QUALITY ASSURANCE MANUAL

DEPARTMENT OF ELECTRONIC ENGINEERING

UNIVERSITY OF YORK

MENG YEAR 3

SOFTWARE ENGINEERING GROUP PROJECT

PENELOPE
NOV 2022

Version Control

Version	Date	Pages Affected	Modified By	Notes
1.0	12 Nov 2022	All	Roman K & Ethan C	First mock-up of the QA manual structure
2.0	22 Nov 2022	All	Ethan C	Reorganised document structure and adjusted format to fit documentation standards
2.1	22 Nov 2022	4.6. Quality Assurance 5.8. Quality Assurance Manager 6. Deliverables 8.2. Monitoring, Analysis & Improvement	Roman K	Expanded on the QA Assurance sections where appropriate in the document. Added a couple of deliverables. Added a section for *Monitoring, Analysis & Improvement*.
2.2	24 Nov 2022	Table of contents, 8.5, 8.6	Ethan C	Replaced the old table of contents with an automated one. Added sections 8.5.1, 8.6.1, 8.6.2 and 8.6.3.
2.2.1	25 Nov 2022	8.6.1. Pipeline	Giuseppe B.	More detailed testing pipeline.
2.2.2	27 Nov 2022	1. Introduction 5.4 Documentation and Communication Manager 8.1 Customer Related Processes	Ana M Ophelia K & Ana M Ophelia & Ana	Further developed all sections in the Introduction Added content in all sections of 5.4 Added content in all sections.
2.3	28 Nov 2022	All the *Risk Management* sections in **5. Management Responsibilities**	Roman K	In detail, expanded upon all of the *Risk Management* sections for each Manager role
2.3.1	28 Nov 2022	Section 8.1.3 - Customer Communication	Ana	Completion of the mentioned section

2.4	29 Nov 2022	Project Management Methodology	Connall	Added Project Management Methodology
2.4.1	29 Nov 2022	Objectives of Major Functional Groups Management Responsibilities	Ana	Completed all sections related to role descriptions
2.5	30 Nov 2022	Management Responsibilities Project Development Cycle Product Realisation	Connall, Roman, Ethan	Completion of 1st Draft Content
2.5.1	30 Nov 2022	Control & Monitoring Phase Processes	Roman	Expanded on the section a little bit
2.6	1 Dec 2022	All sections	Ana, Ophelia	Completion of 1st Draft
2.7	18 Jan 2023	Sections 5.1-5.7, specifically the QA manual sections	Ethan	Updated the QA metrics “Way of Measuring” column.
2.7.1	19 Jan 2023	Sections 5.1-5.7, specifically the Role Description sections	Ethan	Itemised the roll descriptions of each Managerial role.
2.8	30 Jan 2023	Risk Management (All roles)	Roman	Added “Handling of Risk” column
2.9	4 Feb 2023	Section 5.6	Giuseppe & Ana	More descriptive QA Metrics.

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Introduction

1.1. Company Profile

Penelope was founded in the UK at the University of York in late 2022. The organisation was built from the ground up by students, focused on providing high-quality android applications to the local community and beyond.

Here at Penelope, we utilise effective project management strategies that facilitate innovation and communication in the work environment. Striving to provide staff constant self-improvement, and customers with a high-quality product that our employees are proud of.

Penelope's design specifications follow strict industry standards that are frequently consulted, taking into account customer feedback and the performance and quality of completed projects. This allows us to compete and excel above other companies providing similar services, and build a brand synonymous with quality and excellence.

Penelope’s differentiation point comes with the following principles:

- Collaboration with partners and customers
- Complete understanding of users’ needs
- Persistence in delivering the best available solutions, whatever it takes

Our team operates with enthusiasm and flexibility to follow these principles, and are focused on the user experience and customer satisfaction through all stages of the project life cycle.

1.1. Company Vision

Penelope was founded with the vision to enable “secure and easy access to information anytime, anywhere”. The aim is to provide the users with robust, comfortable and easy-to-use systems which not only appeal but inform the user.

1.2. Quality Policy

The Quality Policy Program of Penelope is developed to assure customer satisfaction by providing quality products. We strive for continuous improvement in our quality and meeting the objectives of our company:

- Delivering products that meet or exceed our client's requirements
- Providing a service which results in client satisfaction
- Constant development of our products

We are dedicated to continuous improvement in quality and the assessment of our quality system. This lets us ensure its suitability to meet both the requirements of our client and company.

By meeting the goals defined within this manual, we will be able to:

- Provide customer satisfaction by:
    - Being on time with our deadlines and deliveries
    - Meeting all of the contract requirements
    - Delivering outstanding service and product quality
- Work efficiently by following agile methodologies within our organisation

1.3. Scope

This manual describes Penelope's Quality System Policies and Procedures. These policies and procedures control all activities from the initial phase of scoping requirements and Supplier procurement up to the final delivery of the product to the customer.

1.4. Purpose

The purpose of this manual is to document the company's quality system, instruct and give guidance to Penelope's personnel whose actions affect product quality, also giving a potential customer, inspector or auditor an appreciation of Penelope from the outside showing what controls are implemented to assure product quality.

Revision Control & Review

The Quality Assurance team will review this manual if any employee raises concerns about or suggests amendments to its contents and revise said contents if appropriate. These changes will be documented, detailing the revisions made to the manual, the pages affected by those revisions, the date those revisions were made as well as the employee who approved said revisions. These revisions will correspond to the version of this document, noted in the header in the top right corner of each page.

