost, reliability, performance"

3. **Explicit and Appraised Needs**

- Keywords: "base needs," "explicit," "appraised as required by stakeholders"

4. **Adding Value to a Project**

- Keywords: "adding value," "project"

VOS Viewer Map Interpretation:

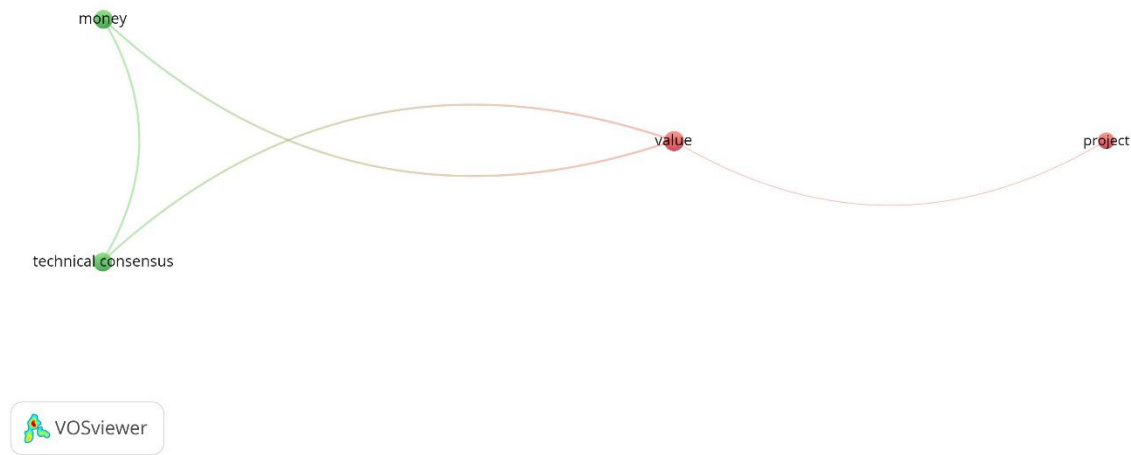


Figure A4.5: VOS Viewer Post-Test Q1 Map

From the map, themes are represented accordingly:

1. Methodical Approach for Value for Money

The map shows "money," "technical consensus" and "value" as major nodes connected to each other. The connections and cluster of these nodes indicate that respondents frequently mentioned these terms together. This suggests a strong emphasis on achieving value for money through clear objectives and consensus.

2. Integration of Multidisciplinary Team and Value Practitioner

Nodes like "technical consensus" and "value" are connected, but there is no direct mention of "multidisciplinary team" in the provided map image. The lack of a direct node for "multidisciplinary team" might indicate it was mentioned less frequently or is integrated into broader terms like "technical consensus" or "value."

3. Explicit and Appraised Needs

The map does not show direct nodes for "base needs" or "explicit" in the image provided. These terms might be part of the broader context captured under "technical consensus" or "value," indicating these needs are considered implicitly.

4. Adding Value to a Project

"Project" appears as a node connected to "value," showing a clear relationship. The connection between "project" and "value" highlights the focus on enhancing project outcomes through value management.

Summary of Interpretation:

- **Methodical Approach for Value for Money** is a dominant theme, strongly represented by the clusters and connections of "money," "technical consensus" and "value."
- **Integration of Multidisciplinary Team and Value Practitioner** is less explicitly represented, potentially due to its integration into broader terms.
- **Explicit and Appraised Needs** may be implied within the clusters of related terms, suggesting an underlying consideration.
- **Adding Value to a Project** is well-represented, emphasizing the importance of value in project contexts.

This analysis shows that while some specific terms from the responses might not appear directly, their underlying concepts are captured within the broader clusters and connections in the VOS Viewer map. The map visualizes the centrality of value, money and technical consensus in the responses, aligning with the identified themes.

Comparing the Pre-Test and Post-Test themes for the question "How do you define Value Management?"

Pre-Test Themes:

1. Methodical Approach for Value for Money

- Keywords: "value for money," "clearly defining objectives" "technical consensus"

2. Integration of Multidisciplinary Team and Value Practitioner

- Keywords: "multidisciplinary team," "value practitioner," "structured problem-solving techniques," "balance between cost, reliability, performance"

3. Explicit and Appraised Needs

- Keywords: "base needs," "explicit," "appraised as required by stakeholders"

4. Adding Value to a Project

- Keywords: "adding value," "project"

Post-Test Themes:

1. Methodical Approach for Value for Money

- Keywords: "value for money," "clearly defining objectives," "technical consensus"

2. Integration of Multidisciplinary Team and Value Practitioner

- Keywords: "multidisciplinary team," "value practitioner," "structured problem-solving techniques," "balance between cost, reliability, performance"

3. Explicit and Appraised Needs

- Keywords: "base needs," "explicit," "appraised as required by stakeholders"

4. Adding Value to a Project

- Keywords: "adding value," "project"

Comparison:

Methodical Approach for Value for Money:

- **Pre-Test:** The theme was represented by terms like "value for money," "clearly defining objectives" and "technical consensus." These were key elements that participants associated with value management.
- **Post-Test:** The emphasis on a methodical approach remains strong, with repeated mentions of "value for money," "clearly defining objectives" and "technical consensus." This consistency suggests that the intervention reinforced the importance of this approach.

