

PROJECT REQUIREMENTS SPECIFICATION

IN PREPARATION FOR: THE
HORTICULTURAL ASSOCIATION OF
AUSTRALIA

K7 PROJECT TEAM

PINNACLE SOFTWARE INC.

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EXECUTIVE SUMMARY

This document was created to provide HAA an analysis of the IT issues and recommended solutions made by PSI. A list of solutions was provided with a cost and benefit analysis to find the most suitable solution to HAA's problem, including Server Renting, HAA Onsite Database and Google Cloud Services. With this, HAA can make an informed decision on what solution shall be most beneficial to their organisation.

Key stakeholders, functional requirements and non-functional requirements have been analysed from the given HAA case study and listed in this document. Legal considerations were also analysed, with respective responsibilities of both PSI and HAA along with penalties for misconduct. These considerations along with PSI's project approach and Quality Assurance standards have been used in the analysis and estimation for the web-based software solutions provided.

All solutions analysed will fulfil the functional and non-functional requirements, though some solutions may complete these requirements more efficiently than others.

Aiven Microsoft Azure

Investment Gain	\$128419.78
ROI	124.21%
Annualized ROI	17.53%
Investment Length	5

Server renting requires the use of a third-party hardware provider, Aiven, to gain the necessary hardware for the database and web-site processes. Cost for developing this solution was estimated to be \$89546.47 for renting of servers and development cost with 322 days of effort. This makes a return of \$128419.78 over 5 years, 124.21% of original investment.

Security, maintenance and backups will depend on standards upheld by the third-party, though web-site and database maintenance will still be the responsibility of HAA.

HAA Onsite Database

Investment Gain	\$68542.15
ROI	41.98%
Annualized ROI	8.40%
Investment Length	5

This solution will have HAA purchase their own servers to place the database and DBMS. Estimates were made with servers and routers recommended by PSI. The estimated cost was \$109264.10, with 336 days of effort due to purchase of servers along with interface development between servers and web-site. This returns \$68542.15, 41.98% of original investment.

Though with more cost and time, quality assurance is easier to maintain as well as security and backups, with the right team trained to support the servers.

Google Cloud Services

Investment Gain	\$123,575.58
ROI	114.18%
Annualized ROI	16.45%
Investment Length	5

Similar to solution 1, Google Cloud Services solution requires the rental of Google Cloud Databases. Estimated cost shall be \$93100.27 with 337 days of effort. This returns \$123575.58, 114.18% of original investment.

Along with being cost effective, this solution also provides the most reliable and scalable system, though security and maintenance will be done by the third-party. Quality is heavily influenced by their standards.

With consideration to cost, time and respective benefits and shortcomings, PSI recommends Aiven Microsoft Cloud Services solution as the most beneficial system for HAA's requirements. This is due to the least effort and highest profit margin, along with the requirement of reliability and scalability as important non-functional requirements in the system.

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INTRODUCTION

Term	Description
HAA	Horticultural Association of Australia
PSI	Pinnacle Software Inc.
DBMS	Database Management System
DB	Database
Integrated System	A system which has the capability to work concurrent with many users.
Recovery Point Objective (RPO)	A measurement in time of how far back a system must be reverted to on failure.
System Recovery Time (SRT)	A measurement in time of how long it would take to get a system back online upon failure and reset.
NPV	Net Present Value

This proposal details aspects of the software solution design from information gathered from the HAA. It is constructed by the K7 project management group of the PSI including Heja Bibani, Jerome Gardiner and Sabrina Handley. This document is a detailed overview of the project stakeholders, objectives, requirements, solutions, and legal considerations. The recommendation will be made using the K7 project management approach.

The project overview: describes the problem that has been identified in the investigation that the PSI has conducted. A preliminary estimate will be made that will be used to describe the solution. This estimate will be used to direct the project manager towards a more thorough investigation of possible solutions.

The functional and non-functional requirements: These have been produced from the project brief. The functional requirements are the things the system must do, and the non-functional requirements are the characteristics that the system must possess.

The solutions that will be recommended must possess these characteristics for them to be considered suitable. Information contained in this section will be used to check if the solution has the characteristics and functions needed to tackle the problem.

Stakeholder analysis provides a list of the organizations and people that are impacted by the current project. This includes names, roles, assumptions, and responsibilities. The analysis should be used to determine the interests of each respective stakeholder. It describes the nature of the stakeholder's role in the business that they are working for. It also states the type of potential role the stakeholder will have in this project. The project manager can refer to this section to determine how a certain stakeholder in the project may be able to contribute to the project.

Solutions: Three solutions will be investigated before one is recommended. A cost benefit analysis will be conducted on each of these. The recommended solution will be the system which is considered the most feasible to tackle the problems the HAA is facing. A recommended solution from the batch of solutions that it has investigated will be chosen and presented in the document. The reasons surrounding the decision will be presented and analysis of the decision will follow.

The project approach: The methodology that will be used to handle this problem. There are various approaches that a project management team can use. The approach is usually determined by the nature of the solution that will be provided. The chosen approach will be designed to be the most suitable for the current business case.

Legal Considerations: The government has various laws which it produces to ensure safety and ethical practice. These laws provide the basis for the way a business should conduct its affairs. All organizations are regulated under these laws and huge penalties can apply if the business does not abide by them. This document will go over the legal issues that both organizations must consider. This is to ensure that both parties are working in accordance with the law's requirements.

Quality assurance: This will detail the method used for verifying that the system possesses the functional and non-functional requirements. This stops mistakes and issues from generating in the finished product. A set of procedures will be used to ensure that the system meets quality requirements. This document will describe the procedures that K7 will use to ensure that the product meets quality standards.

The solution will be tailored for the current business problem. It will then assess the feasibility of the solutions and whether it is reasonable to continue to the next stage of the project.

Project Overview and Objectives

The HAA had contacted the PSI with the problem that they were facing with their current IT setup. This section of the document will give an overview of the problem and will identify the nature of the solution.

HAA Overview

Horticultural Association of Australia is an organization that distributes and promotes garden and horticultural advice, assets, and exhibitions. This organization relies on members and volunteers to conduct their business. There is a maximum of 20 staff members to complete executive and business decisions.

The HAA's current communication and information retrieval system that is used for daily operational procedures requires improvement. This system is used to compound information on members and finances through the secretariat. The HAA is heavily reliant on reports, emails, and meetings to complete information transfer.

Communication to members is also limited to physical mail and advertisements in the press / magazine.

The Problem

The HAA produces and formulates many reports for several different operational purposes. The HAA did not implement a standardized approach for the form design. The lack of standardization of the forms has produced incompatible file formats. Several reports rely on information contained in other reports to function.

The design of the organization caused the employees to input duplicate forms and reports. This significantly increased the workload on the business. The redundant and duplicated information has also caused issues with data consistency. An employee cannot rely on the information contained in a single report.

The HAA has a central system that does not integrate parts of the organization. There was a physical database that held information about employees, but this was separate from other business operations. There was no interface that employees could use to access the data. Most of the data was kept in a physical location and this made the information extremely difficult to access.

There were various security issues that were identified in the business. There are no authorization, authentication, backups, replication, and data integrity services.

The HAA have implemented operational practices that are not working in accordance with the law. This was related to privacy, email, and trademark laws. The lack of security made the data vulnerable to unauthorized access by employees or external entities. Emails may have been sent out without legal consent. There was no information in the member database that stated whether the member consented to being emailed.

The Solution

The PSI has the capacity and expertise to implement a solution that will overcome the problems that the HAA are facing. The primary objective is to ensure that the problems dictated above can be alleviated by the solutions that we provide. From the preliminary examination of the problem our experts have stated that the recommended solution must contain a DBMS.

The DBMS will be connected to an application program that will possess an interface for the users. The DBMS will have backup and replication services which ensures that the system is recoverable and reliable. A user will be presented with an interface with a log-in page. Information about all the stakeholders will be within the DBMS, and the information about the user will be used to determine the user's privileges. The log-in page will act as a form of authentication and authorization service. The user will login and a set of links or tabs will be given based upon the privileges of the user.

The reports, forms, and other operational information can be generated through the application program. The system generates these reports via inputs from the user. The reports and forms will be validated to ensure that correct and necessary information is inputted before being processed in the system.

This system will be implemented as a single unified system which ensures that the system is integrated. The application program shall act as an interface between the user and the DBMS. This system will ensure that it reduces redundancy, improves security, and improves productivity and efficiency.

