



# THE UNIVERSITY *of* ADELAIDE

Faculty of Sciences, Engineering and Technology

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## ENG 4001 Honours Research Project Project Quality Management Plan

### CaveX Exploration Robot 2023

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By

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# 1 Scope

This document outlines the quality management plan for the 2023 CaveX Honours project team. The fundamental processes and procedures in place to ensure the production of a high-quality system are identified and closely related to system testing and evaluation planning in verification of the system level requirements. A carefully considered quality management plan also assists in the team's validation of the design to ensure the project outcome aligns with the end users' expectations.

## 2 Overview

The Project Management Body of Knowledge (PMBOK) guide outlines the key tools and techniques for quality management of a project. Quality management can be broken into three distinct processes as shown in figure 1 below. The processes include quality planning, quality assurance and quality control. Quality planning details the key stages in the project and techniques to ensure the project outcome has a high quality. Quality assurance provides the framework for fulfilling the predefined quality metrics and quality control lists the testing processes which ensure these requirements are satisfied.

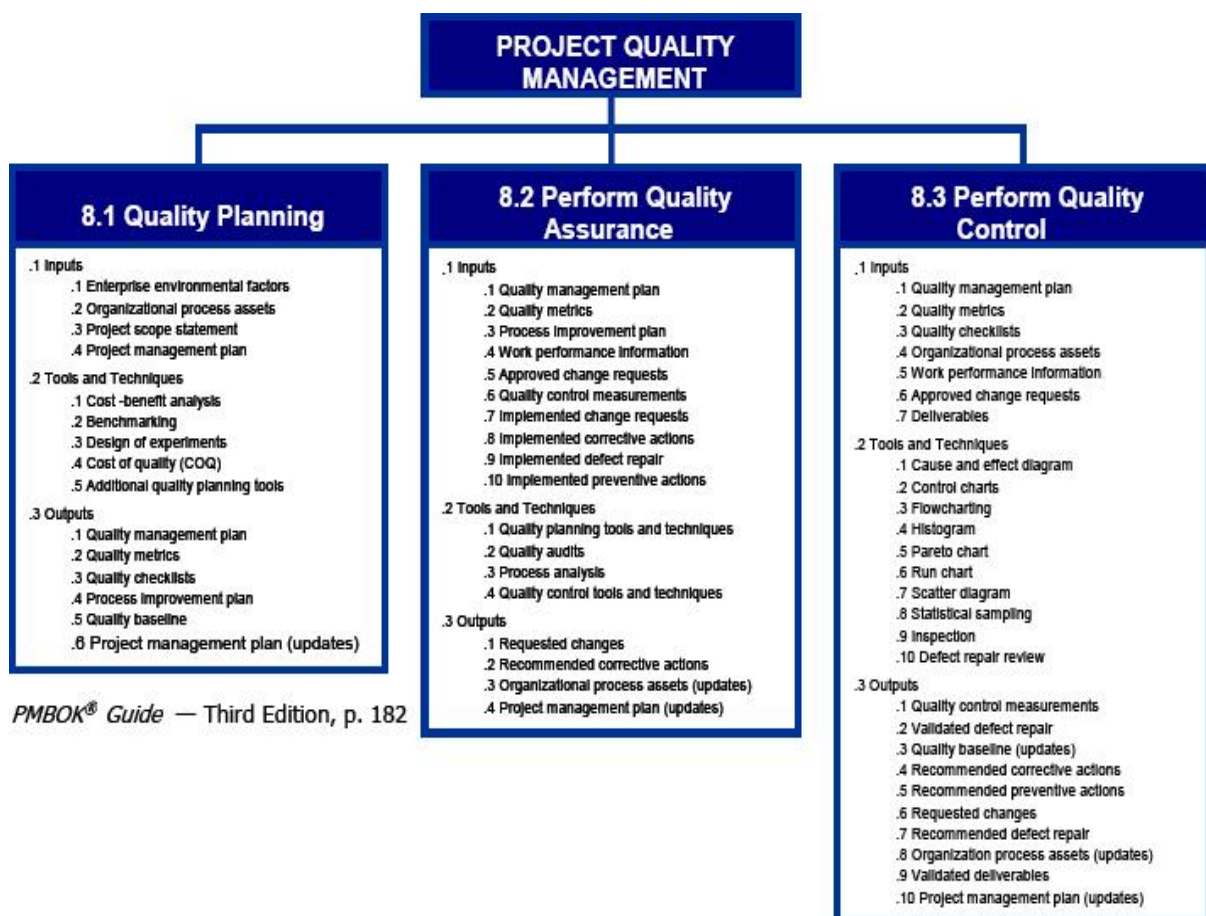


Figure 1: Project Quality Management Overview (PMI 2004) adapted from PMBOK Guide - Third Edition

