
Museum Information Kiosk Quality Assurance

ISO 9001 Gap Analysis

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Overview

Meeting and maintaining standards in both production and meeting client expectations are necessary to ensure ongoing success within Australia. As such, XYZZY Software understands they must acquire ISO 9001 accreditation to secure upcoming government contracts, and to better meet the needs of their customers and stakeholders. Internally, XYZZY has selected the Whoop-Whoop Museum Information Kiosk (and two other) project(s) for review, in order to identify a *standard set of quality procedures* for the company, and to determine which organisational structures, procedures and processes are currently lacking for ISO 9001 accreditation. This documentation reviews both the *requirements for ISO 9001 accreditation* and *the existing processes at XYZZY* (based on the Information Kiosk project), in order to successfully analyse the “gap” between current and required standards for ISO 9001 accreditation.

ISO 9000 Standards

By conforming to the ISO 9000 family of standards (*of which ISO 9001 is a member*), organisations are seeking to ensure that quality management systems are implemented within their daily management and production practises. ISO 9001 provides a list of standards and requirements that XYZZY will have to comply with in order to gain ISO 9001 accreditation from an *accredited* certification body. Further explanation of the differences (and nuances) between certification and accreditation is available on the ISO (2011) site at http://www.iso.org/iso/iso_catalogue/management_standards/certification.htm.

To fully comprehend the ISO 9001 International Standard, it is both necessary and insightful to investigate recent (and current) research on the successful implementation of this standard. Following this, and to successfully achieve this accreditation for XYZZY, it is necessary to identify the specific ISO 9001 requirements XYZZY must fulfil. Once the processes, procedures and structures utilised at XYZZY are identified, the “gap” between both can be successfully analysed.

ISO 9001 Literature Review

Seeking a useful cross-section of literature is a necessary step in developing a background understanding of scope, meaning and ideals of the ISO 9001 International Standard. Many organisations and analysts have published research on their implementation (and insights) of the ISO 9001 standard based within their field. Gupta (2010) discusses the evolution of ISO 9001, from being used solely as a marketing tool with simply a paperwork impact for an organisation to auditors; to the full implementation of a quality management system that helps an organisation define and document processes to better serve customers, employees and the organisation itself; through both improved auditing, as well as identifying opportunities for implementing more effective business processes. One month later, Gupta (2010) published another article, in which he discusses difficulties in implementing this standard. Gupta (2010) offers industry advice for ISO 9001 deployment, including clearly defining performance goals, weekly revisions for continuous improvement, analysis of the root cause(s) of problems in order to take preventative action, and – most importantly – top management including the measurement of the quality management system (itself) into the overall measure of organisation performance. This research (so far) has alluded to the implementation of the ISO 9001 standard as a complete quality management system that covers all aspects of work flow.

Further to this, Lupo (2009) identifies two core principles of the ISO 9001:2008 standard. These core principles are the organisations ability to continually improve the efficiency and effectiveness of its quality management system; and to continually monitor customer feedback, and use or measure this to (again) improve the efficiency and effectiveness of the quality management system (Lupo 2009). Liao (2010) highlights the purpose of the ISO 9001 model is to achieve customer satisfaction. Liao (2010) continues that the structure of the ISO 9001 series continually defines processes that establish, implement and continually improve a quality management system. Qasimeh and Abran (2010) discuss the applied use of ISO 9001 to the software industry, and indicate that an ISO 9001 independent audit of software engineering processes can certify that these processes meet a defined international standard. Thus, it is clear from this research that the ISO 9001 standard requires continuous improvement based on customer satisfaction, as well as scheduled checks (e.g. internal audit).

The research also highlights some difficulties with implementing the ISO 9001 standard. Annous et al. (2010) discusses the difficulty of ensuring outsourced offshore software development companies meet ISO 9001:2008 standards – particularly the *Product Realisation* requirement that follows the traditional software development lifecycle stages. Annous et al. (2010) cites miscommunication, poor controls, lack of competence and limited user / customer interaction as challenges to a quality assurance process that successfully meets customer requirements. Domain specifically, Das et al. (2008) highlight the difficulty of applying the ISO 9001 Standard to a software development organisation. These authors explain that the dynamic networked communication and transportation of digital data within software development environments is a cause of inherent threat to the control of non-conforming software – as sufficient version control is often compromised (Das et al. 2008). Kelemen et al. (2009) provides a brief summary of multi-model approaches to use when meeting multiple standards (such as CMMI), and determine that without expertise (e.g. mapping each requirement to comparative processes) it is difficult for software companies to use multiple quality approaches simultaneously. However, Kelemen et al. (2009) indicates that utilising these standards is essential to institutionalise (i.e. mandate) their quality processes. Clearly the implementation of the ISO 9001 based on this research requires careful planning, implementation and revisitation to determine if the process itself is effective in delivering quality service.

As a summary to the body of research reviewed, Mahmoud et al. (2009) performs a comprehensive breakdown of the processes within the ISO 9001 Quality Management System model. Mahmoud et al. (2009) identify:

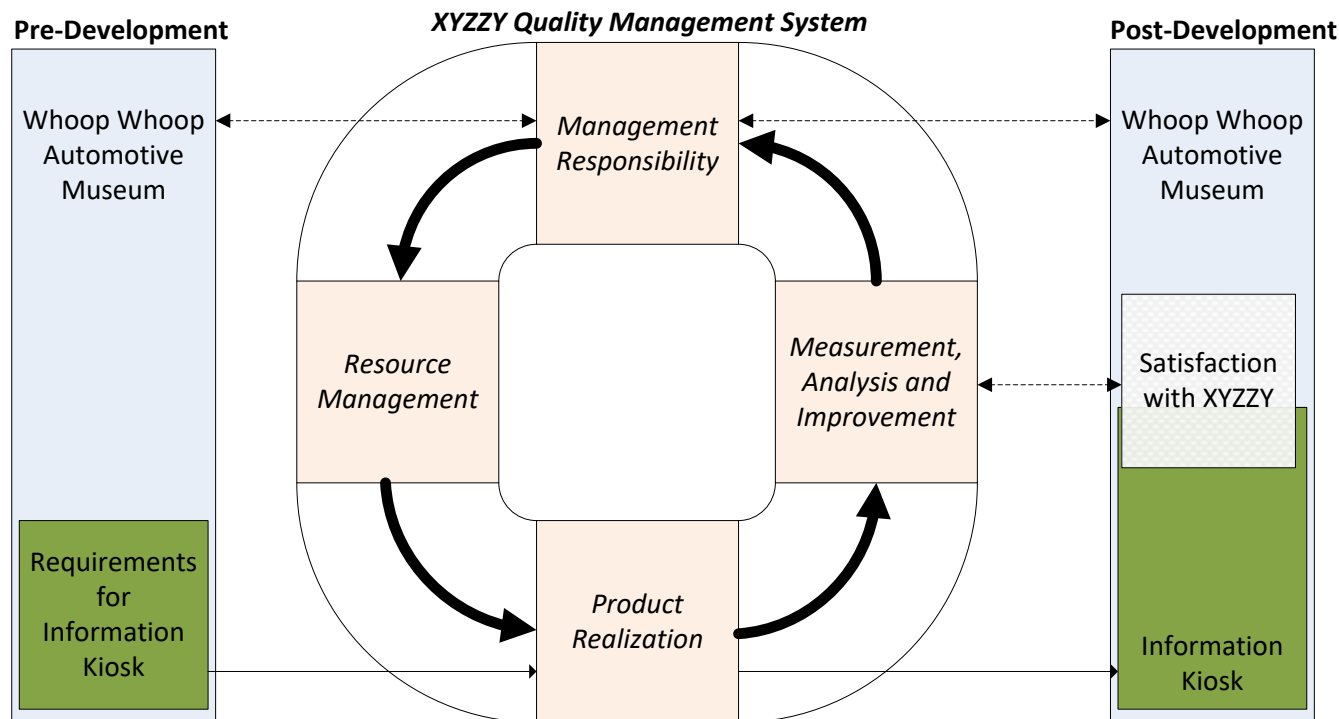
- a) *Direction processes* which attend customer and staff requirements, undertake decision-making and take affirmative action;
- b) *Stock Management processes* which track physical materials, as well as human, intellectual and environmental resources;
- c) *Realization processes* which ensure full planning of customer requirements;
- d) *Monitoring processes* which detect and measure both progress and non-conformity, and readily provide this information for successive and consequential decision making;
- e) *Continuous improvement processes* which make adequate improvements through affirmative and preventative action.