Organisational Structure

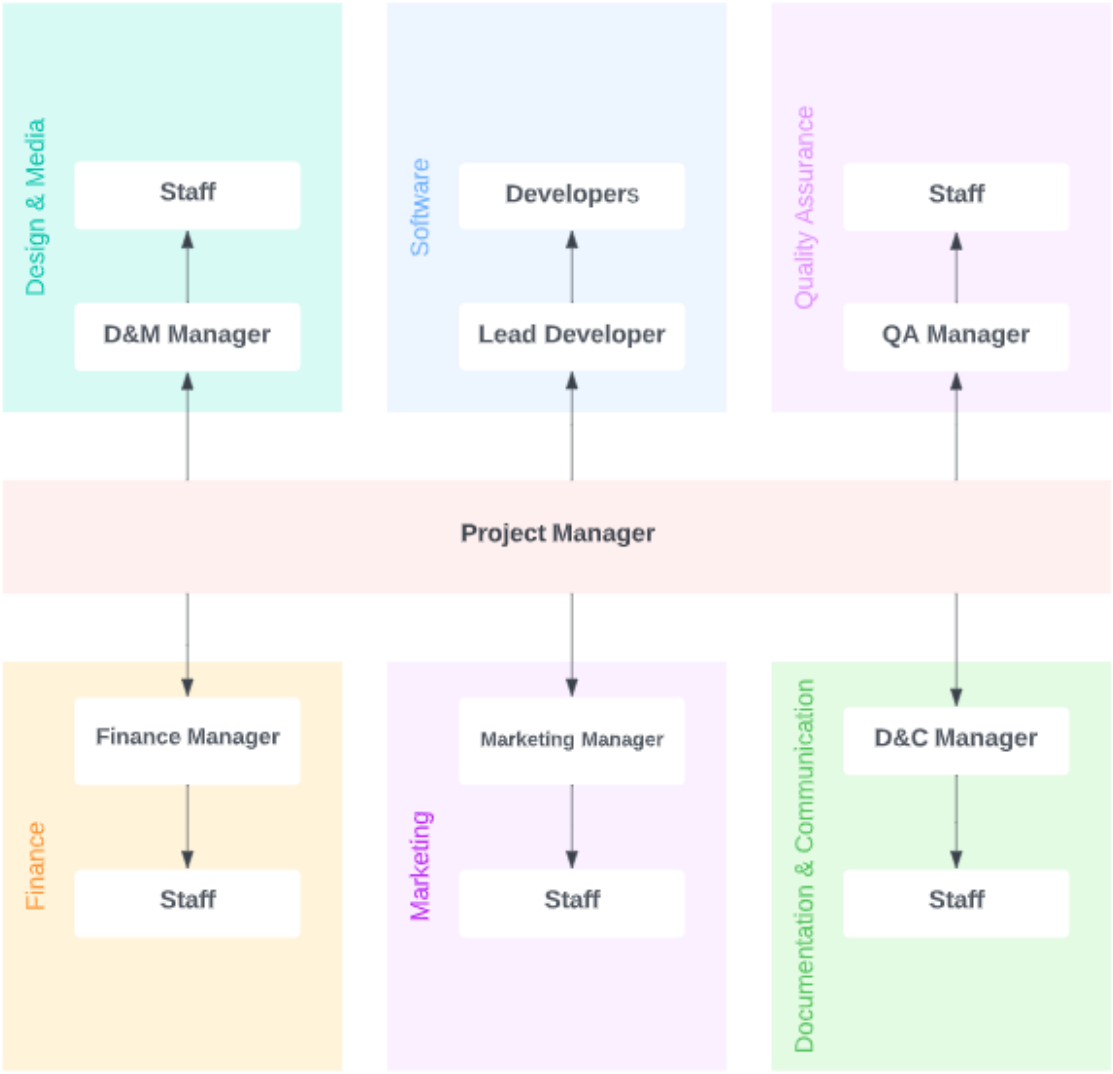

Figure 1: The Structural organisation of project group

Objectives of Major Functional Groups

4.1. Finance

The Finance team is responsible for the financial affairs of Penelope which includes the responsibility for financial reporting and internal financial control, safekeeping of assets, banking and treasury functions, taxation and payroll for the company, administration services, risk management and Business Systems. Therefore, the primary objective of the finance group is to track project finances and act as a consultant on financial decisions.

This team has the authority to establish duties and responsibilities and to authorise working procedures and guidelines pertaining to the above for Penelope.

Finance is responsible for:

- Tracking the organisation's spending and regularly presenting it in a financial report
- Develop a Financial Business Plan that outlines spending throughout the project and acts as a guide
- Ensure the organisation adheres to the created Financial Business Plan

4.2. Marketing

The Marketing team is responsible for the marketing activities for Penelope's product and improving its marketing efforts. They are also responsible for product sales, providing knowledgeable advice on the full range of Penelope's product to clients and agents.

The primary objective of marketing is to ensure the produced product reaches and impacts the intended market.

Marketing is responsible for:

- Conducting research on the current market and recommending a target market. This includes predicting what the future market will look like.
- Producing marketing strategies and effective advertising campaigns which can be included in the Financial Business Plan for investors consideration.
- Reduce the percentage of lost sales
- Increase customer lifetime value
- Improve awareness and demand of Penelope's product
- Increase positive product reviews
- Increase profitability
- Increase brand authority
- Develop an engaged audience

4.3. Documentation & Communication

The Documentation & Communication team is responsible for the management and tracking of documentation tasks to ensure all publication deadlines are met. This also includes maintaining a documentation standard for the organisation.

Documentation And Communication is responsible for:

- Producing meeting minutes and tracking progress
- Managing availability and preparing necessary documentation
- Overseeing accuracy, completeness and promptness of legal documents
- Coordinating with legal officials to execute disclosure and resolve sales and legal issues promptly.

- Training and guiding staff on improving efficiency and evaluating their performance regularly
- Mentoring, coordinating and guiding technical writers and editors
- Assisting in the production of, and maintaining organisational documentation

4.4. Design & Media

The Design & Media team is responsible for planning the form or structure of Penelope's product by providing media assets and ensuring media is presented in a visually appealing manner. This is to ensure users can easily navigate and utilise the product to accomplish the users goal.