KEY PERSONNEL AND STAKEHOLDERS

Internal			
Name	Business Role	Assumptions	Project Role
Secretariat	<ul style="list-style-type: none"> • Routine administration of organization • Communication with other internal stakeholders • Leads team into through centrally integrated system that is headed by the secretariat • Decision maker • Overlooks reports and other information given by other internal stakeholders • Regulates pricing 	<ul style="list-style-type: none"> • Will be available for consultation • Give feedback of progress • Provide insights into how the solution should be designed • Be on call for regular meetings 	<ul style="list-style-type: none"> • Improve the quality of the design significantly • Can identify errors in judgement or planning • Can provide input for project feasibility
Council	<ul style="list-style-type: none"> • Determines policy • Communicates with secretariat • Communicates with accounting team • Analyzes reports • Makes recommendations 	<ul style="list-style-type: none"> • Is available for production of interface design and report format • Provide other assistance to design system • Be on call for regular meetings 	<ul style="list-style-type: none"> • Improve the quality of the design • Can identify errors in judgement or planning • Improve the quality of the report generator
Executives	<ul style="list-style-type: none"> • Implements the policy generates by the council 	<ul style="list-style-type: none"> • Is available for production of interface design and report format 	<ul style="list-style-type: none"> • Improve the quality of the design • Can identify errors in

	<ul style="list-style-type: none"> Analyzes reports from other organizations Makes recommendations Communicates and liaises with the secretariat 	<ul style="list-style-type: none"> Provide other ancillary assistance Be on call for regular meetings 	<p>judgement or planning</p> <ul style="list-style-type: none"> Improve the quality of the report generator
Committees	<ul style="list-style-type: none"> Building business case Provides guidance to the secretariat Monitors business progress Resolving conflicts 	<ul style="list-style-type: none"> Is available for analysis of project plan On call for interviews and regular meetings 	<ul style="list-style-type: none"> Can help with project feasibility testing Can help understand the scope Can help with planning and implementation
Branches	<ul style="list-style-type: none"> Organizes local programs of events Look after local member interests Gathers information from customers and the public 	<ul style="list-style-type: none"> Is available for meetings Will provide recommendations for program design 	<ul style="list-style-type: none"> Can give input on the design of the system especially with regards to generation of reports to the magazines
PSI Executive	<ul style="list-style-type: none"> Decision maker leader Liaises with other team members Overlooks the entire projects 	<ul style="list-style-type: none"> Available for consultation because of expertise in specific areas of IT software design Available for meetings and recommendations 	<ul style="list-style-type: none"> Can help with design Can give direction to team members Input into software errors and design
PSI Project Manager	<ul style="list-style-type: none"> Overlooks entire project Participates in planning Conducts meetings 	<ul style="list-style-type: none"> Is available throughout entire project role out for meetings and consultation 	<ul style="list-style-type: none"> Ensures that project is working according to schedule

	<ul style="list-style-type: none"> • Determines project approach 	<ul style="list-style-type: none"> • Participates in project design 	<ul style="list-style-type: none"> • Ensures project is feasible and success • Solves problems and conflicts
Software Engineers	<ul style="list-style-type: none"> • Codes the entire project • Participates in project design • Project testing and roll out 	<ul style="list-style-type: none"> • Is available continuously throughout the project • Has the skill to complete the tasks 	<ul style="list-style-type: none"> • Design of the entire software system • Production of the entire code
Information Technology Staff	<ul style="list-style-type: none"> • Maintains end use project on the client-side • Responsible for reporting bugs and issues post-implementation 	<ul style="list-style-type: none"> • Available in post-production for meetings and consultation 	<ul style="list-style-type: none"> • No Developmental role

External			
Name	Role	Assumptions	Project Role
Members	<ul style="list-style-type: none"> Receive services that the HAA provide Provides feedback to the HAA 	<ul style="list-style-type: none"> Some are available for interviews 	<ul style="list-style-type: none"> Can help formulate design
Magazine	<ul style="list-style-type: none"> Handles advertisements by the HAA 	<ul style="list-style-type: none"> Available for interviews 	<ul style="list-style-type: none"> Can help formulate interface design Can help formulate report design
Special Interest Groups	<ul style="list-style-type: none"> Shared interest produces growth and opportunity for business Help improve solutions 	<ul style="list-style-type: none"> Available for interviews 	<ul style="list-style-type: none"> Can help formulate design aspect of the interface
International Gardening Association	<ul style="list-style-type: none"> Shared interest group that produces opportunity for the HAA Communicates and provides funding and support for common venture projects 	<ul style="list-style-type: none"> Available for interviews 	<ul style="list-style-type: none"> Can help with design aspects of forms
Public	<ul style="list-style-type: none"> Potential members for organization 	NA	NA
The National Press	<ul style="list-style-type: none"> Handles advertisements by the HAA 	<ul style="list-style-type: none"> Available for interviews 	<ul style="list-style-type: none"> Can help formulate interface design Can help formulate report design

FUNCTIONAL REQUIREMENTS

FUNCTIONAL ID: FUNC01 - STORE, RETRIEVE AND ORGANIZE DATA

Summary: The system is required to store generated reports and to be capable of retrieving those reports. Information about staff members, sites, members, customers, and clients can also be stored. It is also important that this information be entered without the need for duplication.

Reason:

- This will ensure that there is no duplication or redundancy in the data.
- To ensure data is accessible to facilitate business operations.
- To have a storage for all records so that this information can be accessed to handle business operations.
- Make sure staff and members have access to stored reports for both operational and record keeping reasons.

FUNCTIONAL ID: FUNC02 - PRODUCTION OF REPORTS

Summary: Each type of standardized reports is dictated by the functional needs of the business as financial, formal, statistical and status reports. The system generates these reports via inputs from the user. Information will need to be gathered to determine how these reports should be designed on the computer.

The standardized generation of reports within the system will create redundant-free storage. It is also important that each of the reports will reach their respective audiences. These reports will be stored for record-keeping purposes as well as data transfer and decision making.

Report Types:

1. Financial Reports

This is accessed and generated by the treasurer who will place in the necessary information including: membership revenue, other revenue, expenditure, and accounts.

2. Formal Reports

Formal report generation to be on a single system that will be accessed and generated by the staff for general enquiries, requests, and updates.

3. Statistical Reports

The system shall generate statistical reports on information in the system including membership, financial status, location, and promotional information.

4. Status Reports

The status reports to be generated by the system via input by the secretariat which store information about minutes of meetings and other membership status reports.

Reason:

- To help manage the business operations.
- To reduce redundancy and extra work in data storage.
- To improve business operations.
- To ensure the business has the necessary facilities to continue providing their services.

FUNCTIONAL ID: FUNC03 - REPORTS TO PDF AND OTHER FORMATS

Summary: All reports must be stored in one standard format. The system will convert inputs into a common format file for the use and distribution to other organizations, members, and associates. The business sends this information both internally and externally. This is done through meetings, mail, email, fax, and web pages. Therefore, a set of different report formats will be necessary to make sure a given document is valid on several platforms.

Reason:

- To ensure suitable representation of the data for clients and customers.
- To ensure that there are different mechanisms to handle data.
- Reports will become accessible to print or generate a common format for the organization's operational purposes.

FUNCTIONAL ID: FUNC04 - LOGIN SYSTEM

Summary: The system must be able to be accessed by various types of members with different membership privileges. This would also give other functions which can be accessed according to the membership number.

Reason:

- To create accounts and store information about different types of people that are in or are associated with the organization.
- To provide authentication services.

- To improve accessibility
- To improve confidentiality of information

FUNCTION ID: FUNC05 - ACCOUNT TYPES, CREATION AND REGISTRATION

Summary: Account types will be generated to store information about the person who is logging in and the privileges they possess. Different account types will have different authorization levels. Some accounts may have limited access to system information and report generation.

Account Types:

1. Members
2. SIGS
3. Committee members
4. Council
5. Executive
6. Secretariat
7. General Staff

Reason:

- This will help create a form of authentication and authorization at different levels of HAA.
- This will ensure each member will be given only their respective privileges.
- The privileges will determine what page of the system they will be able to access.
- This will also determine which functions they possess for example the report type generation, for the purpose of accessibility, security, and integration.

FUNCTIONAL ID: FUNC06 - GARD INTEGRATION PACKAGE

Summary: The financial system will communicate with the GARD accountancy package to generate financial reports. This will include transferring revenue, membership, and expenditure information into the package.

Constraints on report generation may include time, revenue type and expenses. A report shall be generated from the information and provided to the petitioner.

Assumptions: GARD accountancy shall keep financial information of the company. When petitioned with the correct authorization, it will provide access to the information.

Reason:

- To integrate other software for optimized security
- Ease of access for form generation and record-keeping.

- The report generated from the GARD accountancy package will be validated and written in a report standard of the financial system, making it easier to create the report or input it back into the system.
- To reduce the effect the transition has on the business affairs.
- To reduce the burden of extra training on the business.
- To maintain useability of the current system.
- To reduce extra costs and time for training

FUNCTIONAL ID: FUNC07 – AUTHORIZATION AND AUTHENTICATION

Summary: Assumptions have been made to the security measures of the company. Access to the system is barred without authentication and authorization. Such authorization would require a minimum of a password and username. This may include two step authorization and key encryption for access to places which contain sensitive information.

Reason:

- To ensure the privacy and security of stakeholders involved in the organization.
- To ensure that information is accessed by authorized individuals.
- To ensure that the business works in accordance with the law and is legally protected.
- To reduce information loss.

FUNCTIONAL ID: FUNC08 – MEMBER DATABASE

Summary: The current user database will be updated to collect information from registration by members. This registration will undergo processing and validation before being inputted into the system. Access will be given to authorized personnel petitioning for a change or view information on members. The members will be given restricted access to petition a view or change their own information.

Reason:

- By creating an integrated member database with several access ports, redundancy and incorrect information is reduced with little to no oversight in the closed system.
- To be capable of using this information for statistical purposes.
- Flexibility is assured from the ability to access and change information if necessary.