### 3 Quality Planning

Planning processes to ensure the quality of the project outcome meets a high standard is essential in ensuring the clients' expectations are met. The team has devised a brief plan using systems engineering tools that will address the quality of the project shown in figure 2 below.

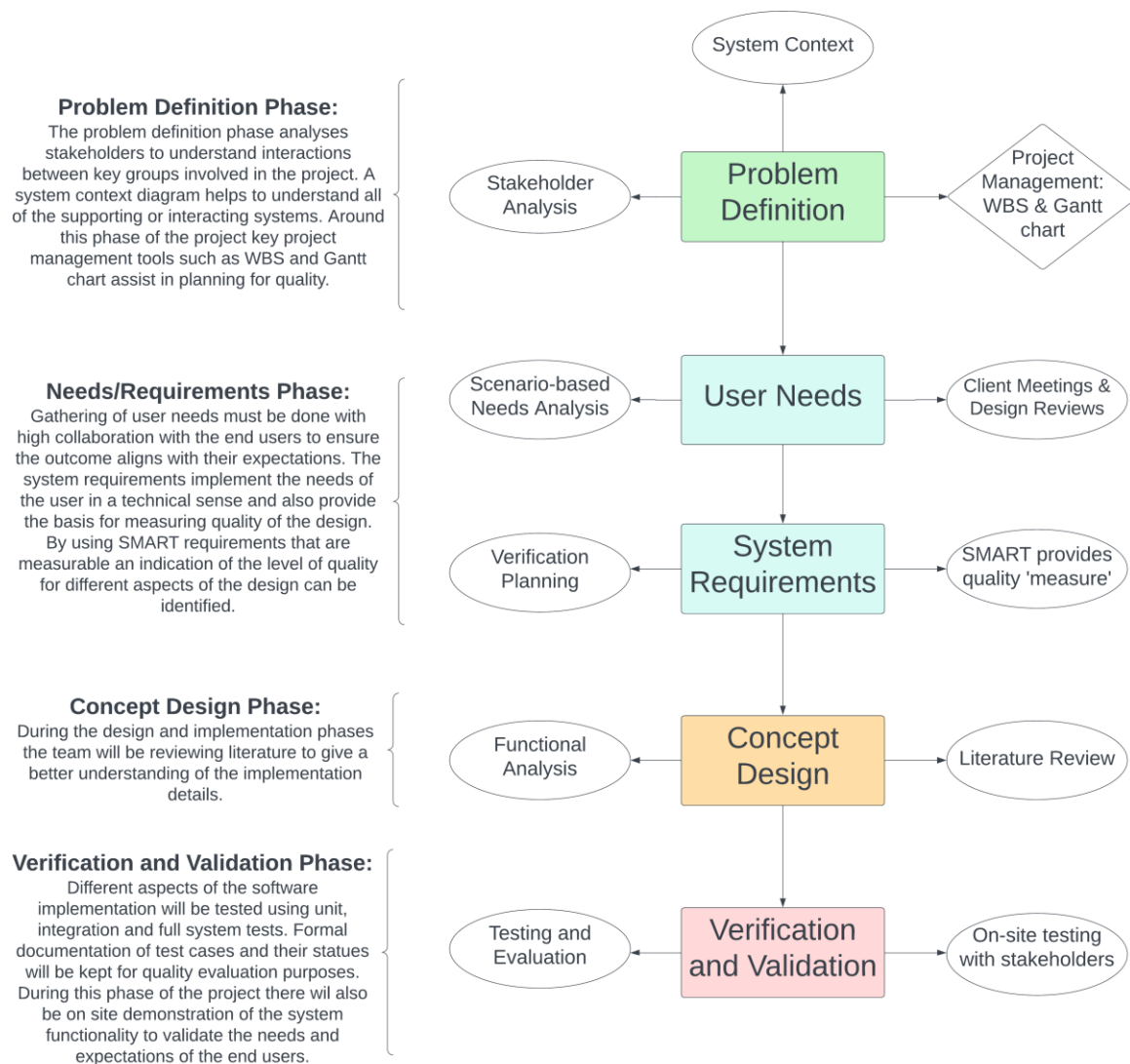


Figure 2: CaveX quality planning for different phases of the project

The first stage is to properly define the problem. This will include a detailed analysis of the current project state and what features need to be improved or added. Furthermore, a stakeholder analysis will be conducted to understand the external groups that are impacted by or can impact the project. The next stage is to accurately identify user needs using systems engineering tools such as scenario-based needs analysis and frequent communication with the end users of the product (Dr Elizabeth Reed and Craig Williams). After a list of fundamental user needs are developed, the team will begin translating these into system requirements that are traceable back to

the needs of the user. The system requirements will be constructed such that they adhere to the SMART (Specific, Measurable, Achievable, Relevant and Time-bound) guideline. The quality of different aspects of the system will be based on the measurable characteristics of the design that are specified to perform to a threshold in the system requirements. To better understand the system's functionality, a system context analysis and functional analysis will be conducted. The group also plans to conduct a literature review on environment mapping and autonomous systems to aid in understanding the implementation details. Finally, a detailed test and evaluation document which identifies fundamental test cases for the software and their corresponding statuses (fail or pass) will be written. This formal record will assist the group in identifying areas which need to be improved or fixed throughout the design phases that will ultimately help the group improve the quality of the final product.

## **4 Quality Assurance**

Quality assurance is the subsection of project quality management that is concerned with providing confidence that the project outcome will fulfill the predefined system requirements which are the basis for the quality metrics (ASQ 2023). The first step in assuring quality for the end users is to carefully construct system requirements that will guide the project design in the right direction. Quality, by definition, is the degree to which a set of inherent characteristics fulfill some set of quality requirements or metrics (Roseke 2018). Therefore, it is imperative that the requirements are specific, measurable, attainable, realistic and time-bound. SMART requirements will not only make the verification processes significantly more efficient, but they will also make it easier to identify areas of the design that do not comply with the desired level of quality.