Design and Media are responsible for:

- Product visual design
- Sourcing project media
- Supporting the Marketing team with a design overhaul
- Designing deliverables that directly contribute to the overall sales

4.5. Software

The Software team is responsible for building Penelope's product functions and components according to the product functional and visual specifications outlined by the documentation produced in the project's planning phase.

Software is responsible for:

- Programming the products
- Overseeing the technologies and tools used during development
- Adhering to technical standards
- Ensuring the deliverables correspond to the requirements
- Implementing and controlling development standards and procedures
- Clarifying and understanding the product requirements and translating them into detailed technical specifications
- Maintaining the ability to improve the product in the future by utilising efficient technical designs
- Reviewing the produced product's code regularly to ensure top quality
- Ensuring the product is safe and robust

4.6. Quality Assurance

The Quality Assurance team is responsible for maintaining an effective and efficient Quality Assurance Agenda by establishing and implementing quality policies and various procedures. These said policies are further organised with the cooperation and assistance of the different team managers, in accordance with the Quality Assurance standards and protocols.

Quality Assurance is responsible for:

- Organising all-inclusive training in the quality policy and requirements as described in the Quality Manual. Every Penelope personnel must under-go said Quality training as indicated, with the specific requirements of each department being covered
- Organising plans for the control of quality in advance to any important work being made. This is to provide evidence for the compliance with the contract requirements

- Indicating compliance with the policies and protocols in this manual through internal audits
- Upholding a system of Review & Revision of the various important processes within this manual. This is vital so that control of amenability with the aforementioned contract requirements is guaranteed
- Testing the functionality of the product
- Pointing out the complaints received by the company, as well as maintaining the investigation, scope, analysis and reporting of said complaints

Management Responsibilities

5.1. Project Manager

5.1.1. Role Description

The Project Manager of Penelope has overall responsibility for:

- The system of quality control, to customers for the quality of Penelope's product and for ensuring that all operations are carried out in compliance with the Quality Assurance Policies, Procedures, Standards and Guidelines.
- Establishing policies and procedures designed to promote an internal culture recognising that quality is essential.
- Delegating authority for managing Penelope's system of quality control to a person or persons with sufficient and appropriate experience.
- Overseeing and organising lines of communication and regular progress updates within the company
- Splitting and delegating tasks effectively between teams
- Ensuring company deadlines are met
- Managing time as a resource and ensuring all teams are never left waiting on objectives to be met by other teams before continuing on with their tasks
- Tracking any roadblocks to progress and driving the team to take effective action to minimise disruption

The quality control policies and procedures should not only be adopted, but also implemented by being communicated to Penelope personnel, adhered to and therefore, should be also monitored by the project manager.

5.1.2. Risk Management

ID	Risk Description	Impact	Level of Risk	Mitigation of Risk	Handling of Risk
1	Incorrect prioritisation	Low to High	Low	Core functionality and aim of the product must be clarified and realised as early on as possible, while other	In the case of said risk occurring, attempt to redirect all possible personnel attention to the core aim of the project. Further assess

				product highlights and secondary features focused at a later stage.	the situation and re-allocate resources if needed.
2	Employees conflicting with each other	Medium to High	Low	Resolve any known issues between the group members, as well as assign specific tasks to the employees in order to minimise commotion overall.	If such risk takes place, identify the root cause of the issue between the group members and attempt to resolve by finding a middle-ground that satisfies all parties. In extreme cases, discharge personnel causing problems.
3	Increased costs and time spent on product development	High	Low to High	Any identified problems must be dealt with early on (design phase), significantly decreasing the cost and time spent dealing with said problem at a later stage of the project.	If said risk arises, organise additional project meetings to re-assess and re-allocate monetary assets if possible. Depending on the scope of the increased time and costs, further funding could be viable.
4	Employee leaves the company or is absent for a prolonged amount of time	Medium	Low	Make sure that more than one team member is trained to do any specific task. For example, all members of a certain group must be comfortable with doing another group member's task.	In the case of prolonged absence, attempt to contact the employee using various methods. If said employee leaves the company on short notice, begin looking for possible temporary

					replacements. Allow a time-gap for this.
5	Project Manager leaves or is absent during project execution	High	Low	Carefully review the role for Project Leader and their responsibilities and think of possible compensations that could be put in place. Hiring a consultant is an option to mitigate further risks due to this.	Contact the person who was designated to lead the team if Project Manager is absent. Reporting employees should contact the Project Manager's manager and request further assistance in this matter.
6	Lack of project resources (employees, equipment, materials etc.)	Low to High	Low to Medium	Plan the strategy for dealing with a lack of resources up front. This could involve sourcing alternative suppliers for specific materials, cross-training your employees so they can cover each other's work when needed.	Identify the situation and its impact, such as the causes for the lack of resources. Realise possible solutions to this and present them to the Change Control Board (personnel who decide whether to implement proposed changes). Adhere to the recommendations of the Control Board.

7	In-house project deadlines overdue	Low to Medium	Low to Medium	Ensure that consistent project review meetings are taking place in order to identify possible overruns ahead of time so that work can be distributed more evenly.	Assess the level of delay and allow for extra time on said deadline. If possible, assigning extra staff to speed up the doing of the task is also a viable option.
8	Failure to meet one of the requirements	High	Low to Medium	Have regular project review meetings to make sure requirement conformity is in order. Possibly ensure that the design of the product is made in such a way that simplifies roll-back in case additional features need to be added.	Refer back to the original objectives and necessities of the requirement and adjust them accordingly (they still need to meet the spec). Allow for extra time to re-implement said requirement if possible. Map out a chain of communication and monitor and measure the progress of the workflow to prevent any further unnecessary failures regarding this matter.