FUNCTIONAL ID: FUNC9 – MEMBER REPORT GENERATION

Summary: Authorized staff may petition a member report from the system. The database will construct a report based on constraints of location, activity and or payment status. This report will be processed and returned to the petitioning staff member with required information stipulated in the petition.

Reason:

- Report generation on the system's part will shorten the time it takes for staff to generate reports as well as remove oversight and human error.
- The report design will also be valid input for other functions.
- Keeps certain information on members secret based on authorization and objective of the report
- Allowing constraints also creates more efficient report designs for different objectives.

FUNCTIONAL ID: FUNC10 – DATABASE ACCESS

Summary: Staff shall complete authentication and authorization before petitioning the system. Upon petitioning, the system shall validate and process the necessary report.

Reason:

- Database access is limited to the system as to remove oversight and create security of the information in the database.
- To ensure that the system is operating in unison with the database.

FUNCTIONAL ID: FUNC11 – PROMOTION DESIGN AND CREATION

Summary: Staff shall have the ability to design and input promotional material in standard formats. The material shall be validated and processed, then given to authorized staff members to review. If validated, the system shall send promotions to the emails of users. This will be done according to their respective location or promotional status. An option can be made to send the promotional material to other entities with access to the system, like the magazines or external press.

Reason:

- The system can make sure promotional material is in a valid format before giving it to supervisors who can then validate that the material is appropriate.

- Constraints can also be made in validation so that promotions shall be sent to those in the location.
- Optionally, the promotion can be sent to the press for hardcopy handouts or advertisements in the magazine.

FUNCTIONAL ID: FUNC12 - DATABASE BACKUP-SERVICES

Summary: The data must be backed up by a system that can ensure that the data is not lost. The system must be able to recover to a certain point if an error occurs.

Reason:

- To reduce data loss.
- To improve data security.
- To ensure the business can transition effectively from one system to the next.
- To improve system reliability.

NON-FUNCTIONAL REQUIREMENTS

NON-FUNCTIONAL ID: NFUNC01 – INTEGRATION

Summary: This integrated system will work both as processes in the database and the website. This system should be able to collect up to 10,000 queries in a day and process them in a timely manner.

Reason:

- Queries will be made by members, staff and external public. This uses the upper most capacity of the system at 417 queries an hour to ensure no downtime during high traffic periods of time like events.
- This system reduces redundancy and keeps all documentation within one framework.
- This reduces the work required to organize the system.
- This also allows the system to be easily accessible, reducing the amount of work to access information.

NON-FUNCTIONAL ID: NFUNC02 – ACCESSIBILITY

Summary: This system should be accessible for 24 hours of the barring maintenance to as many as 5,000 to 10,000 users.

Reason:

- This system must run at all hours of the day to provide querying from staff, members or external public due to necessary functions like username / password changes, financial and operational report generation, or registration.
- To aid in the customer accessibility of the system, certain additions must be made to allow the user to choose a written viewing language (Mandarin, Arabic, Vietnamese, Greek).
- In addition, this system should function consistently across multiple internet browsers, including Google Chrome, Safari, Firefox, and Internet Explorer, as well as various mobile devices.

NON-FUNCTIONAL ID: NFUNC03 – PERFORMANCE

Summary: The system will allow a capacity of at least 3,000 assumed users concurrently.

Reason:

- Many users will need to use this system at the same time, so it is important to make sure the system will have the capability to host a high capacity of individual users without breaking down, especially with large events.
- The higher number will deal with massive influx due to events when capacity is at its highest.

NON-FUNCTIONAL ID: NFUNC04 – CAPACITY

Summary: The database must keep information on 500,000 users as well as 5,000,000 reports.

Reason:

- Servers of the database will be required to store up to 10,000 user entities and respective information including location, contact details, name, email, password and authorization, financial status, and promotional status. This is to account for influx in registrations over years, specifically 5 to ten years.
- The server will also have to keep an assumed 5,000,000 reports and documents including financial and membership reports and promotional material. This amount of reports is necessary as the system will need to keep a record of

reports for as far back as 5 years for tax invoices and other financial documents. GARD may contribute to the storage of this number. This would include yearly records for all users, purchased supplies and events.

NON-FUNCTIONAL ID: NFUNC05 – SCALABILITY

Summary: This system shall be built with the capability to host up to 500,000 member users, along with 500 admin accounts, to account for an influx in users after the new system is in place.

Reason:

- The system that will be recommended will require physical modifications in the future and must be considered.
- A system will be updated with larger storage and processing for concurrent users over time, 1,000 to 5,000 users in a modification. These updates should not interfere with business as usual.

NON-FUNCTIONAL ID: NFUNC06 – SECURITY

Summary: The system will allow those who are authorized access to 128 bits encryption security certification to view and change certain data based on user privileges. For administration and high-level access, it is advised to use 256 encryption level certifications.

Reason:

- Certain security measures would be actioned to include two step authentication and passwords to decrease information disclosure and threats to software and hardware.
- Reduce risk of information loss to unauthorized individuals outside of the company
- To ease anxiety of customers

NON-FUNCTIONAL ID: NFUNC07 – MAINTAINABILITY

Summary: Systems, especially business systems must have a lifespan of 3-5 years and be easily replaced and maintained.

Reason:

- The lifespan should be expected to last the same amount of time as the given hardware, approximately 3 - 5 years for servers.
- Updates and modifications can make servers obsolete or inefficient before then so it is important to update.
- Modulate servers for ease of maintenance which would increase longevity of the system.

NON-FUNCTIONAL ID: NFUNC08 – FAULT TOLERANCE

Summary: Database backups can be produced once every day. Backups will be necessary to achieve fault tolerance in the system. There should be at least 1 backup system. The system can also be designed to produce replicates immediately for each DBMS transaction. This can be done by producing redundant databases.

Reason:

- To improve system reliability
- By leaving redundancy for an influx of information as well as usage on the webpage will ensure that the system will operate at efficiency, even during faults.
- If servers fail or disconnect, having another server site and redundant servers will allow the system to still function and connect with users.
- Backups of files should also be kept in case of failure.
- Keep the information inside the database consistent
- Backups of earlier versions of the system must be kept as well in case of fault or problem in updating it for maintenance.

NON-FUNCTIONAL ID: NFUNC09– QUALITY OF SERVICE

Summary: The system should function with less than a 3 second wait time for customers and staff on user interfaces, and longer with large processing functions like user registry or report generation. There will be a maximum of 10 minutes for report generation.

Reason:

- As mentioned in performance, the system should function with at most 3,000 users concurrently in case of influx of users.
- Such large numbers can slow the system, so processing for user interfaces and form filling should be less than 3 seconds for customers and at most 5 - 10 seconds.
- However, when it comes to processing the system, it may take longer. 10 minutes should be a loose guideline as some files are not under time constraint.

NON-FUNCTIONAL ID: NFUNC10 - AVAILABILITY

Summary: The system will be designed with an uptime availability of 99.9%.

Reason:

- The designed structure will provide a high level of system availability.
- A web-based system must be online a large portion of the time for customer and staff convenience and should only be taken offline during updates and maintenance.
- This makes availability generally limited by the network structure. Maintenance should be applied to the server in a package with more time for testing and diagnostics.
- To improve customer satisfaction

NON-FUNCTIONAL ID: NFUNC11 - CONTINUITY

Summary: Backups and redundancy of system data should be made to ensure the system remains functional even after a catastrophic failure. We should have a Recovery Point Objective (RPO) of at most 1 day. System Recovery Time (SRT) should be at most 2 - 5 days based on assumptions of where the backup is stored.

These backups must be kept offsite from the database and in redundant servers. The latest system update shall be available to fix the system if a failure were to occur. The system can also be designed to produce replicates immediately for each DBMS transaction. This can be done by producing redundant databases. The redundant system should act as a replacement to normal server function until the main servers come back online. This ensures that the HAA's services are provided in a continuous fashion.

Reason:

- To improve availability and maintainability.
- To ensure and improve accessibility.
- To improve system quality of service.
- To ensure that the work is unimpeded and continuous.

ALTERNATIVE SOLUTIONS

SOLUTION 1 AIVEN-MICROSOFT CLOUD

Solution overview

The solution that will be provided is a web-based application that will be run and operated by a database that is connected through a cloud system. The application will conform to the functional and non-functional requirements detailed in the previous sections. The system configuration information and other details are explained in the following sections.

Security

Solution 1 will provide security that will follow the ISO 27001 security certification standards. The ISO/IEC standard is an internationally recognized standard that is developed by global security experts. This ensures that the client's information is secure and meets legal compliance. Replication, consistency, duplication, recovery, and back-up services are provided according to the standard. The products are also designed to be continuous and available as stipulated in the non-functional requirements.

MySQL

The server will be a cloud operating on the Microsoft Azure network and will use the renowned MySQL system that is familiarized with the PSI team. The MySQL system is run and operated by the Oracle foundation. The system is open and there is various documentation that can be accessed for both users and maintainers to access. There is also a large amount of software that is dedicated to MySQL available in the market. This software can be utilized for things such as statistical analysis and report generation. The MySQL system has been known for its high performance and on-demand scalability.