Integration of Multidisciplinary Team and Value Practitioner:

- **Pre-Test:** The theme highlighted the role of a "multidisciplinary team" and a "value practitioner" in achieving value management.
- **Post-Test:** There is a continued emphasis on the role of a "multidisciplinary team" and "value practitioner." The repeated mentions of structured problem-solving techniques and balance between cost, reliability and performance indicate a deeper understanding of the practical application of these roles.

Explicit and Appraised Needs:

- **Pre-Test:** Participants mentioned the importance of making the "base needs" explicit and appraising them as required by stakeholders.
- **Post-Test:** This theme continues to be relevant, indicating that participants still recognize the necessity of clearly defining and appraising needs to meet stakeholder requirements.

Adding Value to a Project:

- **Pre-Test:** The idea of "adding value" to a project was a significant theme.
- **Post-Test:** The post-test responses still highlight "adding value" as a crucial component, suggesting that the intervention effectively reinforced this concept.

Visual Comparison Using VOS Viewer Maps:

By comparing the VOS Viewer maps of the pre-test and post-test responses, the following can be observed.

1. Pre-Test Map:

- Key nodes: "money," "technical consensus," "value," "project"
- Connections: Strong links between "money," "technical consensus" and "value," indicating a focus on financial aspects and technical agreement.

2. Post-Test Map:

- Key nodes: "money," "technical consensus," "value," "project"
- Connections: Similar strong links between "money," "technical consensus," and "value," but with an additional emphasis on "project," suggesting a more project-focused understanding of value management.

Interpretation

The comparison indicates that the intervention reinforced the existing understanding of value management while also deepening the participants' appreciation of specific aspects, such as the role of multidisciplinary teams and the importance of structured problem-solving techniques. The post-test responses show a consistent emphasis on value for money, technical consensus and adding value to projects, reflecting a more nuanced and applied understanding of value management concepts.

Pre-test Analysis of Question: “What do you understand by Value Management?”

The pre-test questionnaire provided valuable insights into the initial perceptions surrounding Value Management. Through the responses gathered, distinct themes emerged, shedding light on various concerns and considerations regarding project execution and management. Below is a comprehensive breakdown of the identified themes along with their corresponding codes and explanations.

1. Quality Concerns (QC)

Quality emerged as a paramount concern among respondents, encompassing issues ranging from poor workmanship attributed to inexperienced workers to the utilization of substandard materials by contractors. Instances of compromised project quality, resulting in delays or subpar outcomes, were also highlighted. These concerns underscore the importance of upholding high standards throughout the project lifecycle to ensure successful delivery and client satisfaction.

2. Oversight and Accountability (OA)

A notable observation was the perceived lack of oversight and accountability within project management processes. Respondents expressed concerns regarding the inadequate monitoring of project progress or components by authorities, which could potentially lead to issues going unnoticed or unaddressed. This theme emphasizes the need for robust governance mechanisms to enhance transparency and accountability in project execution.

3. Skill and Qualification Issues (SQ)

The presence of unqualified personnel lacking essential skills emerged as a significant challenge impacting project execution and outcomes. Respondents highlighted the detrimental effects of employing individuals who do not possess the necessary qualifications or expertise, emphasising the importance of competent workforce management to ensure project success.

4. Cost and Budgeting (CB)

Cost-related considerations featured prominently in the responses, with respondents expressing concerns about hidden costs and unexpected expenses arising during project implementation. Additionally, the subsequent increases in current and maintenance costs due to initial cost-cutting measures or the use of inferior materials were identified as significant challenges. This theme underscores the importance of comprehensive budget planning and diligent cost management to mitigate financial risks and ensure project viability.

5. Impact on Local Labour (IL)

An emerging concern highlighted in the responses was the potential impact on local labour due to the influx of foreign workers. Respondents expressed apprehensions regarding the implications for local employment opportunities, signalling the need for strategies to address workforce dynamics and promote equitable employment practices within the project context.

6. Adaptation and Flexibility (AF)

Respondents emphasized the importance of adaptability in project planning and execution, citing the need for modifications to achieve desired project outcomes. This theme underscores the dynamic nature of project management and the necessity of embracing flexibility to respond effectively to evolving requirements and circumstances.