Mahmoud et al. (2009) synthesised the above processes (*a through e*) based on the ISO 9001 standards. One month later, Mahmoud et al. (2009) published a different research article, discussing a different method for modelling a quality management system (based on object oriented techniques utilising UML); in this later article, Mahmoud et al. (2009) highlights the need for a quality management system to be effective, yet agile and flexible. Wang and Tsai (2009) highlight the structures in place within the ISO 9001 standard; specifically, the documents and records control,

the review and audit of management and the quality process, the handling and improvement of non-conforming processes or products, and the plan-do-check-act structure that belies all requirements of the standard. Thus, it is clear from the research reviewed that the ISO 9001:2008 Quality Management System Requirements documentation must be approached with a customer centred application, keeping in mind benchmark organisational standards for assuring this quality process. Given this, the review of the XYZZY processes, procedures, structures and resulting “gaps” can begin. Initially, the ISO 9001:2008 Quality Management System – Requirements documentation will be investigated.

ISO 9001 Application – Processes, Procedures and Structures

Primarily, as was reflected in the research, the scope of the ISO 9001 Quality Management System International Standard involves both consistently meeting product regulations and customer requirements, as well as seeking continuous improvement of the actual system itself. Furthermore, the need to understand client requirements, the efficiency of processes utilised in terms of added (i.e. cost versus final) value, and the necessity of objective measurement of these processes and overall performance is given as further emphasis of the ISO 9001:2008 quality management system (and within the body of research reviewed). To achieve this, the ISO 9001 implements a process approach for each phase of a Quality Management System requirements. The process approach involves a “Plan-Do-Check-Act” system for each of the required (and thus reviewable) phases shown in the diagram below, which has been specifically adapted from page V of the Standards Australia / Standards New Zealand (2008) ISO 9001 Quality management systems documentation, for XYZZY purposes:



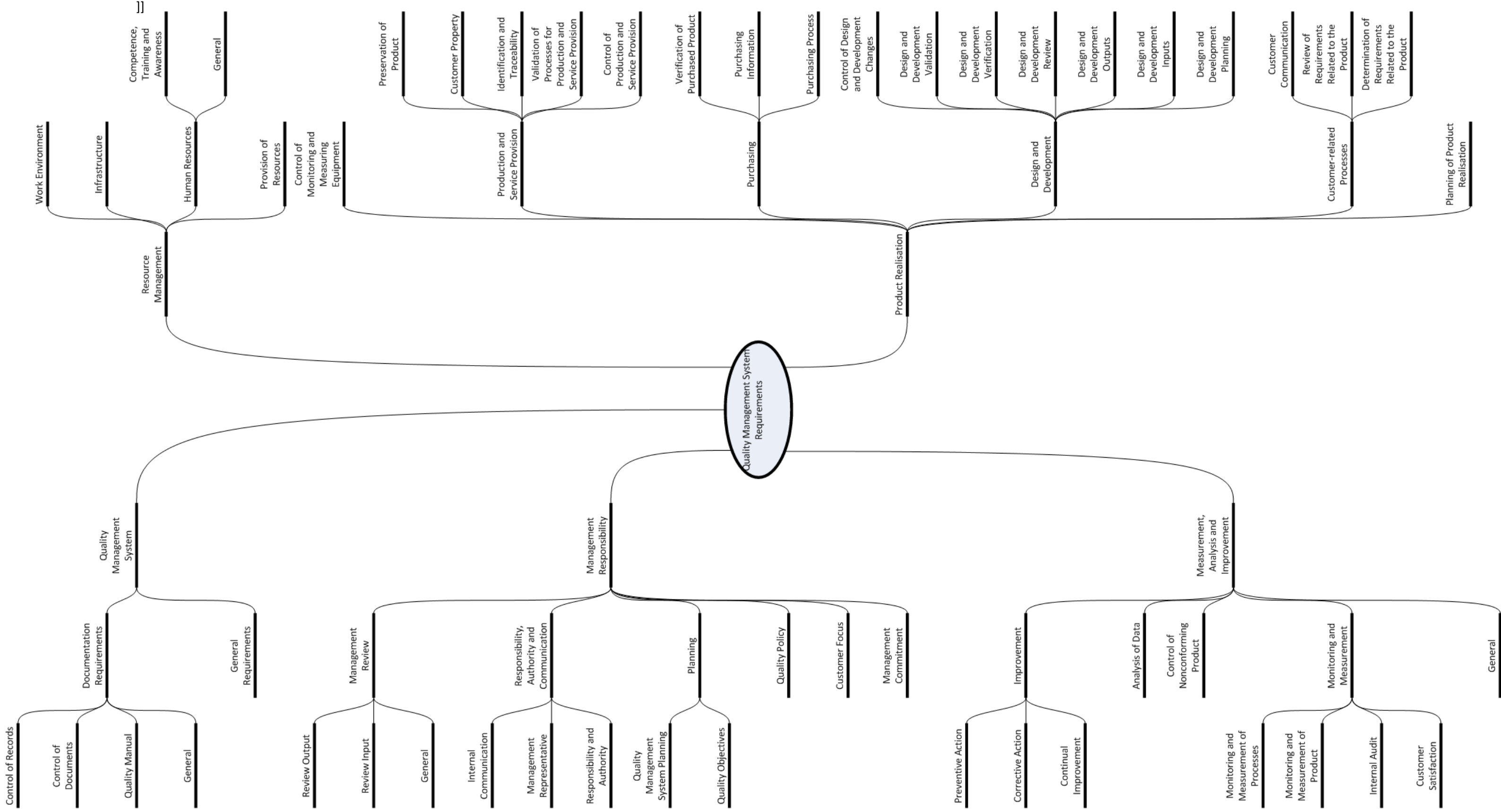
Thus, the necessary processes needed for review in order to meet the requirements of the ISO 9001:2008 standard for Quality Management System implementation at XYZZY is (the):

1. Quality Management System (itself);
2. Management Responsibility;
3. Resource Management;
4. Product Realization;
5. Measurement, Analysis and Improvement.

Each of these processes will be reviewed in the following paragraphs, based on the context of the implementation of the Whoop Whoop Automotive Museum Information Kiosk project. This accreditation will certify XYZZY in that it can (or rather will) demonstrate that it consistently provides software that meets customer requirements and Australian industry standards, as well as aiming to enhance customer satisfaction through Quality Management System implementation (and implementation of Quality Management System continuous improvements processes).