Pricing

All the functionalities are the same for each of the solutions. The major difference between each option is the size of the RAM and storage capacity. The business packages below are related to the Microsoft Azure product specification.

	RAM	Storage	Monthly
Business-4	4GB	80GB	\$370
Business-8	8GB	175GB	\$740
Business-16	16GB	350GB	\$1480
Business-32	32GB	700GB	\$2960

Business-64	64GB	1000GB	\$3400
Business-120	128GB	1400GB	\$6000
Business-240	256GB	2800GB	\$12000

Source: <https://aiven.io/pricing>

Chosen option

The chosen option is the one that has been calculated to meet the technological needs of the HAA. Various estimation techniques were used to calculate the amount of memory needed for the HAA. The memory estimation was primarily based on the Microsoft estimation memory calculator. All the security services are the same for each of the options and therefore it was not used as means to differentiate the products from each other. This is a cloud-based solution that will operate on the Microsoft Azure network with the location close to the HAA headquarters. All expert services are provided for by the organization who package deals the product.

Product Name: Aiven Microsoft Azure	
Items	Description
Type:	Business 32
OS:	Windows
Cloud:	Microsoft Azure
Database Type:	MySQL
Capacity:	700GB
Security:	Replication, Back-up, Authentication, Authorization services
Location:	Australia East
Price Per Month	\$2960

Source: <https://aiven.io/pricing>

Technologies and resources

Platform

Application Platform: The framework that will be used to develop the application is the ASP.net razor pages framework. The razor pages framework significantly reduces the coding effort by giving structure to application development. The ASP.net framework is an integrated framework that possesses high functionality and support. The bootstrap technique for website design greatly reduces the amount of time taken to design the website. The model-view-controller mechanism greatly simplifies database design and access. The database support system within the ASP.net framework is strong and secure. Several developmental environments can be accessed by the programmers and changes are also accessible through the online platform GitHub. This can significantly improve the speed at which the application is developed because the workers can work

on the product when they are sick or if they have free time. Preliminary database systems can be used to test the database before the full-fledged database transfer.

Work Breakdown

The work is broken down according to the work type and the estimated time to finish the task has been detailed in the effort-based cost-analysis table below. **The time calculated in the following tables are based on effort and not of elapsed time.**

There are also multiple staff members that have different pay rates according to their role. The pay rate will be used from their hourly rate to determine the total cost for each project section. Resource levelling was done to ensure that resources were not over-allocated to the tasks needed. The work is broken down into the following sections:

Programming: The programming section is subdivided into various tasks that are stipulated in the effort-based cost-analysis table. These include database programming, user interface programming, network programming, integration programming and testing. A CoCoMo estimation method was used to give initial estimates but was then modified by input from various experts. Most of the programming work is going to be completed using the ASP.net framework.

Project Management: The project management tasks are subdivided and calculated by the estimation taken in the project sprints. The project management tasks are according to the work that is related to organizing, planning, reviewing, quality assurance and producing reports. These are completed before the project begins, during and after the project ends. Multiple members including programmers are going to participate in this work. Most of the documentation in relation to the project will be produced in this section of the work.

Training: The system is going to be designed to be user friendly and should not take great skill to use it. This means that the system will be ergonomic so that training time should be kept to a minimum. Several staff members with expertise in the field will participate in training staff members as time reaches deployment. The training documentation will also be produced by the team who is focusing on design. It was estimated that this work will not be extensive and should be a short duration.

Delivery: Before the product is completely deployed it will be installed and previous data will be migrated. It was estimated that data migration will be the longest procedure for this section of work. The quality acceptance procedure under the IEEE-730 quality assurance standard will be followed to ensure that product meets all the requirements before being deployed.

Cost Calculation

A work breakdown structure was first conducted before the information in this section was completed. This information is clearly documented in the effort-based cost-analysis table below. The granulated form of the work was then used to make estimates of effort and cost. Information about staff members and their salaries were used to calculate the cost for each section of work. Various estimation techniques were used to make the estimates, and this is detailed in the constraints and methods part of this section.

Position and hourly rate

The position of each member of the team is represented as an hourly rate and this information will be used to calculate the total cost in the effort-based cost-analysis table. The tables below will detail the roles needed to develop this application, including the project manager, programmers, testers, and designers.

Position	Hour Rate	Earnings
Project Manager	\$38.46	\$80000
Database Programmer	\$28.85	\$60000
Programmer	\$28.85	\$60000
Senior Programmer	\$48.08	\$100000
Team Lead	\$31.25	\$65000
Tester	\$29.81	\$62000

Note: Hour Rate is calculated on the assumption that staff will be available 40 hours a week for 52 weeks

Effort based cost-analysis table

This table was produced as the result of the work break down structure that was separated before each work task was estimated. The total cost calculation method is shown beneath the table.

		Effort in man-days						Total effort	Cost
		Project Manager	Database Programmer	Programmer	Sen. Programmer	Team Lead	Tester		
	Product								
Programming	Database	0	25	10	0	0	0	35	\$8078.00
	User Programming	0	15	7.5	7.5	0	0	30	\$8077.8
	Interface	0	12	31.2	16.8	0	0	60	\$16432.51
	Network Programming and Organization	0	12.8	5.1	5.1	0	0	23	\$6092.98
	Integration Programming	0	12.5	5	12.5	0	0	30	\$8847.00
	Testing	0	2	2	2	0	10	16	\$4077.28
	Total								\$51605.57

Project Measurement	Project Plan	10	0	0	0	0	0	10	\$3076.08
	Project Sprints	15	3	3	3	3	3	30	\$8619.36
	Documentation	10	0	0	2	3	0	15	\$4596.08
	Team meetings	5	5	5	5	5	5	30	\$8212.00
	Reports	5	1	0	1	2	0	9	\$2653.84
	Total								\$27157.14
Training	User Training	0	1	1	0	0	1	3	\$700.08
	Database Training	0	1	0	0	0	0	1	\$230.80
	Training Documentation	0	2	2	0	0	1	5	\$1161.68
	Total								\$2092.56
Delivery	Data Migration	0	10	0	0	0	0	10	\$2308.00
	Installation	0	0	2	0	0	0	2	\$461.60
	Deployment Schedule	5	0	0	0	0	0	5	\$1538.40
	Software Support	0	2	2	0	0	0	4	\$923.20
	Total								\$5231.20
								Total	\$86086.47

Cost = (Effort In Days * 8 * Hourly rate) + (Effort In Days * 8 * Hourly rate) + (Effort In Days * 8 * Hourly rate)

Methods of Calculating effort

- Work was heavily granulated into sections before estimates were made into a work break down structure.
- Large amounts of internal metrics were used to determine the effort taken.
- Multiple individuals were consulted to gather an opinion about the metrics given.
- The effort required to achieve the outcomes are done using extensive and rigorous research.
- Effort for the coding techniques were estimated using a code effort estimator that utilized the CoCoMo and the Delphi technique.

Constraints and Assumptions

- The PSI staff members will be available 8 hours a day 40 hours per week on 52 calendar weeks.
- We estimated that for 500 000 users it would require 565GB in the short term, this was estimated using Microsoft Database Memory Estimator.
- There is a 10% discount on the NPV calculation and cumulative savings.
- The value of return is stagnant at \$73125.00 per year.

- The price of the products will be the same over the 5 years.
- Migration will be completed by the PSI.
- Training documentation will be completed after the finished product because of the project management approach.
- The maintenance of the server is at a standard \$500 per year, naturally this would expect to increase over time.
- The estimates were drawn from the work and product break down structure.
- The memory requirements were based upon the Microsoft memory requirement generator.
- Multiple members of the team made their own estimates and agreed on one.
- The computers have the hardware capacity to handle the system.

Cost Benefit Analysis

NPV

Year	Outflows	Inflows	Net cashflow	Discount Factor 10%	Discount Cash Flow
0	\$89546.47		-\$89546.47	1	-\$89546.47
1	\$3460.00	\$73125.00	+\$69,665.00	$1/(1+0.1)^1 = 0.91$	\$63395.15
2	\$3460.00	\$73125.00	+\$69,665.00	$1/(1+0.1)^2 = 0.83$	\$57821.95
3	\$3460.00	\$73125.00	+\$69,665.00	$1/(1+0.1)^3 = 0.75$	\$52248.75
4	\$3460.00	\$73125.00	+\$69,665.00	$1/(1+0.1)^4 = 0.68$	\$47372.20
				Net Present Value	\$131291.58

The NPV calculation aimed to estimate the immediate loss of revenue using projected inflows discounted at 10%. The initial outflow in year 0 includes the loss of \$3460 and is added to the \$86086.47 figure which was taken from the cost-based effort-analysis table. The 10% depreciation value progressively depreciates the total output by 0.91, 0.83, 0.75, 0.68 successively. **There is a net positive \$131291.58 after a 5-year period and there is no indication that the decision to move forward with the proposal will affect the business negatively in the long term.**