Overall Insights

The analysis reveals a diverse range of perceptions and concerns, reflecting the multifaceted nature of project execution and management. While quality emerged as a predominant theme, other considerations such as oversight, skill development, cost management, labour dynamics and adaptability were also highlighted as significant factors

influencing project success. By acknowledging and addressing these concerns, stakeholders can adopt informed strategies to enhance project performance and achieve sustainable outcomes.

Counting the frequencies for each theme, the following results are generated:

- Quality Concerns: 4
- Oversight and Accountability: 1
- Skill and Qualification Issues: 1
- Cost and Budgeting: 2
- Impact on Local Labour: 1
- Adaptation and Flexibility: 1

These were transformed to the following percentages for each theme:

- Quality Concerns: 40%
- Oversight and Accountability: 10%
- Skill and Qualification Issues: 10%
- Cost and Budgeting: 20%
- Impact on Local Labour: 10%
- Adaptation and Flexibility: 10%

VOS Viewer Map Clusters

From the VOS Viewer analysis, the clusters can be categorised into three primary themes as per the Map below.

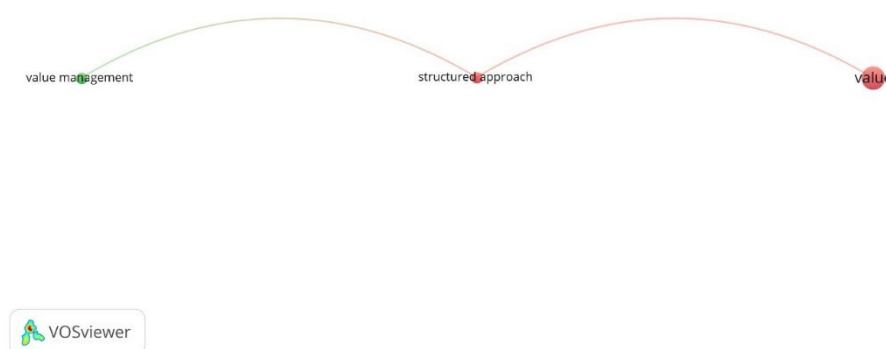


Figure A4.6: VOS Viewer Pre-Test Q2 Map

Value Management: A structured approach based on a well-defined work plan, guided by scientific data, emphasising leadership, communication, skill development, and balancing stakeholder needs and wants.

Structured Approach: An analytical approach to planning processes aimed at better results, obtaining value for money and ensuring the best possible outcomes with minimal costs.

Value: Achieving sustainable value through careful project management, budget control and quality maintenance, focusing on long-term benefits and successful project delivery.

Comparison and Interpretation of Alignment and Differences

1. Quality Concerns (QC)

This theme focuses on issues like poor workmanship and substandard materials. This theme can be hence incorporated into the broader theme of "Value Management" and "Value," emphasising quality maintenance and sustainable value. Both approaches highlight quality but VOS Viewer places it within a larger framework of achieving overall project value.

2. Oversight and Accountability (OA)

This theme shows a specific concern about monitoring and accountability. Part of "Structured Approach" and "Value Management," suggesting that improved structure inherently includes better oversight. VOS Viewer treats oversight as part of systematic management rather than an isolated concern.

3. Skill and Qualification Issues (SQ)

Emphasis on the impact of unqualified personnel. VOS Viewer addressed this under "Value Management" where skill development is key. Both recognise the importance of skills but VOS Viewer integrates it into overall management strategies.

4. Cost and Budgeting (CB)

This theme focuses on hidden costs and budgeting issues. Once again, it is incorporated within "Structured Approach" and "Value," focusing on value for money and budget control. VOS Viewer broadens this theme to encompass a structured approach to cost management.

5. Impact on Local Labour (IL)

Concern about impacts on employment due to foreign workers. This theme might be considered less central in the broader analysis of value management according to VOS Viewer.

6. Adaptation and Flexibility (AF)

The need for adaptability in project planning is part of the "Structured Approach," highlighting adaptability as a component of planning processes. VOS Viewer embeds adaptability within a systematic approach to achieving project goals.

Conclusion

The comparison reveals that while manually generated themes focus on specific issues and concerns, the VOS Viewer clusters present a more integrated and structured view of Value Management. The VOS Viewer analysis highlights a comprehensive approach, incorporating various elements like quality, oversight, skills and budgeting into broader themes of structured approaches and value achievement. This suggests a more holistic understanding and systematic methodology for managing value in projects.

Post-test Analysis of Question “What do you understand by Value Management?”