5.1.3. QA Metrics

Metric	Way of measuring
Maintaining client satisfaction	The client's requirements will be measured against throughout the development process and the company will ensure that the development cycle reflects such requirements.

Maintaining communication within the company	Measuring if regular sprint retrospectives are done.
Maintaining communication within major functional groups	Measuring if communication occurs between relevant groups during meetings.
Tracking project progress	Assigning tasks to the relevant groups or employees with an associated deadline and time frame through Monday.com [1]. Project progress will be measured based on the progression of said tasks.

5.2. Finance Manager

5.2.1. Role Description

The Finance Manager of Penelope is responsible for:

- Overseeing end-to-end finance operations and accounting practices, financial planning analysis, balance sheet reconciliations and looking to make improvements to procedures and controls.
- Distributing the financial resources of Penelope.
- Supporting the Project Managers by offering insights and financial advice that will allow them to make the best business decisions for the company.
- Reviewing all gathered financial information, delivering financial reports related to budgets, account payables, receivables and expenses and the final Financial Business Plan to the Project Manager.
- Reviewing, monitoring, and managing the development of budgets, forecasts and strategies.

5.2.2. Risk Management

ID	Risk Description	Impact	Level of Risk	Mitigation of Risk	Handling of Risk
1	Market risk	Medium	High	Volatility or VaR (Value at Risk) methods in order to correctly evaluate and mitigate Market Risk.	Assess the current position of the market and manage if possible. e.g. Track against limits, hedging strategy, liquidate positions

2	Credit risk	Medium to High	Low to Medium	Produce detailed contracts with clients. Make sure to establish credit terms and ensure the credit terms of the sales agreements are clear.	Stress-test the organisation's loan portfolio. Re-assess and migrate credit risk categories accordingly. Early detection of other possible related risks will reduce non-performance.
3	Liquidity risk	Medium	Low to Medium	Create an accurate budget and carefully monitor during the project lifecycle. Identify liquidity risk factors and lower the exposure.	Reassess the state of the company's financial ratios, such as Quick and Current Ratios. Re-evaluate the company's operational strategy and profitability forecast in order to act accordingly in the future.
4	Poor budgeting	Medium to High	Low to High	Make sure to monitor the budget at regular intervals and possibly adjust if necessary.	Direct attention to areas where costs might increase further, such as direct/indirect and overhead costs. Initiate contingencies that have been set in the project budget. If there are none, set them.

5.2.3. QA Metrics

Metric	Way of measuring
Net Profit Margin	Net profit/Revenue. Measure the profitability of the company, taking all expenses into account.

Return on Equity (ROE)	Net profit/Shareholder's equity. Measure how the company utilises equity investments and produce profit for shareholders. The higher the ROE the better.
Return on Assets (ROA)	Net profit/Average total assets. Measures how the company is managing its resources to generate profit. The higher the ROA the better.
Debt to equity ratio	Total liabilities/Shareholder's Equity. A low ratio implies less debt from borrowing, increasing profits.

5.3. Marketing Manager

5.3.1. Role Description

The Marketing Manager of Penelope is responsible for:

- Developing, implementing and executing strategic marketing plans for Penelope in order to attract potential clients and retain existing ones.
- Overseeing all the marketing campaigns for Penelope.
- Implementing the marketing strategy.
- Ensuring the company is communicating the right messaging to attract prospective clients.
- Representing the marketing team to cross-functional groups including Documentation & Communication, Design & Media or Finance.
- Updating the Project Manager on the progress of marketing activities and reporting on the results of campaigns.
- Managing and coordinating marketing and creative staff.
- Coordinating with the Finance team and other departments to produce effective strategies.
- Monitoring current campaigns.
- Ensuring the staff meets deadlines and completes necessary tasks.
- Analysing data to evaluate the success of the team.
- Coming up with new ideas to improve brand marketing and exposure.

5.3.2. Risk Management

ID	Risk Description	Impact	Level of Risk	Mitigation of Risk	Handling of Risk
1	Reputational risk	Low to High	Low	Ensure that the company stays conscious of their brand's public perception. Perception can be assessed using surveys, customer reviews etc. This feedback may also provide light on where to further focus the company's efforts.	Initiate correct response and contingency plans in case of occurrence. If there are none, set them up. Further re-assess and understand stakeholder expectations. Control processes and further focus on a positive image and communication of the company with its audience.
2	Too small of a marketing scope or lack of diversification	Low to High	Low	Make sure the company includes well-communicated goals and dynamic leadership. Diversify the company's approach as much as possible by extending to blogs, social media, forums etc.	Look into various methods which could further extend the company's presence. This could include making extra advertisements regarding the company, possible sponsor opportunities with well-known influencers and more.

3	Lack of clear brand messaging	Medium	Low to Medium	Re-evaluate the core demographic routinely to guarantee the best return on marketing efforts. This includes demographic info (age, gender), where to find an ideal customer, unique selling points of our product for said customer.	Consider the distribution of surveys regarding the company from the buyer's perspective.
4	Pricing issues related to core products	Low to Medium	Low	Identify trusted sources with sensible pricing.	Identify and outsource from other trusted sources that are up to standard of the company.
5	Market access	High	Low	Gain authorisation from required certification organisations.	Ensure the company is operating up to standards set by the certification organisations.
6	Market competition	Low to High	High	Make sure the quality of the product is up-to standards. Produce an appealing advertisement campaign for the product. Ensure a satisfactory after-sales product service.	Assess and understand the competition. Identify what they're doing better or worse and capitalise on those things to gain the market advantage. After market research, highlight what makes the company different from the competition. Explore any possible strategic partnerships that could boost the company's sales.

5.3.3. QA Metrics

Metric	Way of measuring
Reach & Engagement	Social media marketing metrics.
Customer satisfaction	Customer feedback.
Cost per customer acquisition	Total marketing campaign costs/Total customers gained. Measure the cost-effectiveness of a marketing campaign.
Brand awareness	Market research.