Payback Projection

		Year				
Type	Items	0	1	2	3	4
Costs	Training	\$2092.56				
	Delivery	\$5231.20				
	Project Management	\$27157.14				
	Programming	\$51605.57				
	Server costs	\$2960.00	\$2960.00	\$2960.00	\$2960.00	\$2960.00
	Maintenance	\$500.00	\$500.00	\$500.00	\$500.00	\$500.00
	Cumulative Total Costs	\$89546.47	\$93006.47	\$96466.47	\$99926.47	\$103386.47
	Total Savings	0	73125	73125	73125	73125
NPV	NPV Cash Flow	0	\$66543.75	\$60693.75	\$54843.75	\$49725.00

	Cumulative Savings	0	\$66543.75	\$127237.5	\$182081.25	\$231806.25
	Cumulative Savings – Cumulative costs	-\$89546.47	-\$26462.72	\$30771.03	\$82154.78	\$128419.78

The values for training, delivery, project management, programming was taken from the Effort based cost-analysis table. The cumulative total costs do not have a discount percentage added to it on consecutive years (as in the NPV table). The discount rate for cumulative savings is at 10%. Based on the calculation, the system will have paid itself back by the third year after implementation if maintenance is assumed to be \$500 per year. **The following projection stipulated that the HAA is to expect a net return of \$128419.79.** The NPV calculation discount rate was used to make the projections for the cumulative savings. The server costs are small at a rate of \$2960 per year with maintenance at \$500. **From the values and the analysis of the costs there does not seem to be any caution raised with moving ahead with the project.**

The project calculation for return on invest results:

Investment Gain	\$128419.78
ROI	124.21%
Annualized ROI	17.53%
Investment Length	5

$$\text{ROI} = \frac{\text{Gain from Investment} - \text{Cost of Investment}}{\text{Cost of Investment}}$$

The projected total return on investment is a staggering 124.21% which supports the move to push forward with the proposal. The expected returns should far exceed this amount and was calculated under the assumption that there would be no added tangible benefit as the result of its installation.

Cost-Based Benefit Solution Analysis

- The database is easily upgradable to deal with capacity issues in the future.
- The business is estimated to receive payback with only 3 years of the initial investment.
- It would take an estimated 5-6 months of elapsed time to finish we estimated this using the work break down structure.
- A large chunk of maintenance is done at the other end.
- No outright maximum payment is needed for the database.

- The HAA will be gaining access to specialist expertise.
- The server is not a depreciating asset that is at the expense of the business.
- A professional team of database experts are dealing with back-end issues.
- The speed of installation is enhanced because the delivery of the database is taken care of on the other end.
- There are no electricity payments or other fees because the product is off-site.
- There are no space limitations that will be imposed because the server is not run and operated at the HAA department sites.
- Highly secure environment for the DBMS approach which include all the security features detailed in the non-functional requirements.
- Cheap and highly affordable DBMS system in place.
- Reduce the amount of people working thus reducing costs.
- Simplifies the management of operations.
- The solution provides a system enhancement at an affordable cost.

Benefits and justification of the solution

The solution has all the characteristics necessary to ensure that it meets the HAA requirements. The payback is expected to occur will occur within the third years (or year 2). The HAA will be guided by a team of experts that will handle database issues which also significantly reduces management complexity. There is a net **124.21% return on investment** within the 5th year. **The estimates suggest that project is economically feasible to continue forward with the project.** There are several ancillary benefits that the HAA will acquire if they choose to move forward with this solution and they are listed below:

Benefit of the Product

- Highly secure system to implement controls on data.
- ASP.net Application platform used to speed up development time.
- Improvements in transactional speed and efficiency
- Improved system to handle information from clients in a legal way.
- Highly Integrated system that will be migrated easily.
- Capacity improvements with the ability to improve in the future.
- Business can concentrate on core aspects of the business.
- Improved communication system with added report generation features
- Work can be completed off-site.

SOLUTION 2 HAA App

Solution overview

Solution 2 details a web-based application that can be accessed on mobile and onsite devices. This application can be downloaded on most devices and connects to the database and DBMS through an internet connection.

This application is web based through HAA's website with a few GUI, security and authentication systems being downloaded on each device and will provide a notification system for advertisement distribution.

Report generation would be made with forms in the application and sent to the system database to process the request and return a report. This system will also integrate with the GARD package for financial reports. It will also integrate into the website to transfer information from the application to the system.

Pricing

The cost of the system services will be on the servers. Because of the flexibility in device usage and independence of user usage over the website, the servers for the database and its connection to the internet are the only things that need to be maintained.

- **Server pricing**

This can be upgraded when necessary, based on the manager's decisions. The recommended server would be the Dell PowerEdge R710 Server. This has a quad core CPU which means it contains 4 cores within it. Each server has 6 Terabytes, so it would be sufficient to have one but for the sake of backups it is recommended to have two servers.

It is important to note it is possible to separate and distribute HDDs and CPUs in some servers, but for the sake of estimation it is assumed that two of these servers will be necessary.

Due to the nature of buying the server, the user must commit to using this for at least 3 – 5 years.

	Price	1-year commitment	3-year commitment
Server (2x PowerEdge R710)	\$832.33	\$832.33	\$832.33

- **Internet pricing**

An internet connection will be necessary for servers to communicate with users. It is recommended to take the cisco MX100 router. This comes with integrated security like firewalls and client Virtual Private Networks. Though it is on the low side, throughput will have 750 Megabytes a second, and have a recommended capacity of 500 clients at a time. With using batch processing, and allowing the app to complete its own processing, only two of these may be necessary.

	Price	1-year commitment	3-year commitment
Server (2x Cisco MX100)	\$5012.48	\$5012.48	\$5012.48

Database

The database must have sufficient security and scalability to meet HAA functional and non-functional requirements. The recommended database solution would be MySQL which allows for database design as well as security and reliability.

Product Name: HAA App	
Items	Description
Type:	Database
OS:	Windows OS
Database Type:	MySQL 8.0
RAM	32Gb
Capacity:	6TB Storage
Security:	Two step authentication for staff, username and password for users, and back-up-services.
Price Per Month	\$273.55

Technologies and resources

Application Platform: The technologies required would be Microsoft Visual Studios ASP.NET to design the database and program the application in a mixture of C# and JavaScript languages. This will also provide a good base for creating the graphics design.

Work Breakdown

The work is broken down into separate sections that are categorized according to type. Each section is then estimated to take a certain amount of effort. The position of the member of staff will determine the hourly rate. Each staff member may participate in a certain task and the number of days is given as the total effort. The cost of the work will

be done by calculating the total effort required by the staff members to finish that task. The resources that will be calculated are based upon the application requirements of the section. This does not include the resources that will be needed to run the database. This section details the resources the PSI will use to finish the application. Resource levelling was done to ensure that resources were not over-allocated to the tasks needed.

Programming: The programming section is subdivided into various tasks that are stipulated in the table. Various estimation techniques were used to calculate the effort required to calculate the effort required. The database requires extensive work, and the graph has taken this into account. The work will further be subdivided, and this is specified in the project section of the report.

Project Management: The project management tasks are according to the work that is related to organizing, planning, reviewing, quality assurance and producing reports. This is primarily completed during the SCRUM sprints where various aspects of project management are going to be completed.

Training: The system will be ergonomic so that this aspect should be kept to a minimum. Several staff members with expertise in the field will participate in training staff members as time reaches deployment. The training documentation will also be produced by the team who is focusing on design. This documentation will be completed at the end of the sprints.

Delivery: The product will be deployed and installed at the HAA computers. They may access this through their internet. After this has been completed the data will be migrated. The server will be set up at the site and this has been taken into consideration.

Cost Calculation

A work breakdown was first conducted before the information in this section was completed. The granulated form of the work was then used to make estimates of effort and cost. Information about staff members involved will be used to calculate the cost. Various estimation techniques were used to make the estimates, and this is detailed in the constraints and methods of this section.

Position and hourly rate

The position of each member of the team is represented as an hourly rate and this information will be used to calculate the total cost in the effort-based cost-analysis table. The tables below will detail the roles needed to develop this application, including the project manager, programmers, testers, and designers.

Position	Hour Rate	Earnings
Project Manager	\$38.46	\$80000
Database Programmer	\$28.85	\$60000
Programmer	\$28.85	\$60000
Senior Programmer	\$48.08	\$100000
Team Lead	\$31.25	\$65000
Tester	\$29.81	\$62000

Note: Hour Rate is calculated on the assumption that staff will be available 40 hours a week for 52 weeks

Effort based cost-analysis table

This table was produced as the result of the work break down structure that was separated before each work task was estimated. The total cost calculation method is shown beneath the table.