The processes, procedures and structures in place for each of the XYZZY quality management system that must be met are shown on the following page (note this has been deliberately published in landscape to best fit the required breadth and depth of the standard to the page – the information is simply a breakdown of the structure presented in the *Quality Management Systems – Requirements* documentation by AS / NZS 2008):

Breakdown of the AS / NZS ISO 9001:2008 Quality Management Systems - Requirements Documentation



As shown in the diagram on the previous page, the ISO 9001:2008 Standard of Quality Management System consists of five core requirements (with numerous sub-requirements). The five core requirements, as applied to XYZZY are detailed below with an explanation of each:

Requirement	Description	Page Reference
Quality Management System	XYZZY must establish, document, implement and maintain a <i>quality management system</i> , as well as continually improve its <i>effectiveness in accordance with the requirements</i> of this ISO 9001:2008 standard.	2
Management Responsibility	XYZZY management must: <ul style="list-style-type: none"> • ensure that the <i>requirements</i> of the Whoop Whoop Automotive Museum (as well as all its other customers) are ascertained and are met with the aim of <i>increasing their satisfaction</i>; • commit to implementing and continually improving the <i>quality management system</i> and <i>quality policy</i>; • plan at all levels of XYZZY for both the <i>customer objectives</i> as well as the <i>quality management system</i> itself, and make sure this planning is consistent with the <i>quality policy</i> defined above; • take responsibility for action and communication of this system; • review the role of management in this process at planned intervals. 	3 – 5
Resource Management	XYZZY must determine and provide adequate <i>resources</i> needed for <i>staff training</i> and <i>maintaining staff competence</i> , as well as resources required to <i>perform work</i> with and within (i.e. the <i>work environment</i>). These resources must be provided in accordance with meeting both <i>client requirements</i> and <i>continuous improvement</i> in the <i>quality management system</i> .	6
Product Realization	XYZZY must plan and develop processes to: <ul style="list-style-type: none"> • understand and review client requirements, as well as providing for continual client communication; • maintain adequate <i>design</i> and <i>development records</i>, including verifying and validating <i>customer needs</i> and reaffirming the <i>customer requirements</i> throughout; • establish adequate <i>purchasing processes</i> and keep records of this process; • assert <i>product</i> and <i>service provisions</i> that are validated, controlled, traceable, identifiable and preserved where possible, given customer accountability; • uphold <i>monitoring</i> and <i>measuring equipment</i> and <i>processes</i> through the product realization; 	7 – 12
Measurement, Analysis and Improvement	XYZZY shall monitor, measure, analyse and improve <i>conformity</i> (using validated , preferably quantifiable methods) to: <ul style="list-style-type: none"> • <i>quality policy</i> and <i>client / product requirement processes</i> detailed above; • the <i>quality management system</i> itself. 	12 – 14

Following the compilation of this documentation, the JAZ-ANZ Site (2011) details the process for actually gaining the ISO 9001:2008 Accreditation. As explained on this site, to gain accreditation, a JAZ-ANZ accredited Conformity Assessment Body must attest that XYZZY has demonstrated its competence at implementing this quality management system. The guidelines of JAZ-ANZ for the issuing Conforming Assessment Body indicate that once accreditation has been approved, surveillance assessments of XYZZY – either half-yearly to two-yearly – must take place to ensure ongoing compliance. Finally, re-assessment of this accreditation must occur every four to five years. More information on finding a certification body can be found on the ISO (2011) Site:

(http://www.iso.org/iso/iso_catalogue/management_standards/certification/choosing_a_certification_body.htm).

For XYZZY to find an accreditation body to gain formal accreditation (*not certification*), it is recommended that the JAS-ANZ Register tool on the JAS-ANZ website be utilised, as illustrated below:

JAS-ANZ Register

About the JAS-ANZ Register
Certified Organisations
Accredited Bodies
Accredited Bodies Register Help
Certified Personnel

FAQ

Applying for JAS-ANZ Accreditation
How Certification and Inspection Bodies apply for JAS-ANZ accreditation. Read more...

Import Requirements
How do I find out if a product needs to be certified before being imported and

Accredited Bodies

Important Notices

Search Accredited Bodies

Name:

Program: Management Systems

Standard: AS/NZS ISO 9001:2008

ANZSIC: Any

Location¹: Australia QLD

Country²: Australia

¹Offices located in selected country.
²Accredited to issue certificates in selected country.

Search

Having established the processes, procedures and structures with the ISO 9001:2008 standard, it is now necessary to investigate the XYZZY processes, procedures and structures to formulate a final comparison.

XYZZY Processes, Procedures and Structures

The XYZZY processes, procedures and structures will be investigated under the ISO 9001:2008 framework presented above. This assessment is based on the implementation of the Whoop Whoop Automotive Museum Kiosk Information System. It is recommended that the results be cross-collaborated with the other two projects that XYZZY have selected for review for accreditation purposes.

Quality Management System

Based on the development of the Whoop Whoop Automotive Museum Information Kiosk, and known information from experience and XYZZY organisational currency, it can be assumed that currently, limited quality management system has been recognised at XYZZY.

In terms of *internal quality assurance*, a process exists whereby XYZZY require (from their engineers) documented project planning, requirements specification and design documents, as well as fortnightly progress reports. Their products (i.e. the software that is produced for clients) require full testing and documentation, as well as user instructions and (upon completion of) a full project review.

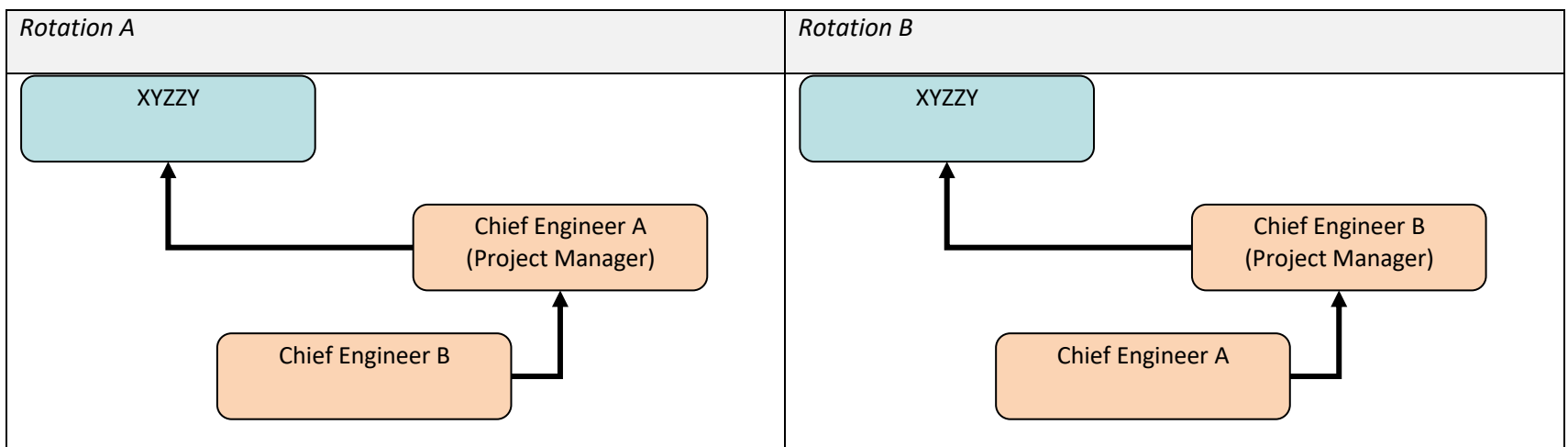
Given this, as far as records and documents outlining or detailing standards for communication, infrastructure, customer interaction and detailed management protocols – these have yet to be developed within the XYZZY organisation. As far as staff grievances, documentation of processes required for the development of products, as well as mitigation strategies, development cycle documentation and process review – these have been made available by XYZZY via the resources within the engineer training course (see *Resource Management* below) as well as supplied literature and *top management* client brief (see *Management Responsibility* below).