From the responses the following two themes were generated:

1. Maximising Value and Efficiency:

Respondents perceive Value Management as a systematic and strategic approach aimed at maximising value, efficiency and benefits while optimising costs and resources. This theme encompasses various aspects such as identifying ways to increase project budgets without compromising quality or time, achieving value for money through clear objectives and consensus, creating sustainable value and maximising cost-benefit ratios.

- Frequency: 5

2. Comprehensive Approach to Project Management:

Value Management is seen as a multidisciplinary and structured approach to project management, encompassing procurement, project phases and key criteria such as quality, budget and timeliness. This theme underscores the holistic nature of Value Management, which considers multiple factors and stages in project planning and execution.

- Frequency: 3

These combined results offer a holistic understanding of the perceptions surrounding Value Management among the respondents post-tests. They highlight the predominant emphasis on maximising value and efficiency while also acknowledging the importance of a comprehensive approach to project management.

Vos Viewer Analysis

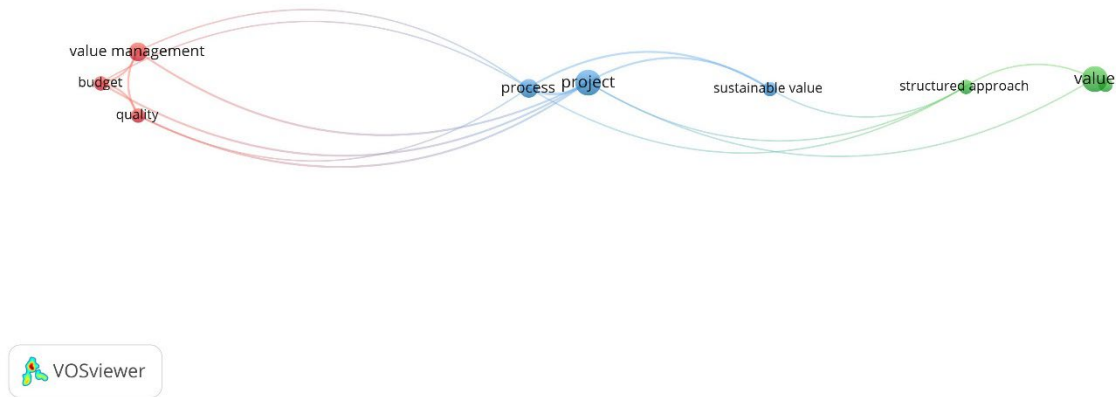


Figure A4.7: VOS Viewer Post-Test Q2 Map

VOS Viewer Map Analysis

The VOS Viewer post-test map for the responses received for this question, clusters terms into three primary themes:

1. Value Management

Keywords: value management, budget, quality

This emphasises a structured approach with a focus on managing budget and quality aspects.

2. Structured Approach

Keywords: structured approach, project, process

This theme shows value management as an analytical and structured approach to planning and executing projects, ensuring value for money and optimal outcomes.

3. Value

- **Keywords:** value, sustainable value

Value as a theme promotes achieving sustainable value through careful project management, focusing on long-term benefits and successful project delivery.

Comparative Summary

1. Maximising Value and Efficiency (MV) vs. VOS Viewer Themes

This theme aligns closely with the **Value Management** and **Value** clusters from the VOS Viewer map. Both emphasise maximizing value, efficiency, cost management and ensuring high-quality standards. There is a strong agreement in recognising the importance of optimising resources and achieving sustainable value.

2. Comprehensive Approach to Project Management (CP) vs. VOS Viewer Themes

This theme is in line with the **Structured Approach** and **Value Management** clusters from the VOS Viewer map. Both highlight the need for a multidisciplinary, structured approach to project management, including planning processes, budget control and quality maintenance. There is a clear understanding of the holistic nature of Value Management, considering multiple factors and stages in project execution.

Conclusion

The comparison between manually generated themes from post-test responses and the VOS Viewer map reveals a significant alignment. Both methods underscore the importance of structured, efficient and comprehensive approaches to Value Management. The shift in focus observed in the post-test responses towards maximising value, efficiency and comprehensive project management is well-represented in the VOS Viewer map.

Comparison of Pre-test and Post-Test for the Question “What do you understand by Value Management?”