5.4. Documentation & Communication Manager

5.4.1. Role Description

The Documentation Manager of Penelope oversees the company's technical documents to ensure a cohesive voice representing the company and its message. They are responsible for:

- Creating, maintaining, releasing company documents, reports, keeping track of meetings, filing and storage.
- Creating templates, drafting style guides and managing technical writers.
- Setting out the project-wide standards for the creation of documents.
- Ensuring that the documents created across the team are of good quality and are completed on time.
- Assisting the Project Manager with the drafting of essential documents.
- Ensuring each technical writer follows the same tone of voice
- Ensuring each document follows the style guide and template
- Ensuring each document is published on time
- Ensuring old documents get archived, and new documents get uploaded
- Making sure assignment workflows are efficient and productive
- Making sure documents maintain the proper structure
- Making sure online records link to the correct locations

5.4.2. Risk Management

ID	Risk Description	Impact	Level of Risk	Mitigation of Risk	Handling of Risk
1	Documents are unintentionally lost or destroyed	Low to High	Low	Develop strict policies which enforce the backup of all important documents within the company. Possibly automate the backup of said documents.	Restore the last saved backup of the lost/destroyed file and enforce measures towards further mitigation of this risk.
2	Documents out of date	Low to High	Low	Develop a version control framework. Create strict policies around version control, including naming convention, number of revisions made, role-based access rules etc.	In the worst case scenario, manually handpick the most up-to-date necessary files and further enforce rules for proper version control.
3	Wasting time on searching for a specific document	Low	Low	Create a document structure which reflects the project roadmap, as well as good naming conventions.	In the worst possible case, contact members of staff who frequently interact with said document, if there are any.

4	Not clear where a specific document is located	Low	Low	Develop an audit checklist that includes document location information. Employees can easily access this checklist in case they need a certain document.	In the worst possible case, request assistance from members of staff who were last known to have made changes to the document.
5	Group members are not completing documents on time	Medium	Low	Monitor the progress on the documents.	Contact said group members and investigate the cause of late submissions. If this persists, contact the Project manager.
6	Documents are not of good enough quality or do not match the standards expected	High	Medium	Ensure the standards are known by all team members. Edit or rewrite if necessary any documents that are not of good enough quality.	Request assistance from the QA or Project managers to further solidify any questions or issues regarding specific document standards.

5.4.3. QA Metrics

Metric	Way of measuring
Documents delivered	No. of documents expected VS delivered.
Deadlines met	Deliverable submission date VS timetabled.
Documents standards	No. of submitted documents that met project-wide documentation standards VS expected.

5.5. Design & Media Manager

5.5.1. Role Description

The Design & Media Manager of Penelope oversees the design aspects of the product on behalf of Penelope. They coordinate all design and layout matters related to the product, facilitating communication and collaboration across departments to ensure client specifications are met.

A Design & Media Manager is responsible for:

- Overseeing and managing art preparation and platemaking layout
- Providing guidance as needed.
- Establishing and implementing a work order process through which design consultation can occur and specifications can be collected.
- Maintaining a portfolio of exemplary work samples.
- Collaborating with the Finance and Marketing teams and the client to ensure all expectations are sufficiently met and assisting team members with matters as needed.

5.5.2. Risk Management

ID	Risk Description	Impact	Level of Risk	Mitigation of Risk	Handling of Risk
1	Additional features being added after already starting the project	High	Low to Medium	Clearly state in the contract that the addition of more features during project development will cost more and cause additional delays in getting the work done on time. Hence, encourage the client to visibly outline all the features prior to project development.	Account and adjust for additional time and costs for said extra features by outlining and updating the roadmap of the project lifecycle. Clearly outline the needed requirements and communicate with the staff members to decide upon the best course of action in terms of implementing the extra feature. Maintain constant communication with the client to ensure all aspects of the additional feature is met correctly

2	Design completion delay	Medium to High	Medium	Re-allocate the current tasks in order to conclude important design features efficiently, so the next phase of project development can start. Review the cause of said delay and identify any solutions.	Account for additional time and possibly costs in the overall project lifecycle. Assess the cause of the delay and account for the future.
3	Non-conformance of product according to client's standards	Medium	Medium	Allow for frequent reminders and clear objectives regarding what features and standards the client is looking for in the final delivery.	Review and identify the parts which are non-conformant. Analyse and resolve according to the standards.

5.5.3. QA Metrics

Metric	Way of measuring
Client design requirements	Measuring the client's expectations and requirements of the design against the current design.
User-friendly design	Checking the design against usability heuristics.
Media collection	Measuring the amount of media collected against the number of subjects in a collection table.

5.6. Lead Developer

5.6.1. Role Description

The Lead Developer of Penelope has the ability to bridge the gap between all other teams. They are responsible for:

- Helping translate client requirements into technical requirements for the Software team
- Planning and documenting technical specifications for features or system design.
- Designing, building and configuring applications to meet business process and application requirements.
- Directing the Software team in the design, development, coding, testing and debugging of the application.
- Writing testable, efficient code.
- Leading code reviews.
- Mentoring junior team members and ensuring they adhere to determined software quality standards.

5.6.2. Risk Management

ID	Risk Description	Impact	Level of Risk	Mitigation of Risk	Handling of Risk
1	Failure of code	High	Low to High	Enforce standard satisfactory coding practices, as well as maintaining code structure. Ensure code is well commented and documented if necessary.	If reoccurring, consider assigning more manpower to correct identified failure. Cooperate with the QA testing team in order to provide a complete set of test cases required.
2	Poor quality code	Medium to High	Low to High	Identify and provide specific standards for coding in terms of format, comments, naming conventions etc.	Refer and adjust code relative to standard coding practices to make sure code can be fairly easily understood.
3	Other employees aren't aware of the code's functionality	High	Low to Medium	Possibly arrange meetings with the entire group in order to review and showcase any parts of the code that other employees don't understand.	Produce appropriate code documentation which explains the functionality of all the critical parts of the code.