		Effort in Man-Days						Total effort	Cost
		Project Manager	Database Programmer	Programmer	Sen. Programmer	Team Lead	Tester		
	Product								
Programming	Database	0	30	20	0	0	0	50	\$11540
	User Programming	0	15	7.5	7.5	0	0	30	\$8077.8
	Interface	0	12	31.2	16.8	0	0	60	\$16432.51
	Network Programming and Organization	0	12.8	5.1	5.1	0	0	23	\$6092.98
	Integration Programming	0	12.5	5	12.5	0	0	30	\$8847.00
	Testing	0	2	2	2	0	10	16	\$4077.28
	Total								\$55067.57
Project Management	Project Plan	10	0	0	0	0	0	10	\$3076.08
	Project Sprints	15	3	3	3	3	3	30	\$8619.36
	Documentation	10	0	0	2	3	0	15	\$4596.08
	Team meetings	5	5	5	5	5	5	30	\$8212.00
	Reports	5	1	0	1	2	0	9	\$2653.84
	Total								\$27066.36
Training	User Training	0	1	1	0	0	1	3	\$700.08
	Database Training	0	4	0	0	0	0	3	\$692.40
	Training Documentation	0	2	2	0	0	1	5	\$1161.68
	Total								\$2554.16
Deployment	Data Migration	0	10	0	0	0	0	10	\$2308.00

	Installation	0	0	2	0	0	0	2	\$461.60
	Deployment Schedule	5	0	0	0	0	0	5	\$1538.40
	Software Support	0	2	2	0	0	0	4	\$923.20
	Total								\$5231.20

- Training documentation and workshops will be completed after the finished product, during implementation.
- Standard maintenance on the server per year would be \$13500 p/y, accounting IT maintenance. This number will be calculated with depreciation of 10%.
- Projected savings is based off of savings from staff 31.25h of work time a week in the secretariat. This equates to 1625 hours a year saved. These savings will be calculated with depreciation of 10%.
- Efforts for coding techniques were estimated using the CoCoMo Method.
- It is assumed this project will be considered basic in terms of the CoCoMo Formula due to the use of basic validation and processing functionals.
- It is assumed the project programs are considered small in terms of the Programming method due to basic functional processes.
- The effort is under the assumption there are no problems or breaks, so the projected length will naturally be longer.
- HAA will buy and maintain their own servers on a given onsite location.

Cost benefit analysis

NPV

Year	Outflows	Inflows	Net cashflow	Discount Factor 10%	Discount Cash Flow
0	\$109264.10		-\$109264.10	1	-\$109264.10
1	\$13500	\$73125	+\$59625	$1/(1+0.1)^1 = 0.909$	\$54258.75
2	\$13500	\$73125	+\$59625	$1/(1+0.1)^2 = 0.826$	\$49488.75
3	\$13500	\$73125	+\$59625	$1/(1+0.1)^3 = 0.751$	\$44718.75
4	\$13500	\$73125	+\$59625	$1/(1+0.1)^4 = 0.683$	\$40545
				Net Present Value	\$79747.15

The NPV value is used to estimate loss or gain of revenue represented by potential inflow from other investments. This potential is shown through a discount of 10% of possible inflows over the years.

It is observed that business will not be negatively affected by investing in this system.

Payback Projection

		Year				
Type	Items	0	1	2	3	4
Costs	Training	\$2554.16				
	Delivery	\$5231.20				
	Project Management	\$27066.36				
	Programming	\$55067.57				
	Server costs	\$5844.81				
	Maintenance	\$13500	\$13500	\$13500	\$13500	\$13500

	Cumulative Total Costs	-\$109264.10	-\$122,764.10	-\$136264.1	- \$149,764.10	-\$163264.10
	Total Savings	0	73125	73125	73125	73125
Saving	NPV Cash Flow	0	\$66543.75	\$60693.75	\$54843.75	\$49725
	Cumulative Savings	0	\$66543.75	\$127237.5	\$182081.25	\$231806.25
	Cumulative Savings – Cumulative costs	-\$109264.10	-\$56220.35	-\$9026.60	+\$32317.15	+\$68542.15

The payback projection calculates how many years it would take for the system to pay for itself, by accumulating the amount of costs versus the amount of savings in the following years after implementation.

Based on the calculation, the system will have paid itself back by the third year after implementation if maintenance is assumed to be \$13500 per year. It is also assumed the savings being \$73125 with depreciation of the same numbers for the accumulative cost of getting staff to do the same work across a larger span of time.

The project calculation for return on invest results:

Investment Gain	\$68542.15
ROI	41.98%
Annualized ROI	8.40%
Investment Length	5

$$\text{ROI} = \frac{\text{Gain from Investment} - \text{Cost of Investment}}{\text{Cost of Investment}}$$

Cost-Based Benefit Solution Analysis

- Extra security placed on onsite database and servers.
- Redundant database
- Easy replacement of devices and / or servers
- Backup servers can be maintained.
- Redundant internet connections
- Widely available web-application for various devices
- Access from many locations
- Information on traffic and statistics and usage by users
- Security systems on the router and application

Benefits and justification of the solution

This solution shall cost the most to maintain as shown above and would require an IT department to keep it. There is a reasonable **return on investment after 5 years of 41.98%**. However, it offers control in redundancy in databases and provides necessary backups and security. **This solution offers the most control over database maintenance and information security.**

Benefit of the Product

- Highly secure system to implement controls on data.
- Improvements in transactional speed and efficiency.
- Improved system to handle information from clients in a legal way.
- Highly Integrated system that will be migrated easily.
- Improved communication system with added report generation features.
- Work can be completed off-site.

SOLUTION 3 GOOGLE CLOUD SERVICES

Solution overview

The solution that will be provided is a web-based application that will be run and operated by a database that is connected through a cloud system. The application will meet the functional and non-functional requirements detailed in the previous sections. The configuration and differences in the system are detailed below.

Configuration

Google uses configuration modes to determine the availability and security of the services that they provide. The configuration mode that will be utilized is the “high availability mode”. This is the configuration mode that is used with the subsequent pricing schemes. The purpose of this mode is to reduce down-time and improve availability and continuity of services. This mode also includes security qualities that include, backup, replication, and encryption related services. This ensures instances of fail over where an unresponsive cloud switches to another service which duplicates the data. It has also been designed so that it meets all service-level agreements and non-functional requirements detailed in the project brief and the document.

Pricing

The services of the cloud are placed into three separate categories:

- **CPU and Memory Pricing**

This option can be upgradable and is chosen up to the managers decision. It can warrant up to 96 CPUs and 624 GB of memory. This depends on the region that the server is located.

	Price	1-year commitment	3-year Commitment
vCPUs	\$0.0413 per vCPU	\$0.03098	\$0.01982
Memory	\$0.0070 per GB	\$0.00525	\$0.00336
HA vCPUs	\$0.0826 per vCPU	\$0.06195	\$0.03965
HA Memory	\$0.0140 per GB	\$0.01050	\$0.00672

Sources: <https://cloud.google.com/sql/pricing>

- **Storage and networking pricing**

The pricing scheme is primarily determined by the region in which the services are hired.

Sources: <https://cloud.google.com/sql/pricing>

	Price
Storage	<ul style="list-style-type: none">• \$0.230 per GB/m for SSD• \$0.122 per GB/m for HDD• \$0.108 per GB/m for backups
HA Storage	<ul style="list-style-type: none">• \$0.459 per GB/m for SSD• \$0.243 per GB/m for HDD• \$0.108 per GB/m for backups

Chosen Options

The HAA must be able to have the option to upgrade the services if capacity were to reach in the future. The chosen option meets the security requirements and is run in the high availability described in the previous section. The MySQL service has all the necessary functions to ensure that the chosen option meets the functional requirements.

Product Name: Google Cloud	
Items	Description
Type:	CP-DB-SQLSERVER-4-26
OS:	Windows OS
Database Type:	SQL Server 2017 Enterprise
Memory:	24 GB memory
Capacity:	1773 GB Storage
Security:	Replication and Back-up-services
Configuration Mode:	High availability mode
Price Per Month	\$3282.60

Sources: <https://cloud.google.com/sql/pricing>

Technologies and resources

Platform

Application Platform: The framework that will be used to make the platform is the PHP-storm by JetBrains. This is an IDE framework that has been used by the company on various occasions. It contains functionality which supports JavaScript, Java, HTML, PHP, and CSS, and this will be used to make the product.

Work Breakdown

This section details the resources the PSI will use to finish and deploy the application. The work is broken down into separate sections that are categorized according to type. Each section is then estimated to take a certain amount of effort in man-days. The position of the member of staff will determine the hourly rate. Each staff member may

participate in a certain task and the number of days is given as the total effort. **The time calculated in the following tables are based on effort and not of elapsed time.** The cost of the work will be done by calculating the total effort multiplied by the hourly rate of a worker. Resource levelling was done to ensure that resources were not over-allocated to the tasks needed.

Programming: The programming section is subdivided into various tasks that are stipulated in the effort-based cost analysis table below. Various estimation techniques were used to calculate the effort required. It was noted that the database section did not need as much as effort as the rest of the solutions. This is because the platform that google presents has specified that most of the effort will be handed to the google experts.

Project Management: The project management tasks are according to the work that is related to organizing, planning, reviewing, quality assurance and producing reports. This is primarily completed during the SCRUM sprints where various aspects of project management are going to be completed.

Training: The system will be ergonomic so that training time should be kept to a minimum. Several staff members with expertise in the field will participate in training staff members as time reaches deployment. The training documentation will also be produced by the team who is focusing on design. This documentation will be completed at the end of the sprints.

Delivery: The quality assurance acceptance phase will be conducted under the IEEE-730 quality assurance standards to ensure that the product meets all the requirements before being deployed. The product will then be deployed and installed at the HAA computers. After this has been completed the data will be migrated from the old system to the current.