Comparing the frequencies of themes identified in both tests to understand any changes or consistencies in perceptions before and after the intervention the following summary of the themes and frequencies from the pre-test/post-test was generated:

Pre-test Analysis:

1. **Quality Concerns:** 4
2. **Oversight and Accountability:** 1
3. **Skill and Qualification Issues:** 1
4. **Cost and Budgeting:** 2
5. **Impact on Local Labour:** 1
6. **Adaptation and Flexibility:** 1

Post-test Analysis:

1. **Maximising Value and Efficiency:** 5
2. **Comprehensive Approach to Project Management:** 3

Hence, comparing the frequencies of corresponding themes between the pre-test and post-test one can provide the following:

1. **Quality Concerns (Pre-test) vs. Maximizing Value and Efficiency (Post-test):**
 - Pre-test: 4
 - Post-test: 0
2. **Cost and Budgeting (Pre-test) vs. Maximizing Value and Efficiency (Post-test):**
 - Pre-test: 2
 - Post-test: 5
3. **Oversight and Accountability (Pre-test) vs. Comprehensive Approach to Project Management (Post-test):**
 - Pre-test: 1
 - Post-test: 3
4. **Skill and Qualification Issues (Pre-test) vs. Comprehensive Approach to Project Management (Post-test):**
 - Pre-test: 1
 - Post-test: 3
5. **Impact on Local Labour (Pre-test):**
 - Pre-test: 1 (Not represented in Post-test)
6. **Adaptation and Flexibility (Pre-test):**
 - Pre-test: 1 (Not represented in Post-test)

From this comparison, one can observe the shifts in emphasis or new themes that have emerged between the pre-test and post-test responses. For example, while Quality Concerns and Cost and Budgeting were prominent in the pre-test, the post-test highlights a stronger focus on themes related to maximising value and efficiency, as well as adopting a comprehensive approach to project management. This analysis provides valuable insights into how perceptions may have evolved after the intervention regarding Value Management. Hence, it is evident that the Intervention helped the respondents to open up to the opportunities and benefits offered by the implementation of a Value Management approach.

Post-test Analysis of Question: “What strengths, opportunities and problems have you encountered during the application of the Value Management Approach?”

Analysing the responses quantitatively and identifying common themes and corresponding codes resulted in the following themes and codes:

1. Collaboration and Effective Decision-Making (CED):

This theme highlights the strength of Value Management in encouraging collaboration among stakeholders, leading to more effective decision-making. It emphasises the positive impact of stakeholder engagement on project outcomes.

- Frequency: 2

2. Communication Improvement (CI):

Respondents mention that the Value Management approach improves communication by providing clear pathways and facilitating better project handling. It addresses the opportunity to enhance communication channels and ensure clarity in project execution.

- Frequency: 1

3. Efficiency and Problem-Solving (EPS):

Value Management is seen as a useful tool for quickly addressing problems and finding the best solutions through collaborative sessions with stakeholders. It highlights the efficiency and effectiveness of Value Management in problem-solving and decision-making processes.

- Frequency: 2

4. Conflict Resolution (CR):

Diverse opinions among stakeholders may lead to conflicts in decision-making. This theme reflects the challenge of managing conflicting viewpoints and resolving disputes during the application of the Value Management approach.

- Frequency: 1

5. Challenges Anticipation (CA):

Respondents recognise Value Management as pre-empting various challenges that a project may face during planning and execution. It underscores the proactive nature of Value Management in identifying and addressing potential hurdles.

- Frequency: 1

6. Regulatory Compliance (RC):

The public service procurement and financial regulations are identified as factors affecting the application of the Value Management approach. This theme highlights the importance of complying with regulatory requirements in project management.

- Frequency: 1

7. Lack of Follow-Up (LFU):

Respondents mention instances where issues are not followed up effectively. This theme reflects the challenge of ensuring continuous monitoring and indicates that the implementation of Value Management principles could be effective throughout the project lifecycle.

- Frequency: 1

8. Detailed Discussion and Planning (DDP):

Value Management involves discussing in detail the way forward, sharing ideas and technical solutions, and planning and monitoring the effective and efficient execution of the project. This theme highlights the importance of thorough planning and collaboration in Value Management processes.

- Frequency: 1

Analysis of the above themes

These themes provide a quantitative perspective on the strengths, opportunities and problems encountered during the application of the Value Management approach, following a deeper understanding of the respondents' experiences. The analysis therefore underscores the collaborative and problem-solving strengths of Value Management, while also highlighting opportunities for improving communication and addressing challenges, such as conflict resolution and regulatory compliance. By leveraging its strengths and addressing identified opportunities and challenges, organisations can make use of Value Management with the aim of achieving better project success. Several strengths and opportunities were identified, indicating that respondents perceived Value Management as beneficial and effective in enhancing project outcomes. These included a number of soft benefits which was a critical aspect of this study.

The positive aspects highlighted include:

1. Encouragement of collaboration among stakeholders, leading to more effective decision-making.
2. Efficient problem-solving and decision-making processes facilitated by Value Management sessions.
3. Improvement in communication pathways, enabling clearer project handling.
4. Proactive anticipation and mitigation of project challenges during planning and execution.
5. Recognition of Value Management as a useful tool for quickly addressing problems and finding optimal solutions.
6. Emphasis on detailed discussion, idea sharing and thorough planning, contributing to effective project execution.