Thus, it can be stated that the *quality management* existing within the Whoop Whoop Automotive Museum Information Kiosk has been **integrated** within the cycle of constituent phases that would comprise a *quality management system* itself. Therefore, the processes that exist for XYZZY to maintain standards are detailed within the *Management Responsibility, Resource Management, Product Realisation and Measurement, Analysis and Improvement* sections below.

Thus, currently under a loosely connected umbrella system of standards at XYZZY, very little exists in the formal recognition of any quality management system put in place.

Management Responsibility

Internally, XYZZY assigned the management responsibility of the Whoop Whoop Information Kiosk project to two chief engineers. These engineers were given time and resource constraints (discussed further below in *Resource Management*) in which to complete their work. Furthermore, they were given a shared management structure; insofar as each engineer was allocated the role of *Project Manager* for an equal amount of time. The current responsibility hierarchy of XYZZY is thus shown in the following diagram:



Through the engineer collusion, it was decided that this rotation would occur on a fortnightly basis. Over a 12 week development window, this would allow 6 weeks per management cycle (3 sets of 2 weeks). Management responsibilities are shown in the following table, which is based solely on experience of the implementation of the Whoop Whoop Automotive Museum Information Kiosk project:

Hierarchy	Responsibility
XYZZY	Management of departments (e.g. Marketing, Development, etc.); Assignment of projects to departments; Facilitate work collaboration between (but not within) departments; Co-ordination of department and external client communication and interaction; Progress check departments through reporting mechanisms (e.g. milestone documentation).
Chief Engineer (Project Manager)	<i>Including the Chief Engineer Tasks listed below, a Chief Engineer (Project Manager) must also:</i> Lodge fortnightly progress report (including updated risk plan).
Chief Engineer	Develop objectives and constraints, as well as hardware and software requirements within XYZZY assigned project; Determine project plan, including work breakdown, project organisation, schedule, risk plan and milestones; Ascertain project requirements from both system functionality from use case scenarios; Design user interface(s), classes and database objects required; Implement and document specified solution, including the creation of user documentation (and commenting of code); Participate in the project review process.

Given the processes detailed in the management of tasks in the preceding table, it is evident that within the Whoop Whoop Automotive Information System Kiosk project that **top management responsibility** was given to the *project engineers*, with full authority inside of the constraints initially specified by XYZZY.

Resource Management

Resources assigned to the **top management** (defined above) of the Whoop Whoop Automotive Museum Information Kiosk included the time, physical (hardware and software) resources as well as the human resources. The management of these resources became the responsibility of the top management to utilise effectively to achieve the responsibilities set out above.

Time constraints allocated to top management by XYZZY were a twelve week period to deliver the proof of concept system. Milestones and reporting mechanisms based on task scheduling were all responsibilities of time resource management carried out by the chief engineers.

Hardware resources were (in this instance) self-determining, with engineers cross-collaborating on IBM PC compatible architecture. The engineers themselves provided sufficient hardware and physical infrastructure (including access to internet and suitable storage devices) in which the project itself could effectively be realised. Due to the remote / distributed nature of the development process, the engineers were able to work in both fixed locations (e.g. home offices) and mobile environments (e.g. airports). Thus, the desired environment in which to complete work was left to the engineer(s) discretion.

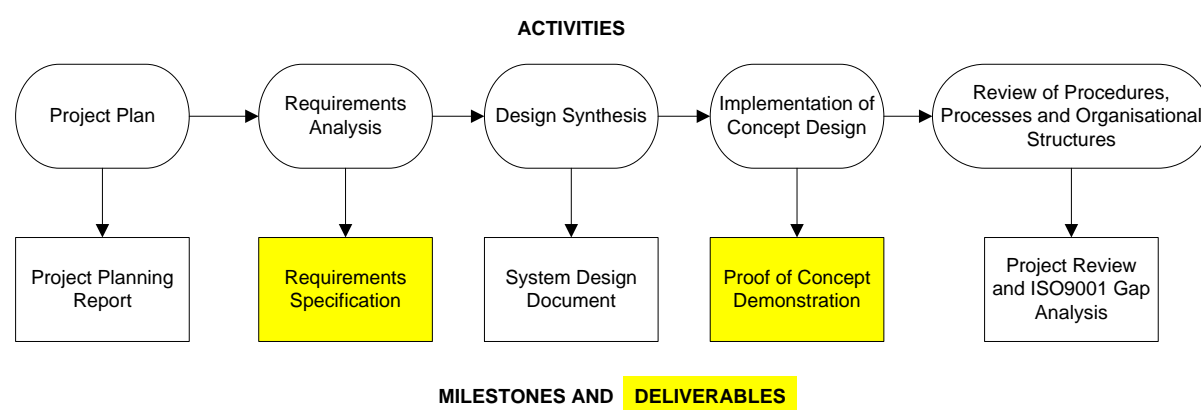
Software to realise the product was limited by XYZZY to Visual Studio 2005 C++ / CLI utilising the most recent release of the Microsoft .NET platform. This was utilised at no monetary cost to XYZZY or engineer. The software itself provided sufficient functionality to competently implement the requirements of the Whoop Whoop Automotive Museum Information Kiosk.

The human resourcing of the engineering team itself was provided by XYZZY. The engineers selected were assured of competence, which by default was provided by the *academic pre-requisites* of initially being assigned the project. Inherently, to be assigned this project, the engineers themselves must have gained credit of post-graduate units in structural and object-oriented programming.

Internal training of engineers was also provided by XYZZY – in this case in the form of a course in project management, with lecture slides and set readings to follow each week. Upon completion of this course it is hoped the engineers have gained advance skills in information technology project management.

Product Realisation

XYZZY top management for the Whoop Whoop Automotive Museum Information Kiosk project implemented a series of processes to ensure quality delivery of the product itself. The processes are detailed in the following diagram, which was delivered within the *Project Planning Report* milestone:



Initially, following the *marketing department brief* that was supplied to the engineers upon commission of the project, a set of objectives were formed that would determine the breakdown of work processes (and work dependencies) to follow. Through this initial project planning, the engineers were able to analyse the client requirements and deliver a *Requirements Specification* document to the client before construction work began on the software (product) itself. The resulting client approval (and thus **verification**) led to a set of benchmarks that the engineers could use to measure **product success** upon completion. It is of noteworthy mention that the *System Design Document* was planned around the (client verified) *Requirements Specification*. Coupling this with fortnightly reports has led to the XYZZY *documentary evidence available* of the aforementioned development process of the product.

Following the initial planning stages, however, customer contact has been infrequent and necessity based only. The fortnightly progress reports were (believed to be) delivered internally – to the XYZZY organisation – as these contained sensitive data, including risk assessments and raw (i.e. uncensored) assessments of project status to date (it was not advisable to not share the entirety of this information with the client as to avoid unnecessary panic or unease).