5.6.3. QA Metrics

Metric	Way of measuring
Code commenting	Measure the amount of comments against blocks of functional code.
Extensibility	Record if adding new user stories breaks previously written code.
Efficiency	Measure the computing resources needed for the software to run. Measure the estimated time it takes for the software to run on the average target platform (every mobile device is different).
Documentation	Keep an up to date document explaining how particular parts of the codebase work and the design choice behind said code. Measure how often said documentation is updated.

5.7. Quality Assurance Manager

5.7.1. Role Description

The Quality Assurance Manager of Penelope works through procedures and protocols stated in this Manual in order to ensure the results manufactured by the company are of the highest possible quality that meet the client's requirements. The manager is responsible for the progress and management of the company's Quality affairs. This includes:

- First-hand for maintaining/editing the Quality Assurance Manual and introducing changes in order to meet internal needs
- Adjusting the quality system according to internal audits or direct orders from Project Manager
- Recognising necessary corrective actions and ascertaining that they are accomplished
- Monitor the use of Quality Manual procedures through the collection of QA Metrics
- Present regular updated reports to the Product Manager regarding project progress and efficiency in following the Quality policy
- Ensure that all documents produced follow the general standard set by the company
- Ensure that the documentation available and used by the company is up-to-date at all times

- Ascertain that all project meetings are appropriately documented and recorded
- Monitor the document's delivery deadlines
- Conducting exploratory testing – simultaneous test design and execution
- Produce and execute test cases to detect usability and performance issues with the product
- Heavy participation in test planning as well as providing feedback to the Software team

5.7.2. Risk Management

ID	Risk Description	Impact	Level of Risk	Mitigation of Risk	Handling of Risk
1	Missing or corrupted documents	High	Low to High	Always present a backup whenever a document is about to be added or updated.	Attempt to recover last known backup of said document. In the worst possible case, re-do the document from scratch while also making sure to backup any changes made.
2	Failure to carry out a Quality protocol	Medium to High	Low	Hold regular project meetings to reflect Quality processes. Contemplate said protocols on a regular basis and make sure of their validity.	Re-assess and further evaluate the core requirements of the product, to make sure it fully complies with the quality protocols that exist.
3	QA metric not met	Low to High	Low	Regularly validate employees' adherence to the Quality Assurance protocols.	Assess the cause of not meeting a certain metric and ensure this doesn't occur again by publishing guidance.
4	Poor communication with the client	Low to High	Low to High	Request detailed requirements and clarification	Adjust the regularity of communication occurring with the client, as well as send

				regarding certain parts of the product.	frequent progress reports regarding the project lifecycle.
5	Frequently changing requirements	Medium to High	Medium to High	Identify the change in requirements and consult the Project Manager to define further steps.	Identify the change in requirements and consult the Project Manager to define further steps.

5.7.3. QA Metrics

Metric	Way of measuring
Test plan followed	Monitor test execution and compare the execution against the plan.
Error correction	Measure the time it takes to fix errors.
Quality Assurance Editing	Monitor changes made to the document and compare those changes to the version control section.

Deliverables

Deliverables	**Maker**	**Recipient**	**Due Date**
Project Requirements	The client	Project/QA/Design/ Software Manager	Start of project
Project Schedule	Project Manager	Project team	Start of project
Functional Specification	Design/Documentation Teams	Project team	End of specification phase
General Design Specifications	Design/Software Teams	QA Manager	Design phase

Project Management Methodology

7.1. The Agile Project Management Methodology

We at Penelope follow an Agile project management methodology, utilising a Scrum framework to implement the 4 central Agile values [2]:

- Individuals and interactions over processes and tools
- Working software over comprehensive documentation
- Customer collaboration over contract negotiation
- Responding to change over following a plan

The Agile project management methodology is adopted for Penelope's projects as most projects begin with many unknowns and require a fast and flexible development. Following the Agile values allows Penelope to quickly produce a high-quality product while quickly reacting and adapting to changes in the project. This is achieved by adopting the 4 central values, and implementing the 12 Agile principles to gain an organisation status of flexible, responsive and adaptive to changes, allowing Penelope to quickly and efficiently deliver a high-quality product to customers.

The 12 Agile principles [3] are as follows:

1. Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
2. Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.
3. Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.
4. Business people and developers must work together daily throughout the project.
5. Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.
6. The most efficient and effective method of conveying information to and within a development team is face-to-face conversations.
7. Working software is the primary measure of progress.
8. Agile processes promote sustainable development. The sponsors, developers and users should be able to maintain a constant pace indefinitely.
9. Continuous attention to technical excellence and good design enhances agility.
10. Simplicity - the art of maximising the amount of work not done - is essential.
11. The best architectures, requirements, and designs emerge from self-organising teams.
12. At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behaviour accordingly. For Penelope each team meets on a weekly basis to discuss what has been achieved in the current sprint, the way forward in accordance to the scope and what is blocking progress (if any factor is).

In summary, implementing the Agile project manage methodology helps our organisation:

- Produce a product early in the development process to quickly gain feedback from customers
- Adapt to changes in the development process

- Maintain a healthy working environment where employees feel appreciated
- Reduce workflow waste leading to a more cost-efficient product

7.2. The Scrum Framework

Penelope implements the Agile Project Management Methodology by using the Scrum Project Management Framework. The Scrum framework follows an iterative approach to project management that breaks the project down into sprints that last 2 weeks. Each sprint focuses on the completion of a working version of the final product/deliverable by the end of the sprint. This encourages an evolutionary design that is not threatened by changes in the product vision.