However, some challenges and areas for improvement were also noted, such as conflicts in decision-making due to diverse opinions among stakeholders and the need for better follow-up and compliance with regulatory requirements.

VOS Viewer Map Analysis

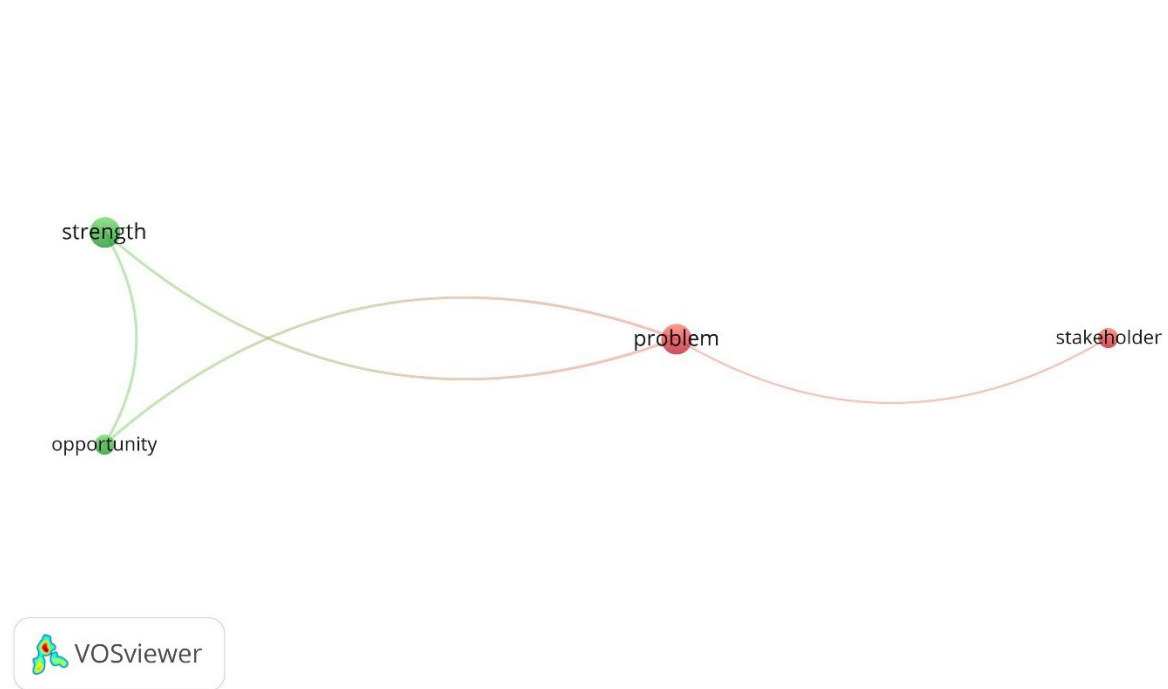


Figure A4.8: VOS Viewer Post-Test Q3 Map

The VOS Viewer post-test map for the responses generated by this question clusters terms into key themes:

1. Strength

Represents the strengths encountered during the application of the Value Management Approach.

2. Opportunity

Identifies the opportunities presented by the Value Management Approach.

3. Problem

Highlights the problems or challenges faced during the application of the Value Management Approach.

4. Stakeholder

Emphasises the role of stakeholders in the Value Management Approach.

Comparative Review

1. Collaboration and Effective Decision-Making (CED) vs. VOS Viewer Themes

This theme encourages collaboration among stakeholders for effective decision-making. The VOS Viewer map does not explicitly mention collaboration but emphasises the role of stakeholders, which aligns with the theme of stakeholder collaboration. Both the qualitative themes and VOS Viewer map recognise the importance of stakeholder involvement in decision-making.

2. Communication Improvement (CI) vs. VOS Viewer Themes

This theme discusses the importance of communication in Value Management and how it improves communication for better project handling. The VOS Viewer map does not explicitly focus on communication but emphasises stakeholder involvement, which indirectly improves communication. Effective communication is an implicit part of stakeholder engagement and collaboration.

3. Efficiency and Problem-Solving (EPS) vs. VOS Viewer Themes

This theme discusses how Value Management addresses problems and finds solutions through collaboration. The VOS Viewer map highlights the theme of problems, aligning with the problem-solving aspect of Value Management. Both the qualitative and quantitative analyses emphasise the importance of problem-solving in Value Management.

4. Conflict Resolution (CR) vs. VOS Viewer Themes

This theme discusses how Value Management helps manage conflicting viewpoints. The VOS Viewer map once again highlights problems, which can include conflicts among stakeholders. Conflict resolution is a critical aspect of addressing problems in Value Management.