During development, purchasing of software to realize the Information Kiosk was not a formalised process; as all resources were made available without cost via the Microsoft DreamSpark and .NET Framework agreements. Future publishing requirements and restrictions may involve purchasing licenses for the products currently used.

Following implementation of the product, **verification** testing occurred with full documentation of this process (and results) available for all stakeholder(s) review (including both upper tiers of XYZZY, clients, marketing and other interested parties). This *Proof of Concept Demonstration* formulated the second (and more critical) deliverable to the client, which illustrated whether (or not) successive quality processes had (or had not) led to competent product realisation – based on initial client *Requirement Specification(s)*.

Finally, at XYZZY the product realisation process contains a project review – which the top level management engineer(s) utilise to document successes and shortcomings within the processes and structures in place, both in terms of product realisation and other areas of the quality management system (detailed further below in *Measurement, Analysis and Improvement*). This provides an opportunity to highlight necessary future changes to the structures, procedures and processes in place at XYZZY. As yet, post-development support for the client has been offered with user instructions, however, no training packages, warranty information or other post-production agreements have been put in place between XYZZY and the Whoop Whoop Automotive Museum.

Measurement, Analysis and Improvement

Throughout the processes described above, continual consultation and collaboration between all stakeholders led to an *action-ongoing* process of measurement, analysis and improvement throughout each stage of development. This includes the provision of all deliverables and milestones, as well as fortnightly progress reports; these reports contained quantitative measures of resource consumption (e.g. hours worked), and product progress. Risk assessment was initially assessed in planning and progress report stages, with (again) quantitative measurements for risk analysis and mitigation strategies for improvement (if development was behind schedule).

Formally, however, the final process of *Measurement, Analysis and Improvement* was alluded to in the previous section – the *Project Review*. This enabled client satisfaction to be measured (and thus the success of the product meeting its stated objectives), as well as the time / cost effectiveness of the software development processes employed. This document can (and should) form the basis for XYZZY internal auditing processes.

Finally, it must be noted that this document itself – the ISO 9001:2008 gap analysis – forms a further part of the XYZZY top management engineers at auditing and implementing quality processes, based on client (customer) satisfaction.

Given these processes, procedures and structures, a gap analysis can now take place highlighting the areas that XYZZY must take action within to comply with the ISO 9001:2008 standard in quality management systems.

The results of the gap analysis begin on the following page.

Gap analysis

Given the processes, procedures and structures implemented above at XYZZY, the following is a gap analysis of all areas required for XYZZY to meet the ISO 9001:2008 standard of Quality Management System requirements. Where a requirement of the International Standard is not met (as shown with red shading), a **suggested solution** has been provided (as shown with blue shading). Green shading indicates areas of current competence. With this in mind, the table has been split into three columns; the requirement itself, followed by the XYZZY gap analysis, and finally the competence indicator – this final column (alongside the associated shading already mentioned) indicates whether or not XYZZY has currently demonstrated necessary implementation of the respective requirement to be granted competency:

Requirement Standard	XYZZY Gap Analysis	Competence
4. Quality Management System		
4.1 General Requirements	<p>Although XYZZY documents, implements and maintains quality through processes deployed throughout its development system, and offers the chance at the end of each product delivery to improve its effectiveness, to date no official Quality Management System based on <i>International Standard(s)</i> has been established through formal recognition at XYZZY.</p> <p>In particular XYZZY must satisfy (taken from ISO 9001:2008 page 10 Standard 4.1) the following two criteria:</p> <p>a) the determination of processes needed for a quality management system and their application throughout the organization, as formal recognition of a <i>quality management system</i> at XYZZY does not yet exist; and</p> <p>b) the determination of the sequence and interaction of these processes, which will be identified in a Quality Management System document once this has been established.</p> <p>Given that standard 4.1 is a base clause of the ISO 9001:2008, the determination of criteria and methods needed to ensure effective operation and control of processes can be integrated into the processes themselves; however, at time of publishing no criteria exists to measure the effectiveness of an established (future) <i>quality management system</i> itself. Continued, as this as a base clause, it is inherently more logical that these criteria exist as objectives within the quality manual – which will be detailed below.</p> <p>Formal recognition of a quality management system at XYZZY must recognise International Standards in software authoring, publishing, deployment and support in order to meet competency for this standard.</p> <p>Suggested Solution:</p> <p>It is recommended XYZZY develop a <i>process model</i>, to (in more detail) show the full sequence and interaction of work. This must include all business / client / department (e.g. marketing, development, etc.) / management and quality review processes. Put simply, the process model should be done using a <i>flow-chart style</i> diagram, which can be successfully completed using software such as Visio 2007. It is further recommended that the diagram itself (for coherence) is limited to two pages.</p> <p>International governing standards (and authorities) that impact the business processes (as shown on this diagram) must be explicitly stated and labelled.</p>	✘
4.2 Documentation Requirements		
4.2.1 General	<p>No formal, recognised, documented statements of a quality policy or quality objectives currently exist within the XYZZY organisation. As such, <i>no quality manual currently exists</i>.</p> <p>However, documentation of procedures and records mostly exist in line with the (following) standards, as well as documents pertaining to the effective planning, control and operation of its processes.</p> <p>Suggested Solution:</p> <p>See 4.2.2 Quality Manual (below) – fixing this will inherently provide competence to this base clause. Included in this documentation must be a <i>quality policy</i> and <i>quality objectives</i>, e.g.:</p> <p>“XYZZY is committed to both the requirements and continual improvement of this Quality Management System, in order to best ensure it is meeting all of the diverse and intangible needs of its clientele. Through continued innovation and investment in this process, XYZZY will maintain organisational standards through the resulting on-going strategic renewal. Measurable and / or qualitative objectives of this process may include:</p>	✘

	<ul style="list-style-type: none"> Increasing standard of final customer product acceptance to 98%; Reducing delay in projects to less than 10% of the allocated project time; Increasing the number of mitigation strategies for each risk to include outsourcing alternatives; Etc. 	
4.2.2 Quality Manual	<p>A formally agreed upon <i>Quality Manual</i> has yet to be recognised at XYZZY.</p> <p>Suggested Solution:</p> <p>XYZZY must establish (and maintain) a quality manual that:</p> <p>a) defines the scope of the quality management system (with exclusions), for example: "...to encompass the software development, marketing and financial controls of the business, but exclude the international distribution process due to outsourcing";</p> <p>b) makes reference to the procedures of the XYZZY quality management system, for example the governing standards (and more-so the absolute processes to meet these standards) defined below;</p> <p>c) describes the interaction of the quality management system processes specifically pertaining to the XYZZY – which could be an adaptation of the document defined by the author on page 3 of this gap analysis document.</p>	✘
4.2.3 Control of Documents	<p>XYZZY top management employs version control on all documents, with track changes, revision edits, distributions and previous versions all managed within the networked file system of the employee environment (in the case of the Whoop Whoop Automotive Museum Information Kiosk, via the internet). With this, and with controlled time backups, XYZZY may be awarded competence here, provided the new documents introduced in this accreditation process (e.g. the <i>Quality Manual</i>) continue to maintain this standard.</p> <p><i>This procedure must simply be documented.</i></p> <p>Suggested Solution:</p> <p>Document the above mentioned procedure (copy and paste is nearly sufficient) and make reference to it in the <i>Quality Manual</i>.</p>	✘
4.2.4 Control of Records	<p>As specified in 4.2.3, records (which as defined in 4.2.3 are simply a special type of document) used within XYZZY have been successfully controlled using the aforementioned document strategies.</p>	✔
5. Management Responsibility		
5.1 Management Commitment	<p>Top management – for the scope of this gap analysis – has been previously defined as the engineer(s) responsible for the production of the Whoop Whoop Information System Kiosk. With this in mind, the engineers frequently communicated the importance of meeting customer requirements through planning, specification and risk assessment documentation, as well as researching (and ascertaining previous studies within) software development life cycle requirements.</p> <p>Furthermore, the top management was able to establish benchmarks at which quality (in this case meeting client requirements) could be measured. The review process and the assurance of resources were all successfully handled by top management.</p> <p>In this case, the only failure of the top management, as defined by ISO 9001:2008 page 12 Standard 5.1 is:</p> <p>b) establishing the quality policy.</p> <p>Suggested Solution:</p> <p>Establish a quality policy taking into account the standards set out in 5.3 Quality Policy below.</p>	✘