Cost Calculation

A work breakdown was first conducted before the information in this section was completed. The granulated form of the work was then used to make estimates of effort and cost. Information about staff members and their salaries were used to calculate the cost. Various estimation techniques were used to make the estimates, and this is detailed in the constraints and methods of this section.

Position and hourly rate

The position of each member of the team is represented as an hourly rate and this information will be used to calculate the total cost in the effort-based cost-analysis table. The tables below will detail the roles needed to develop this application, including the project manager, programmers, testers, and designers.

Position	Hour Rate	Earnings
Project Manager	\$38.46	\$80000
Database Programmer	\$28.85	\$60000
Programmer	\$28.85	\$60000
Senior Programmer	\$48.08	\$100000
Team Lead	\$31.25	\$65000
Tester	\$29.81	\$62000

Note: Hour Rate is calculated on the assumption that staff will be available 40 hours a week for 52 weeks

Effort based cost-analysis table

This table was produced as the result of the work break down structure that was separated before each work task was estimated. The total cost calculation method is shown beneath the table.

		Effort in Man-Days						Total effort	Cost
		Project Manager	Database Programmer	Programmer	Sen. Programmer	Team Lead	Tester		
	Product								
Programming	Database	0	20	0	0	0	0	20	\$4616.00
	User Programming	0	15	17.5	7.5	0	0	40	\$10385.8
	Interface	0	12	45.2	16.8	0	0	74.3	\$19663.71
	Network Programming and Organization	0	12.8	10.1	5.1	0	0	28	\$7246.98
	Integration Programming	0	12.5	5	12.5	0	0	30	\$8847.00
	Testing	0	2	2	2	0	10	16	\$4077.28
	Total								\$54836.77
Project Management	Project Plan	10	0	0	0	0	0	10	\$3076.08
	Project Sprints	15	3	3	3	3	3	30	\$8619.36
	Documentation	10	0	0	2	3	0	15	\$4596.08
	Team meetings	5	5	5	5	5	5	30	\$8212.00
	Reports	5	1	0	1	2	0	9	\$2653.84
	Total								\$27157.14

Training	User Training	0	1	1	0	0	1	3	\$700.08
	Database Training	0	1	0	0	0	0	1	\$230.80
	Training Documentation	0	2	2	0	0	1	5	\$1161.68
	Total								\$2092.56
Delivery	Data Migration	0	10	0	0	0	0	10	\$2308.00
	Installation	0	0	2	0	0	0	2	\$461.60
	Deployment Schedule	5	0	0	0	0	0	5	\$1538.40
	Software Support	0	2	2	0	0	0	4	\$923.20
	Total								\$5231.20
								Total	\$89317.67

Cost = (Effort In Days * 8 * Hourly rate) + (Effort In Days * 8 * Hourly rate) + (Effort In Days * 8 * Hourly rate)

Methods of Calculating effort

- Work was heavily granulated into sections before estimates were made into a work break down structure.
- Large amounts of internal metrics taken from previous tasks were used to determine the effort taken.
- Many other mathematical estimation techniques were also used to calculate effort taken.
- Multiple individuals were consulted to gather an opinion about the metrics given.
- The effort required to achieve the outcomes are done using extensive and rigorous research.
- Effort for the coding techniques were estimated using a code effort estimator that utilized the CoComo and the Delphi technique.

The products or deliverables that are provided are mainly intangible. There is no other tangible benefit for the server because this will be handled by google. The intangible nature of the deliverables has made some of the estimates a bit difficult to measure.

Constraints and Assumptions

- The PSI staff members will be available 8 hours a day, 40 hours a week and for 52 weeks.

- It would take an estimated 11-12 months of elapsed time to finish we estimated this using the work break down structure.
- We estimated that for 500 000 users it would require 565GB in the short term, this was estimated using Microsoft Database Memory Estimator
- There is a 10% discount on the NPV.
- The value of return is stagnant at \$73125.00.
- The price of the products will be the same over the 5 years.
- Migration of data from previous system will be completed by the PSI.
- Training documentation will be completed after the finished product because of Project management approach.
- The maintenance of the server is at a standard \$500 per year, naturally this would expect to increase over time.
- The estimates were drawn from the work and product break down structure.
- The memory requirements were based upon the Microsoft memory requirement generator.
- Multiple members of the team made their own estimates and agreed on one.
- The computers have the hardware capacity to handle the system.

Cost Benefit Analysis

NPV

Year	Outflows	Inflows	Net cashflow	Discount Factor 10%	Discount Cash Flow
0	\$93100.27		-\$93100.27	1	-\$93100.27
1	\$3782.60	\$73125.00	+\$69342.40	$1/(1+0.1)^1 = 0.91$	\$63101.58
2	\$3782.60	\$73125.00	+\$69342.40	$1/(1+0.1)^2 = 0.83$	\$57554.19
3	\$3782.60	\$73125.00	+\$69342.40	$1/(1+0.1)^3 = 0.75$	\$52006.08
4	\$3782.60	\$73125.00	+\$69342.40	$1/(1+0.1)^4 = 0.68$	\$47152.83
				Net Present Value	\$126714.41

The NPV calculation aimed to estimate the immediate loss of revenue using projected inflows discounted at 10%. The initial outflow in year 0 incorporates the loss of \$3782.60 and is thus added to the \$89317.67 figure that was taken from the effort-based cost-analysis table. The net cashflow is forwarded with a depreciation of 0.91, 0.83, 0.75 and 0.68 in each successive year. **It is stated that the net present value after 5 years will be to the sum of \$126714.41.** The inflows are also used as the cumulative saving projections which is listed in the pay back projection diagram. **The NPV calculation stipulates that the business should make the decision to move forward with the project.**

Payback Projection

		Year				
Type	Items	0	1	2	3	4
Costs	Training	\$2092.56				
	Delivery	\$5231.20				
	Project Management	\$27157.14				
	Programming	\$54836.77				
	Server costs	\$3282.60	\$3282.60	\$3282.60	\$3282.60	\$3282.60
	Maintenance	\$500.00	\$500	\$500	\$500	\$500
	Cumulative Total Costs	\$93100.27	\$96882.87	\$100655.47	\$104448.07	\$108230.67
Saving	Total Savings	0	73125	73125	73125	73125
	NPV Cash Flow	0	\$66543.75	\$60693.75	\$54843.75	\$49725
	Cumulative Savings	0	\$66543.75	\$127237.5	\$182081.25	\$231806.25
	Cumulative Savings – Cumulative costs	-\$93100.27	-\$30339.12	\$26582.03	\$77633.18	\$123575.58

The values for training, delivery, project management, programming was taken from the work break down structure analysis. This provided the output for these values with no discount accounted for Cumulative costs. The payback projection uses the NPV calculations from the NPV graph to calculate the Cumulative savings – Cumulative costs. This will include training, delivery, project management and programming sectors of the diagram. The major difference between the various recommended platforms is the server costs. **There projected return after 5 years is very positive and equates to \$123575.58. It is also projected that the business will have positive returns in the third year.** The server costs amount to \$3282.60 per month and this is done on a continuous basis. The usual \$13500 estimated for maintenance is diminished to \$500.00 because the responsibility of the database will be handed to another organization.

The project calculation for return on invest results:

Investment Gain	\$123,575.58
ROI	114.18%
Annualized ROI	16.45%
Investment Length	5

$$\text{ROI} = \frac{\text{Gain from Investment} - \text{Cost of Investment}}{\text{Cost of Investment}}$$

There is a **114.18% return on investment** after the 5th year with an **annual 16.45%** expected return average. **The projected returns also indicate that the push to move forward with the proposal is highly recommended.**

Cost-Based Benefit Solution Analysis

- The database is easily upgradable to deal with capacity issues in the future.
- The business is estimated to receive payback with only 3 years of the initial investment.
- It would take an estimated 11-12 months of elapsed time to finish we estimated this using the work break down structure.
- A large chunk of maintenance work is done by the organization who is responsible for the database.
- No outright maximum payment is needed for database.
- Gaining access to specialist expertise.
- The server is not a depreciating asset that is at the expense of the business.
- A professional team of database experts are dealing with back-end issues.
- The speed of installation is enhanced because the delivery of the database is taken care of on the other end.
- There are no electricity payments or other fees because the product is off-site.
- There are no space limitations that will be imposed because the server is not run and operated at the HAA department sites.
- Highly secure environment for the DBMS approach which include all the security features detailed in the non-functional requirements.
- Cheap and highly affordable DBMS system in place
- It will reduce the amount of people working thus reducing costs.
- This orientation greatly simplifies the management of operations.
- The solution provides a system enhancement at an affordable cost.

Benefits and justification of the solution

It has been carefully examined that this solution will meet all the functional and non-functional requirements. **There is a net 114.18% return on investment within the 5th year.** The amount of revenue and savings generated by the company significantly outweigh the costs required to produce, maintain, and acquire the solution. The HAA will be guided by a team of experts that will handle database issues. The pay-pack projection states that the system is to be completely paid back within only the second year. **The estimates have been analyzed and it has been projected that this**

solution is economically feasible. There are several ancillary benefits that the HAA will get because of undertaking this solution and they are listed below:

Benefit of the Product

- Highly secure system to implement controls on data.
- Improvements in transactional speed and efficiency.
- Improved system to handle information from clients in a legal way.
- Highly Integrated system that will be migrated easily.
- Capacity improvements with the ability to improve in the future.
- Business can concentrate on core aspects of the business.
- Improved communication system with added report generation features.
- Work can be completed off-site.