Another crucial aspect of assuring quality is having carefully considered project management tools in place. The most important include schedule, scope and budget management. The team will follow a systems engineering approach with a strong emphasis on project management to assist in breaking down the project and keeping on the right track. A strict project schedule with soft deadlines, captured in the team's Gantt chart, will ensure the group starts implementation aspects on time which will mitigate risk associated with some project aspects exceeding their allocated time budget. Following the schedule closely will ensure there is adequate time for testing and evaluation of the system which will identify areas for improvement and overall ensure a higher quality product is produced.

## **5 Quality Control**

Quality control refers to the processes and techniques in place to fulfill the quality requirements (ASQ 2023). This project will follow an agile software engineering process where functionality will be developed iteratively in sprints. During each sprint, items will be moved from the product backlog, which contains a set of all tasks to be completed, into the sprint backlog to be completed in the current sprint. When new functionality is added it will be tested immediately. Testing during the sprints will allow early detection of bugs and will mitigate risks associated with poor quality and

exceeding the project's schedule. The most common type of test performed in the sprints will be unit tests that isolate individual software components and attempt to identify any flaws in its implementation. As the software implementation progresses, it will become necessary to perform integration tests which test the interaction between different components in the system such as the LiDAR-based mapping system and path planning software. Finally, towards the end of the project there will be full system testing where the entire robot system will be tested in an environment similar to the caves it will be deployed in to verify each of the system requirements. The system requirements should also be relevant to the needs of the user and, therefore, there must be consistent communications between the end users and CaveX team throughout the design stages. This will help to ensure the final product aligns with the clients' expectations.

## **6 References**

ASQ 2023, *Quality Assurance & Quality Control*, American Society for Quality, viewed 18/03/2023.

<<https://asq.org/quality-resources/quality-assurance-vs-control>>.

Roseke, B 2018, *Project Quality Management According to the PMBOK*, ProjectEngineer, viewed 18/03/2023.

<<https://www.projectengineer.net/project-quality-management-according-to-the-pmbok/>>.