5.2 Customer Focus	The engineers established customer needs that were verified in the Requirements Specification documentation; furthermore, through the Proof and Concept Demonstration and <i>Project Review</i> , these needs were again checked against the original benchmarks to determine satisfaction of customer. Through this, and with insights taken from the client brief further developed, it can be stated the processes currently in place – that were utilised in the development of the Information System Kiosk – are successful tools for enhancing customer satisfaction.	<input checked="" type="checkbox"/>
5.3 Quality Policy	In Standard 5.1 (above), it was identified that no <i>quality policy</i> exists.	<input checked="" type="checkbox"/>
	Suggested Solution: Develop a quality policy – within half an A4 page – that outlines the commitment and purpose of the business, both to the products it delivers and to the continual improvement of the quality management system. For example: “XYZZY aims to provide leading, reliable, cost-effective and efficient information technology solutions for its clientele. XYZZY is committed to the continuous improvement of its products and services, as well as ensuring ongoing compliance with its Quality Management System. Through this, XYZZY hopes to provide better, longer lasting customer satisfaction.”	
5.4 Planning		
5.4.1 Quality Objectives	XYZZY engineers – responsible for managing this project – ensured quality objectives documented in the <i>Project Plan</i> were in alignment with (primarily) customer needs, as well as (secondarily) standards in software development, engineer competence and resources available. Continuous improvement of this process was ensured by the <i>Project Review</i> process, which measured the degree of success of each one of these objectives.	<input checked="" type="checkbox"/>
5.4.2 Quality Management System Planning	Planning time for the Quality Management System has yet to be allocated within the XYZZY organisation. Once the <i>General Requirements (Standard 4.1)</i> have been established, the time to continuously improve the system itself must be factored (suggestively into the <i>Project Review</i> , but wherever necessary), as well as carrying out the process of measuring the quality objectives detailed in <i>Standard 4.2.1</i> .	<input checked="" type="checkbox"/>
	Suggested Solution: XYZZY must undertake adequate Quality Management System planning processes as indicated in the gap analysis description (above).	
5.5 Responsibility, Authority and Communication		
5.5.1 Responsibility and Authority	Responsibilities of the engineers have been defined in both the <i>client brief</i> given to the engineers upon commission, and using the work schedule breakdown in the <i>Project Plan</i> (alongside the Project Organisation documentation), top management were able to further delegate (and assign responsibility of, and authority to) allocated tasks.	<input checked="" type="checkbox"/>
5.5.2 Management Representative	The Project Organisation section of the initial Project Plan documentation clearly appointed the project manager, whose responsibility it was to liaise within the organisation with required progress, resource consumption and future strategies. The engineer(s) themselves were an equally commissioned project and thus dual responsibility was maintained throughout for quality process assurance.	<input checked="" type="checkbox"/>
5.5.3 Internal Communication	Communication was established in the <i>Project Plan</i> documentation, through email, Skype, telephone and mail. This enabled alternative forms of communication and a true collaboration of work. The communication system itself further entailed effective on-going review of quality management within the Information System Kiosk.	<input checked="" type="checkbox"/>
5.6 Management Review		
5.6.1 General	The informally recognised quality management system utilised by the top management engineers in this instance was reviewed throughout development within the <i>Fortnightly Progress Reports</i> , as well as within the <i>Project Review</i> . Risks to the quality process were established throughout; these were measured and mitigated where possible. The final review process assessed all areas of development and allowed for the identification of opportunities for improvement to the whole quality process; all of these documents were kept as records to attest to this process.	<input checked="" type="checkbox"/>

5.6.2 Review Input	The review process mentioned in 5.6.1 included customer feedback, measurements of progress and risks to date, details of client discussions or organisation decisions, and suggestive actions made towards top management that were necessary to affect change.	<input checked="" type="checkbox"/>
5.6.3 Review Output	The review process mentioned in 5.6.1 provided adequate breadth and depth to comment on process and product performance, make suggestion of potential changes to the processes being employed and highlight opportunities for improvement of the entire process.	<input checked="" type="checkbox"/>
6. Resource Management		
6.1 Provision of Resources	All resources provided by XYZZY were sufficient to both implement quality management and to achieve product realisation; furthermore, these resources successfully met customer needs and allowed for the collaboration and improvement of quality processes. These resources included, but were not limited to – physical (hardware and software), environmental, human, and management – these will be further detailed below.	<input checked="" type="checkbox"/>
<i>6.2 Human Resources</i>		
6.2.1 General	Competence of all engineers was ensured through academic pre-requestion, as well as the on-going external university support course – “Information Technology Project Management” – which was compulsory for all engineers in the top management of this project.	<input checked="" type="checkbox"/>
6.2.2 Competence, Training and Awareness	As was alluded to in Standard 6.2.1, the determination of competence of engineers was provided by the XYZZY organisation itself through past academic performance. Furthermore, evaluation of this competence was provided throughout the development of the project, based on documentation and deliverable results.	<input checked="" type="checkbox"/>
6.3 Infrastructure	The infrastructure has been provided by top management themselves, and given the nature of this industry, very little is required in terms of industrial equipment. A suitable work environment (compliant with Australian OHS and Ergonomic Health standards), as well as internet, software and sufficient PC architecture were supplied and maintained by the engineers themselves.	<input checked="" type="checkbox"/>
6.4 Work Environment	This is competent as illustrated in Standard 6.3 above.	<input checked="" type="checkbox"/>
7. Product Realisation		
7.1 Planning of Product Realisation	Recorded evidence has been kept throughout the implementation of the Whoop Whoop Automotive Museum Information Kiosk development project, of the planning (<i>Project Planning, Requirements Specification and Design Documentation</i>), as well as the <i>Fortnightly Progress Reports, Testing and Project Review</i> . All of this documentation has determined, verified and validated quality processes and objectives, opportunity and need for change, and other necessary steps towards product realisation.	<input checked="" type="checkbox"/>
<i>7.2 Customer-related Processes</i>		
7.2.1 Determination of Requirements Related to the Product	Customer requirements have been established for the Whoop Whoop Automotive Museum Information Kiosk in the client brief given to the engineers upon commission of the project. These were further ideated for production and post-production; and finally detailed as measure objectives within the <i>Project Planning</i> before commencement of the final product began. These objectives were further cross checked with applicable Australian guidelines in software development, as well as processes identified by XYZZY and academic course materials of the aforementioned course.	<input checked="" type="checkbox"/>
7.2.2 Review of Requirements Related to the Product	The <i>Project Planning</i> document mentioned in Standard 7.2.1 was presented as a milestone to the customer and verified before further work commenced. By this stage, the monetary and deliverable aspects had been agreed upon between the Whoop Whoop Automotive Museum and XYZZY. Furthermore, XYZZY had internally confirmed its ability to deliver the product.	<input checked="" type="checkbox"/>
7.2.3 Customer Communication	Milestones, Project Review and the initial client brief are all documented evidence of customer information gathering and dissemination, in relation to product queries and concerns. Though minimal, there is enough evidence to suggest competence (though room for improvement) here.	<input checked="" type="checkbox"/>
<i>7.3 Design and Development</i>		