At the end of each sprint, Penelope completes a face-to-face sprint retrospective meeting to ensure we are fully utilising project time during each sprint. During the retrospective the team:

- Reflects on what went well in the sprint
- Reflects on what could be improved
- Decides what we will commit to improve in the next sprint

Sprint retrospectives ensure all employees are using their time effectively and producing high-quality work. It also gives employees an opportunity to give feedback to management and have a voice in the organisation's continuous improvement.

7.3. The Product Development Cycle

To simplify the product development process, Penelope splits the project lifecycle into 5 distinct phases that provide the project with more predictability.

The first phase consists of the Initiation Phase where the project is defined and a product vision is created.

The second phase (Planning Phase) is the phase where all the goals and details are defined in order to complete what has been set on the first phase.

The Execution Phase is characterised by the execution of the product, when all that has been defined comes to life.

During the Control & Monitoring Phase, which happens alongside the previous phase, the Project manager is responsible for monitoring progress and making adjustments if necessary, ensuring that the product is aligned with what was defined in the project plan.

At last, the Closure Phase dictates the end of the project and during this phase Penelope ensures that the product meets all the requirements defined in the first phase.

Product Realisation

8.1. Initiation Phase Processes

The Initiation Phase of the product development cycle defines the “what” we are producing. This phase consists of creating a product vision and defining the project. This includes communicating with the customer to create a functional specification document that they approve of, giving the customer an expectation for the end product and giving the organisation a defined set of requirements to achieve.

By the end of this phase, the Project Manager should have a clear understanding of the project's purpose, requirements and risk.

8.1.1. Customer Requirements

Each business unit together with the technical support groups determines the performance and manufacturing requirements (including availability, delivery and support) related to the product or customer.

We at Penelope, will follow a thorough requirements capture analysis in order to outline all the important needs presented by the client. These may include unstated requirements by the customer but are necessary for the specified or intended use of the product by the customer. Examples of these requirements include:

- Codes and standards from industry and/or government regulatory bodies
- Applicable government, environmental regulations applied to the acquisition, storage or handling of the product

Any inconsistencies or imprecisions between the functional specification and requirements will be identified and discussed with the client, to ensure the requirements are understood, internalised into process, agreed to and confirmed as achievable by Penelope.

The client should provide a statement to Penelope of what they require the product to do and we conform to the client's requirements for the designation, documentation and control of special characteristics.

8.1.2. Review of Customer Requirements

Before committing to the client, Penelope reviews the requirements related to the project to ensure they are met. These include reviews of the design and product specifications.

The purpose of these reviews is to ensure that the projects' requirements are appropriately defined. Any differences with the previously contracted requirements are resolved and are subject to the review and approval of the Project Manager, the Quality Assurance and the Software team as applicable.

Where a client provides a verbal order, an order confirmation is produced and sent to the client to guarantee agreement on the requirements.

Before the acceptance of an order from the client, Penelope reviews such orders to ensure that:

- The order requirements are adequately defined, documented and agreed to internally before acceptance
- All product or client requirements are met
- Any differences between the order requirements and the company capacity plan are resolved
- The company has the capacity to meet the order requirements
- The company has investigated the feasibility of the product including a risk assessment

These reviews are always performed and records of these reviews are maintained. Changes to the original client order are reviewed in the same manner as the original review.

8.1.3. Customer Communication

In accordance with our commitment to exceed our customer's expectations, Penelope highlights effective customer communication as an essential part of delivering customer satisfaction. Appropriate handling of customer communication helps to reduce customer complaints and dissatisfaction.

The Documentation & Communication Team and Project Manager are responsible for establishing adequate methods of communication with the client to ensure that enquiries, requests, contracts and client feedback are handled promptly and professionally.

The Project Manager is responsible for establishing communication with the Marketing, Design, Quality Assurance or Finance departments within Penelope or directly to the end customer on any technical, capacity, post delivery and other planning and completion details to meet the client's requirements. Penelope communicates information, including data, in the client's specified language and format. The following formats, events and processes constitute an example:

- Brochures, specifications or technical data sheets relating to our product
- Enquiries, quotations and order forms, invoices and credit notes
- Confirmation of authorised orders and amended orders
- Delivery notes and certificates of conformity
- E-mails, letters and general correspondence
- When customer property is handled or controlled
- Customer feedback and complaints management process

8.2. Planning Phase Process

The Planning Phase defines the "how" we are creating the product defined in the initiation phase. This phase is arguably the most important stage, and hence can take a larger amount of time to complete than other phases as this phase typically defines how the remainder of the project will run.

In the planning phase, we outline all details and goals needed to complete the requirements laid out in the initiation phase. Vitally, this includes creating a roadmap for the project to follow. Main objectives of this phase are as follows:

- Define employee roles and responsibilities
- Create a project plan
- Establish logistics and communication channels for teams
- Identify project risks and create contingency plans
- Create a workflow/roadmap

8.2.1. Project Planning

Project planning and realisation starts with the design phase and ends with the delivery to the client. All phases of development and realisation, including necessary design aims, media collecting, software and testing are completed by various team groups during the project lifecycle. Regular internal meetings are held to review weekly progress, suggest new ideas, and develop new processes and other procedures that might need attention. Project records are kept in various forms such as separately filed documents, meeting minutes, actions items and progress reports.

8.2.2. Design

Penelope incorporates an overall design process which incorporates other team groups where necessary, in order to make sure all the necessary planned out requirements are met. The design process incorporates the following key elements: Planning, Inputs, Outputs, Review and Validation.

Planning

Project design and realisation starts off with a design review. This is organised by the Design & Media Manager and includes the participation of the Software and Quality Assurance departments. Project design is thoroughly negotiated and revised if needed, ensuring all the final aspects of it are kept as realistic as possible. Design meeting results are recorded and documented.