5. Challenges Anticipation (CA) vs. VOS Viewer Themes

This theme focuses on challenges during planning and execution. The VOS Viewer map does not explicitly mention challenge anticipation but highlights problems, which aligns with anticipating and addressing challenges. Anticipating challenges is a proactive approach to problem-solving in Value Management.

6. Regulatory Compliance (RC) vs. VOS Viewer Themes

This theme discusses how Value Management improves procurement and aligns with financial regulations. Although the VOS Viewer map does not explicitly mention regulatory

compliance, regulatory compliance is an essential aspect of Value Management that may not be explicitly captured in the VOS Viewer keywords.

7. Lack of Follow-Up (LFU) vs. VOS Viewer Themes

Value Management helps to ensure continuous monitoring and implementation. VOS Viewer map does not explicitly mention follow-up but highlights the need to address ongoing problems. Continuous follow-up is crucial for effective problem-solving and Value Management implementation.

8. Detailed Discussion and Planning (DDP) vs. VOS Viewer Themes

This is a critical theme in Value Management as it promotes thorough planning and idea sharing. The VOS Viewer map highlights opportunities, which can include detailed planning and discussions. Thorough planning and discussions are integral to seizing opportunities in Value Management.

Conclusion

The comparison between the manually generated themes from post-test responses and the VOS Viewer map reveals a strong alignment. Both methods emphasise stakeholder collaboration, problem-solving and addressing challenges as integral components of Value Management. The VOS Viewer map visually represents the connections between strengths, opportunities, problems and stakeholder involvement, which align with the qualitative themes identified from the post-test responses. The qualitative analysis correctly identifies common themes and codes based on the respondents' feedback. The frequencies of each theme are consistent with the qualitative data, providing a structured and insightful perspective on the strengths, opportunities and problems encountered during the application of the Value Management approach. This approach not only highlights the benefits but also identifies areas for improvement, making the analysis comprehensive and actionable.

Appendix 5: Value Management Study Framework Report Template

Date:

Location:

Time:

Title: (Enter the Project Title)

Invitees: (Stakeholders such as: Ambjent Malta Decision makers/Directors Project Manager/s, Project Sponsor/Client Representative, Project Architect/ Engineer, Cost Consultant, Mechanical and Electrical Engineers, Environment and Resources Authority (ERA), Superintendence of Cultural Heritage (SCH), Commission for the Rights of Persons with Disability (CRPD), Transport Malta (TM), Planning Authority (PA))

Attendees:

Project Brief: (Definition of Project)

Agenda: (How the Value Management Study shall be carried out)

Value Study Leader:

--

Workshop Tools used: (Example: Issues Analysis, Function Analysis, SWOT, Cost Quality Triangle, etc...)

--

Issues present: (List/ diagram of Issues highlighted following Issues Analysis/ brainstorming etc...)

--

Alternative Solutions: (Table/List of Functions/Solutions mentioned after carrying out Function Analysis/ FAST Diagram etc...)

--

Evaluation of Best Alternatives: (Table with different solutions including benefits for each, disadvantages, and cost)

--

Solutions: (Summarise the team's recommended solutions and proposals)

--

Way Forward: (This consists of setting an action plan which details those actions/tasks to be undertaken following the Value Management Study)

Appendix 6: Tools used for Project Value Management Workshops

Issues Analysis

In Value Management (VM), issues analysis is a critical step that involves identifying and analysing potential challenges, problems, or concerns related to a project. Addressing these issues early in the project planning process is essential for effective value management. Addressing potential issues effectively during the early stages of a project through comprehensive analysis and strategic planning is fundamental to successful Value Management. It ensures that the project remains on track, within budget, and delivers the intended value to stakeholders.

The Issues Analysis as described by Kelly et al was deemed as inappropriate for this study taking place, due to the constraints of the work environment. However, considering today's technological advancements, the conventional method used by Kelly et al was modernised using an online virtual tool which allows the use of virtual sticky notes instead. This tool allowed also the placing of the sticky notes of the different members under the headings as listed hereunder:

- Legal Issues
- Project Timeframe
- Project parameters
- Community
- Project drivers
- Client Organisation
- Natural Habitat
- Politics
- Finance
- Location
- Project Context

The virtual sticky notes were then sectioned according to the above headings and visually shown on screen shared with all members/stakeholders. This allowed all members to see the various issues listed by the different stakeholders so that a discussion, followed by a vote could be taken to highlight the most critical issues that needed immediate action. This technique lasted between forty-five minutes to one hour until all issues were exhausted and placed under their appropriate headings.