7.3.1 Design and Development Planning	<p>Standard 7.3 is predominantly concerned with XYZZY's implementation of the lifecycle development of the Whoop Whoop Automotive Information Kiosk system. Acceptance testing, verification and validation and validation occurs wherever possible at each of the following stages:</p> <ul style="list-style-type: none"> • <i>Client Brief</i> – presented to engineers upon commissioning of the Information Kiosk project; • <i>Project Planning</i> – collected client information from the client brief, analysed and synthesised potential requirements and client objectives, determined and proposed task schedule, risk and project management in order to achieve desired product, as well as agreed upon monitoring and reporting mechanisms; • <i>Requirements Specification</i> – included use case scenarios and system functionality which was presented to the client; • <i>Design Documentation</i> – detailed project designs to industry level specification (taking into account current industry standards) for top management engineers, ready for implementation; • <i>Fortnightly Progress Reports</i> – assessed resource consumption, progress, risk and mitigation strategies, as well as providing opportunity for necessary changes in the quality management process; • <i>Proof of Concept Demonstration</i> – proven functionality evidenced by thorough testing and user instructions; • <i>Project Review</i> – allows for insights and opportunities for improvement into all aspects of the quality process, including the use of resources, management structure, process reflection, product realisation and the effectiveness of these processes in collaboration with each other. <p>Thus, as specified in Standard 7.3.1, these processes have distinct purposes, and can be recorded separately or in combination – thus the Standard 7.3 can be ascertained as competence in reflection of the current situational project.</p>	<input checked="" type="checkbox"/>
7.3.2 Design and Development Inputs		<input checked="" type="checkbox"/>
7.3.3 Design and Development Outputs		<input checked="" type="checkbox"/>
7.3.4 Design and Development Review		<input checked="" type="checkbox"/>
7.3.5 Design and Development Verification		<input checked="" type="checkbox"/>
7.3.6 Design and Development Validation		<input checked="" type="checkbox"/>
7.3.7 Control of Design and Development Changes		<input checked="" type="checkbox"/>
7.4 Purchasing		
7.4.1 Purchasing Process	Limited purchasing occurred in the development of the Information Kiosk system.	<input checked="" type="checkbox"/>
7.4.2 Purchasing Information	Licenses and development platforms were made available through Microsoft; and the engineers provided and managed their own hardware and office environment as part of the commissioning agreement with XYZZY.	<input checked="" type="checkbox"/>
7.4.3 Verification of Purchased Product	Thus, as this information was all documented, it shows some evidence of purchasing (even though currency exchange did not occur), and thus fulfils the requirements of Standard 7.4. It is noted that future revision of this standard may be necessary with third-party technology required for future projects.	<input checked="" type="checkbox"/>
7.5 Production and Service Provision		
7.5.1 Control of Production and Service Provision	Providing pre-production, production and post-production service was carried out within the agreed scope of the project between XYZZY and the Whoop Whoop Automotive Museum. As applicable, under <i>controlled conditions</i> (in this instance, based on the hardware architectural platform the software was made), this included user instructions, proof of concept demonstration and (thus the resulting) client feedback in the project review (in which measuring and monitoring decisions could be made).	<input checked="" type="checkbox"/>
7.5.2 Validation of Processes for Production and Service Provision	The software provided is identifiable and traceable, using file system methods such as checksum, size of the file, date / time modified, author, revision etc, and product status can be measured through functionality by the client. The intellectual property of the kiosk itself was preserved by top management throughout development. Handling and storage of the product does not cause difficulties due to its digital nature. Monitoring of the resources and equipment used during the process is available through online and system tools, as well as configuration of the IDE itself.	<input checked="" type="checkbox"/>
7.5.3 Identification and Traceability	Highlighted above was the lack of warranty and agreed on-going support. This is noted, although within the confines of the current agreement, XYZZY met contractual obligations and required (also agreed upon) service provision arrangements. Thus, enough evidence exists to be granted competency in this instance.	<input checked="" type="checkbox"/>
7.5.4 Customer Property		<input checked="" type="checkbox"/>

7.5.5 Preservation of Product		<input checked="" type="checkbox"/>
7.6 Control of Monitoring and Measuring Equipment		<input checked="" type="checkbox"/>
8. Measurement, Analysis and Improvement		
8.1 General	Measuring and analysis occurred in all aspects of the documentation as shown in the gap analysis of Standard 7.3. Specifically, however, the <i>Fortnightly Progress Reports</i> involved the most significant quantitative measurements of progress and risk, with the <i>Project Review</i> measurements specifically pertaining to the success of the product, the quantitative measure of final resource use, and the analysis and synthesis of client feedback and other processes previously mentioned geared towards the continuous improvement of the quality management system.	<input checked="" type="checkbox"/>
<i>8.2 Monitoring and Measurement</i>		
8.2.1 Customer Satisfaction	Determined methods in the <i>Project Review</i> enabled customer feedback on satisfaction, as did feedback during each of the customer milestones met.	<input checked="" type="checkbox"/>
8.2.2 Internal Audit	Currently, no internal audit method takes place at XYZZY. The current <i>gap analysis</i> is not an audit per se. Furthermore, without an internal audit, XYZZY is not showing commitment to the continuous improvement of the quality management system, and will thus not be granted ISO 9001:2008 accreditation. Suggested Solution: An internal audit must take place at planned intervals at XYZZY. This must be conducted in consultation with management, staff and client data, and must define the scope, frequency and methods used in the audit itself. The audit must have defined methods, responsibilities and procedures for record collection and collation, as well as the publishing of results. It is recommended that given the task of auditing, it is necessary to employ (or promote) an audit officer capable of organising the necessary documentation for audit, and to follow-up any inconsistencies, and report shortcomings to a board of selected management and staff capable of implementing the necessary changes.	<input checked="" type="checkbox"/>
8.2.3 Monitoring and Measurement of Processes	The processes and product in this instance were continually measured and analysed throughout the documentation process listed in Standard 7.3. For example, the risk management strategies in the <i>Fortnightly Progress Reports</i> highlighted strategies that needed to occur in order to take corrective action for product realisation. The <i>Proof of Concept Demonstration</i> and associated testing determines whether or not the product objectives (in the <i>Requirements Specification</i>) have been met.	<input checked="" type="checkbox"/>
8.2.4 Monitoring and Measurement of Product		<input checked="" type="checkbox"/>
8.3 Control of Nonconforming Product	Luckily, the product met the desired specifications of the Whoop Whoop Automotive Museum in this instance. However, this is not acceptable for ISO 9001:2008 accreditation. No documented procedure exists for the control of a non-conforming product at XYZZY. Suggested Solution: Document a procedure that clearly details the necessary steps in either presenting an allowable fix or other acceptance method to the client for the non-conforming solution.	<input checked="" type="checkbox"/>
8.4 Analysis of Data	Data is collected and analysed throughout the development process. Examples of this include the gap analysis for both Standard 8.2.3/4 and Standard 7.3 (among others).	<input checked="" type="checkbox"/>
<i>8.5 Improvement</i>		
8.5.1 Continual Improvement	With a (future) audit in place, as well as the aforementioned fixes, enough processes exist (as highlighted above) within the XYZZY framework to ensure continual improvement of the quality management system.	<input checked="" type="checkbox"/>