Inputs

Project requirements such as client, performance, functional, accessibility and other necessities crucial to the application are all design inputs. All the design inputs are documented on the appropriate project functional specification.

Outputs

Project design outputs incorporate a plan for executing the application and testing the product in order to verify the specified requirements are satisfied. Outputs could also comprise information for in-house production, sales and purchasing if appropriate.

Review

Following the design review meetings, extra comments and reviews take place in order to talk over any new results, make any changes and document anything necessary.

Validation

Final project inspection takes place in order to confirm that all the specified design specifications are met. This is achieved by undergoing all the necessary test cases produced by the Testing team. These results are recorded and documented.

8.3. Execution Phase Processes

The Execution phase of the product development cycle is when the team produces the product. Before reaching this phase, the Project Manager should have a clear and high-level understanding of what the project is creating and how it will be created. Deliverables are set to ensure project requirements are met and to keep the project on track.

8.3.1 Version Control

Utilising Git, development will take place on several branches to ensure version control is maintained. Development on the main branch should be avoided to avoid bugs and vulnerabilities occurring in the live product. A separate development branch will be used when writing software to reinforce this, which will then be merged at the end of the testing phase of production. Additional branches will be created in the case of multiple developers working at the same time to allow them to work in parallel without harming the development branch.

8.3.2 Test Driven Development

Each user story will be fed through a pipeline to ensure the feature not only functions as intended by the customer and developer, but also is of high quality and secure.

Before implementing any new feature, the Software Development team must approach the Quality Assurance team so that they can provide a testing methodology they deem appropriate, and make sure both teams are working towards the same goal. The Software Development team must gain a good understanding of the proposed testing plan before making any changes to the code.

When a member of the Software Development team has finished working on a feature, they will submit a pull request.

If the pull request fails to pass the tests, it cannot be merged and the development team will have to address the issue(s). Alternatively, if the pull request passes the tests, the code will be peer-reviewed by either the Quality Assurance team or a developer who was not involved in writing the patch. If the reviewer deems the code fit, the pull request can be merged into the main branch.

8.3.3 Test Execution

Unit tests and Instrumentation tests will be written by members of the Quality Assurance team to ensure not only that individual classes function correctly, but also that the addition of the user story does not introduce bugs and complications that interfere with the rest of the product. Unlike Unit and Instrumentation testing, User Interface testing will be handled by an automated test framework.

8.3.4 Automated Test Framework

Espresso [4] is an automated test framework for Android created by Google that will be utilised when writing User Interface tests. This ensures reliable end-to-end tests that can be reused with each new user story, where appropriate.

8.4. Control & Monitoring Phase Processes

This phase is executed alongside the execution phase. During this phase the Project Manager carefully monitors progress and keeps the project on track, removing any roadblocks that may appear and making adjustments to the project plan if necessary due to unforeseen circumstances or changes in the project requirements that may be requested by the customer. The Project Manager ensures status meetings and reports are constantly produced and that the organisation is constantly undergoing continuous improvement.

The quality of produced work is also monitored by the Project Manager and Quality Assurance Team to ensure all deliverables are completed to a high-quality standard. Adjustments in the workflow or project plan may be necessary to improve the quality of work.

8.4.1 Status Meetings & Reports

Sprint Retrospectives and status meetings are regularly scheduled to inform the Project Manager of project progress and gain insight on current roadblocks to progress. These meetings also give a chance for employees to provide feedback and suggest improvements, promoting communication and continuous improvement.

Status meetings are conducted according to documented protocols in order to make sure that timely corrective actions are implemented to correct any insufficiencies that may be found. The

results of status meetings are recorded and submitted to the necessary company personnel having responsibility in the sections of the project discussed. Such meetings and audits are considered successful when the application and effectiveness of corrective actions have been validated and documented.

The resulting reports produced from status meetings allows the Project Manager to ensure the project is on track and quickly adapt to changes in the project roadmap.

Status meetings and subsequent reports also meet the contract and/or regulatory requirements.

8.4.2 Resource Management

Tasks are allocated to each team by the Project Manager according to the project plan/roadmap. Utilising resource management tools such as monday.com [1], the Project Manager can view current and future deliverables, and allocate resources accordingly. The use of resource management tools allow the organisation to troubleshoot problems before they occur, and prevent burnout from over-allocation of resources.

The tools also provide transparency to teams of the overall workload allocation and give insight to the overall efficiency of each sprint, providing valuable monitoring information.

8.4.3 Corrective/Preventive Action

Penelope will incorporate a corrective and preventive action system which is utilised for the monitoring and analysis of all quality related issues, allowing us to identify trends and determine any causes of project non-conformances. This process is also used for keeping track of any corrective and/or preventive actions in order to measure their efficiency.

Any corrective and preventive actions may originate from internal status meetings, reports during the implementation phase, customer feedback complaints and management reviews.

8.5. Closure Phase Processes

This phase marks the end of the project. The Closure Phase cannot be started until a complete product has been produced. During this phase, Penelope ensures the product has undergone and passed all required tests and that the product meets all requirements defined in the Initiation phase. Then the product is released to the customer and if required, handed over to another development team.

The Closure Phase also provides an opportunity for the organisation to review the project performance and results, and take action to improve for the next project.

8.5.1 Product Review

A report is completed outlining all passed tests. Quality Assurance ensures all tests still pass and that the product contains all features outlined in the project vision.

8.5.2 Product Handover

Communications with the customer are made to receive feedback on the final product, and ensure the customer is satisfied with the finished product.

During the handover, if the product is being handed over to another team for further development, this is the time to provide completed documentation for the use of the team.

8.5.3 Project Post-Mortem

On project completion, Penelope holds a project post-mortem. The organisation reviews the performance of the project and identifies areas for improvement going forward. This is also a time to acknowledge team members and celebrate the project completion.

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