Function Analysis

Function Analysis is a fundamental component of Value Management (VM) workshops. It involves systematically breaking down a project, system, or product into its fundamental functions or purposes. Analysing these functions helps in understanding the core

requirements of the project and enables the team to brainstorm more creative and efficient ways to achieve those functions. By conducting a thorough Function Analysis in VM workshops, project teams can gain a deeper understanding of the project's essential functions. This understanding, coupled with creative brainstorming and rigorous evaluation, leads to optimized solutions and better value for the resources invested. Function Analysis brings out technical solutions which place focus on the actual needs and wants of the customer. It helps guide the different stakeholders to a consensus on the objectives of a project.

The technique/tool of function analysis requires that a function be described by a verb and noun. It is helpful to use active verbs instead of passive. The goal of such a tool is to identify, compare and classify the functions in order to build a virtual, function-oriented model of the project. A function analysis systems technique known as FAST diagram is highly versatile. It helps improve communication and motivation and can be used to cover a diverse range of complex problems in all sectors (Thiry, 1997).

A Brief Overview of the Function Analysis process (Value Analysis Canada, 2015).

1. Identify Project Functions:

Brainstorming: The participants were encouraged to brainstorm and list all the functions or purposes of the project, system, or product. These functions represent what the project is supposed to do and are the foundation of the analysis.

2. Function Analysis System Technique (FAST) Diagram:

Constructing a FAST Diagram: The FAST diagram was used as a visual representation of the project's functions and sub-functions. The main function was placed at the top, and sub-functions are arranged below it. Arrows show how functions contribute to higher-level functions.

3. Analyse Functions:

Value Analysis Questions: For each function, value analysis questions such as "Why is this function necessary?" and "What does this function do?" were asked. This helps in understanding the purpose and importance of each function.

4. Functional Performance Requirements:

Clarify Requirements: The performance requirements associated with each function were clearly defined as these requirements outline the criteria that the functions must meet, ensuring that they are measurable and specific.

5. Identify Redundancies and Overlaps:

Review Functions: the functions were examined in order to identify redundancies (functions that overlap in purpose) and overlaps (functions that serve multiple purposes). Redundancies were eliminated, and overlaps were optimised for efficiency.

6. Function Dependency Analysis:

Dependency Relationships: The relationships between functions was analysed. Some functions might depend on the completion of others. Understanding these dependencies is crucial for efficient project planning.

7. Creative Idea Generation:

Brainstorming Solutions: Once functions were well-defined and understood, brainstorming sessions to generate creative solutions for each function were carried out. Participants were encouraged to think outside the box and propose innovative ways to fulfil the functions.

8. Evaluate Alternatives:

The proposed alternative solutions for each function were evaluated. Factors such as cost, feasibility, environmental impact, and stakeholder satisfaction were considered when evaluating the alternative solutions.

9. Documentation:

Document the Analysis: The identified functions, alternatives considered, chosen solutions, and rationale for the decisions made were documented. Clear documentation ensures that the analysis process and decisions are transparent and can be communicated effectively to stakeholders. (Kelly, Male, & Graham, Value Management of Construction Projects , 2015)

The Function Analysis used for this study was in principle similar to the one explained above and by Male at al. However, some major changes were done in order to switch it virtually and make it more suitable for the projects, workshops and stakeholders present. Once more a virtual online platform was used to create a visual chart where all members inputted the different functions for the project. These were then placed in order of High order Needs to Low Order Wants on the virtual platform diagram during the workshop. From this FAST Diagram the Value Study Leader developed another virtual Diagram dividing the functions according to their level of importance. This was critical for the group to come up with the solutions for the different functions listed. The stakeholders bought up the potential solutions to the functions listed.

Element Function Analysis

An element for cost analysis purposes is defined as a component that fulfils a specific function or functions irrespective of its design, specification or construction. Elemental function analysis is a value engineering technique that seeks to identify innovative technical solutions that retain or add value to the project. Element function analysis seeks to provide the

necessary element functions at the required quality and at the lowest cost whilst identifying and eliminating any unnecessary cost. (Kelly, Male, & Graham, Value Management of Construction Projects , 2015)

Solution Pros and Cons Table

From the Function Analysis, the team, with guidance by the Value Study Leader tabled the Solutions gathered and discussed the Pros and Cons for each solution in order to have the most cost effective and efficient solution which met the functions and Base need of the Project.

Software used for Case Studies

The Main Virtual online software used was Miro which is a digital collaboration platform used to facilitate remote and distributed team communication and project management. Miro is a whiteboarding platform, Miro helps the team go beyond brainstorming, with a wide variety of tasks that require collaboration: workshopping, strategy mapping, Agile ceremonies, UX research and design, product development, customer discovery and process visualization. Hence it was deemed suitable for the applications required and enabled the conversion from manual sticky notes and notepad exercises and tools to more modern virtual online tools.

Google Forms

Google Forms was the software used in order to create, distribute and analyse the Pre and Post -Workshop questionnaires. Google Forms is a free to use questionnaire/survey software developed by Google.