8.5.2 Corrective Action	<p>As has been discussed above in Standard 8.3, (luckily) the standard in this instance of the product was accepted by the client. Before this, no documentation of Corrective Action existed (and still doesn't).</p> <p>Suggested Solution:</p> <p>Develop a standard method-based inquiry into non-conforming software, with the aim to reduce further non-conformities through better resource / human / quality management processes. The results of this inquiry must be utilised in the review of the Quality Management System.</p>	✘
8.5.3 Preventative Action	<p><i>Fortnightly Progress Reports</i> and <i>Project Planning</i> ensured detailed risk and prevention strategies employed to mitigate potential non-conformities. These detailed actions taken and the effectiveness of these actions.</p>	✔

In summary, the following nine (9) underlined requirements have yet to meet conformity with the ISO 9001:2008 Quality Management System – Requirements of the International Standard. They are:

- **Standard 4: Quality Management System**
 - 4.1 General Requirements
 - *4.2 Documentation Requirements*
 - 4.2.1 General
 - 4.2.2 Quality Manual
 - 4.2.3 Control of Documents
- **Standard 5: Management Responsibility**
 - 5.1 Management Commitment
 - 5.3 Quality Policy
 - *5.4 Planning*
 - 5.4.2 Quality Management System Planning
- **Standard 8: Measurement, Analysis and Improvement**
 - *8.2 Monitoring and Measurement*
 - 8.2.2 Internal Audit
 - *8.5 Improvement*
 - 8.5.2 Corrective Action

Thus, three out of the five standards require action to gain ISO 9001:2008 accreditation. An example of this action required is listed in the recommended suggested actions underneath the respective gap analysis for each.

Future Directions

The final gap analysis indicates that XYZZY needs to take action in standards pertaining to the Quality Management System, Management Responsibility and Measurement, Analysis and Improvement in order to comply with the ISO 9001:2008 standard in quality management systems. For each of the non-compliant standards, a suggested solution has been made. The following is the author's recommended course of action for each non-compliant standard:

For Standard 4 (Quality Management System):

- establish a process model to show the full sequence and interaction of work, including all business processes and affecting applicable national and international standards;
- create a quality manual, with both quality policy and quality objectives;
- make a reference to the control of documents procedure in the quality manual.

For Standard 5 (Management Responsibility):

- establish a quality policy, that takes into account customer satisfaction, the aims of the business, and the commitment to ongoing improvement to the Quality Management System;
- allocate planning time for this Quality Management System.

For Standard 8 (Measurement, Analysis and Improvement):

- establish an Internal Audit procedure, and employ a competent manager of this process that can report findings to a selected board of stakeholders within the XYZZY organisation;
- document a procedure to handle a non-conforming product (including necessary corrective action).

Upon implementation and documentation of all processes, procedures and structures to comply with the ISO 9001:2008 Quality Management Systems - Requirements, XYZZY may continue the process in applying for ISO 9001:2008 Accreditation. It is noted that as long as XYZZY can ensure control over all quality processes, any of these processes may be outsourced (See page 10 Standard 4.1 of ISO 9001:2008 Quality Management System – Requirements documentation). This, or by following the suggested actions above, will position XYZZY in better merit to gain the desired accreditation.

References

Unless otherwise specified, this assignment was completed using only the following references:

- Annous, H., Livadas, L. & Miles, G. 2010, 'OffshoreQA: A Framework for Helping Software Development Outsourcing Companies Comply with ISO 9001:2008', In *5th IEEE International Conference on Global Software Engineering (ICGSE)*, pp. 313-315.
- Das, S., Yaylacicegi, U., & Canel, C. 2008, 'Using ISO 90003 for software design and development in large virtual teams', In *Industrial Management & Data Systems*, vol. 108, no. 6, pp. 775-793.
- Gupta, P. 2010, 'The Role of ISO 9001 Standards', In *Quality*, vol. 49, no. 2, p. 14.
- Gupta, P. 2010, 'Barrier to Excellence: ISO 9001 Deployment', In *Quality*, vol. 49, no. 3, p. 16.
- International Organisation for Standardization Website. 2011.
Date Accessed: 10 January 2011
Website: <http://www.iso.org>
- Joint Accreditation System of Australia & New Zealand (JAS-ANZ) Website. 2011.
URL: <http://www.jas-anz.org>
Date Accessed: 10 January 2011
- Kelemen, Z.D., Trienekens, J., Kusters, R. & Balla, K. 2009, 'A Process Based Unification of Process-Oriented Software Quality Approaches', In *Fourth IEEE International Conference on Global Software Engineering (ICGSE)*, pp. 285-288.
- Liao, R. 2010, 'Using QFD to Link ISO 9001 QMS and PZB Gap Model – An Integrated Approach for Customer Satisfaction', In *International Conference on Service Sciences (ICSS)*, pp. 173-179.
- Lupo, C. 2009, 'ISO 13485: Just the facts', In *Quality*, vol. 48, no. 1, pp. 65-68.
- Mahmoud, H.B., Romdhane, T.B. & Ketata, R. 2009, 'A new MAS based approach modelling the QMS continual improvement', In *IEEE International Conference on Systems, Man and Cybernetics (SMC)*, pp. 4734-4739.
- Mahmoud, H.B., Ketata, R., Romdhane, T.B. & Ahmed, S.B. 2009, 'Modelling Quality Management System: A multi-agent approach', In *International Conference for Internet Technology and Secured Transactions (ICITST)* pp. 1-6.
- Microsoft .NET Website. 2011.
URL: <http://www.microsoft.com/net/>
Date Accessed: 12 January 2011
- Microsoft DreamSpark Website. 2011.
URL: <https://www.dreamspark.com/>
Date Accessed: 12 January 2011
- Procedure Number Five: The Conduct of Accreditation Assessments. Issue No. 10 Dated 25 May, 2009. Joint Accreditation System of Australia & New Zealand (JAS-ANZ) Website.
URL: <http://www.jas-anz.org/images/stories/Documents/Procedures/procedure05.pdf>
Date Accessed: 11 January 2011
- Qasaimeh, M. & Abran, A. 2010, 'Investigation of the Capability of XP to Support the Requirements of ISO 9001 Software Process Certification', In *Eighth ACIS International Conference on Software Engineering Research, Management and Applications (SERA)*, pp. 239-247.
- Standards Australia / Standards New Zealand, 2008. ISO 9001:2008 Quality management systems—Requirements. Joint published by Standards Australia and Standards New Zealand on 30 Dec 2008 (Fourth Edition).
- Wang, C. and Tsai, D. 2009, 'Integrated installing ISO 9000 and ISO 27000 management systems on an organization', In *43rd Annual International Carnahan Conference on Security Technology*, pp. 265-267.