RECOMMENDED SOLUTION

Overview

The staff investigated the options of using an onsite server or a cloud-based server. In this section the characteristics of each solution will be detailed and evaluated. This will include a quality and cost-based analysis which will be done to determine which is to be the recommended solution.

Quality and Benefit Analysis

Solution 1 - Aiven Microsoft Azure Cloud

Product Name: Aiven Microsoft Azure	
Items	Description
Type:	Business 32
OS:	Windows
Cloud:	Microsoft Azure
Database Type:	MySQL
Capacity:	700GB
Security:	Replication, Back-up, Authentication, Authorization services
Location:	Australia East
Application Platform:	ASP.net
Application Development Time:	322 Days (Man-Days)
Price Per Month	\$2960

- On demand scalability and growth.
- Need further upgrades if it reaches estimated capacity of 500000 users.
- No on-site hardware or depreciating assets.
- Extremely high availability of server to ensure security.
- Highly secure environment that complies with the law.
- Vast amounts of enterprise-level development tools.
- Maintenance is done at the other end and stagnant at set price of \$500.
- Access to expert specialist in the field of database.
- No other space that is taken up by the server because the server is not run at the site.

- Simplifies the management of process and reduces the amount of people working there.
- Uses ASP.net which significantly reduces application development time.
- 700 GB storage with large capacity.

Solution 2 – Dell power Edge

Product Name: HAA App	
Items	Description
Type:	Database
OS:	Windows OS
Database Type:	MySQL 8.0
RAM	32Gb
Capacity:	6TB Storage
Security:	Two step authentication for staff, username and password for users, and back-up-services.
Application Platform:	ASP.net
Application Development Time:	336 Days (Man-Days)
Price Per Month	\$273.55

- Extra work needed by the project team to set up programming and hardware.
- Hardware maintenance may require extensive skill to complete and extra staff and training may be needed.
- The system will take up extra space in the offices of the HAA.
- Information statistics enhanced using traffic and statistics.
- Highly secure environment developed by the PSI team.
- This secure environment can be difficult to maintain.
- Hardware warranty expires after the end of the 5th year and is added as an expense.
- Scalability is easy to do but is more costly and complex to implement.
- Extra hardware maybe needed in the future in the event more security is required.
- The server is classified as a depreciating asset.
- Maintenance costs is expected to increase as time moves forward.
- Highly controlled DBMS in terms of reliability and availability.

Solution 3 – Google Cloud

Product Name: Google Cloud	
Items	Description
Type:	CP-DB-SQLSERVER-4-26

OS:	Windows OS
Database Type:	SQL Server 2017 Enterprise
Memory:	24 GB memory
Capacity:	1773 GB Storage
Security:	Replication and Back-up-services
Configuration Mode:	High availability mode
Application Platform:	PHPStorm
Application Development Time:	333 Days (Man-Days)
Price Per Month	\$3282.60

- There is on demand scalability and growth.
- High availability configuration mode by google ensures that system is up and running according to standards.
- No on-site hardware or investment in depreciating assets.
- Highly secure environment that provides, replication, duplication, backup services that ensure that the system complies with the law.
- Vast amounts of enterprise-level development tools.
- Maintenance is done at the other end and stagnant at set price of \$500 per month.
- Access to expert specialist in the field of database
- Application Platform is PHPStorm which has increased the amount of time to complete the application.
- No other space that is taken up by the server because the server is not run at the site.
- Simplifies the management of process and reduces the amount of people working there.
- 1773 GB storage will take a very long time to reach capacity.

Conclusion

The analysis shows that cloud-based solutions 1 and 2 are preferred over the on-site solution. The cloud-based systems will not take up physical space and there are also fewer extra costs for maintenance, development, and scalability. It is noted in the document that the HAA maybe greatly affected by the risks that an onsite solution will bring.

The major focus of the next part of the analysis is to determine which of the cloud-based solutions were to be recommended. The cloud-based systems were expected to have remarkably similar benefits as both services are provided by renowned and respected organizations. There are three major differences between the Solution 1 and Solution 3 which include:

- Storage and Capacity
- Application Platform
- Application Development Time

Solution Differentiation Table

Type	Storage	Application Platform	Application Development Time (Man-Days)
Solution 1: Aiven Microsoft Azure	700GB	ASP.net	322 Days
Solution 2: Dell Power-Edge	2000GB	ASP.net	336 Days
Solution 3: Google Cloud	1773GB	PHPStorm	337 Days

Solution 1 has smaller storage capacity than Solution 3 and this meant that Solution 3 would need to be updated after a very long time. Solution 1 also uses the ASP.net platform whilst Solution 3 uses PHPStorm platform. In the effort-based cost analysis table for both solutions it was noted that ASP.net platform significantly reduces the time taken to produce a web-based application. In the description of each solution, it stated that Solution 1 has an application development time of 322 days whilst Solution 3 has an application development time of 336 days. From the analysis we calculated that the elapsed time should be between 11 to 12-month period which fits within the 12-month timeframe of the HAA. This forwards us to the second section of the analysis where we compare the cost benefits of solution 1 and solution 3.

Cost Analysis

The quality analysis above suggested that the off-site solutions were more beneficial than the onsite option. Solution 2 is much less cost effective than the alternatives, and solution 3 will take considerably more time to finish. Solution 2 is also more difficult to scale and the price to scale was greater than the alternatives. A cost analysis of the product was conducted for each of these solutions and the summary results are listed in the table below.

Cost Summary

Solution	Cost	Net Present Value	Payback Projection	Annualized Return	ROI
Solution 1: Aiven Microsoft Azure	\$86086.47	\$131291.58	\$128419.78	17.53%	124.21%
Solution 2: Dell Power Edge	\$89919.29	\$79747.15	\$68542.15	8.40%	41.98%
Solution 3: Google Cloud	\$89317.67	\$126714.41	\$123575.58	16.45%	114.18%

It was estimated that the Microsoft Azure solution will take longer to develop and there are extra costs required for it be constructed. Solution 1 provides a return on investment of 124.21% whilst solution 3 provides 114.18% return on investment.

Recommended Solution

Solution 1 is cheaper and will also be built on the native ASP.net platform which significantly reduces the amount of time and effort to finish the application. Solution 1 also has 10% greater return on investment in comparison to solution 3. Solution 1 and 3 have all the same benefits apart from these three provisions:

Solution 1 provides:

- Superior application development platform
- Less application development time
- Greater long term financial benefit

PSI thus recommends that Solution 1 should be chosen based on the benefits stated above.

PROJECT APPROACH

Overview

The PSI has three software development teams across the world that will participate in the completion of the project. Software projects must follow a method of processes that are called the software development life cycle (SDLC). The AGILE methodology is an umbrella term for several SDLC methodologies which can be implemented. The AGILE methodology that will be used in this project is the “SCRUM” methodology.

Reason

The major reason why the PSI is using the AGILE and SCRUM methodology is because it wants to focus its attention on these principles:

- Working Software
- Collaboration and Cooperation
- Response to changing requests.
- Implementing organized project stages called sprints.
- Managing progress after sprints have been completed.
- Speed and Accuracy
- Quality Assurance

The HAA is strained by reaching capacity and needs a software product as fast as possible. To reduce the strain of reaching capacity the PSI has chosen a method which focuses on creating a finished product in a timely manner.

The focus of this methodology is on creating working software and prototypes that may be used to generate feedback and testing at all stages of development at the expense of extensive documentation. Project documentation is not as important as the product and any other software documentation like manuals can be processed after the software has been completed.

The AGILE methodology is also flexible, to allow changes to scope and functional requirements throughout the project development. There will be regular meetings during and after completion of the phases (or sprints) of the project in SCRUM Methodology. These meetings could include input from members of the HAA, and functional changes could be recommended, then implemented during the completion of a sprint. The SCRUM methodology can be used to ensure quality. The SCRUM methodology also adapts to the standards specified in the IEE-730-2014 quality assurance standard.

SCRUM Software Development Methodology

The methodology that will be employed to tackle project tasks is through the SCRUM methodology. Sprints are short duration milestones that allow members to finish functional requirements. After a sprint is completed some functional requirements about the software should be completed. The sprints contain three fundamental concepts which include elements, phases, and burndown charts.

Elements

Roles: The project tasks will be divided upon the teams that the PSI is composed of. The SCRUM methodology has clearly defined parameters that identify the people who are responsible for the project tasks. The team is composed of:

- **Product Owner:** is the person who re-examines the functional requirements and make sures that they are suitable for the given problem
- **Scrum Master:** ensures that the project is following the schedule as expected, and that every member has the resources they need to complete the work. They set up meetings, monitors the work being done and facilitates release planning
- **Team Members:** The project tasks will be divided upon the teams that the PSI is composed of.

Artifacts: Artifacts are descriptions of the things that are being developed during the completion of a sprint and include:

- Functional requirements and sprint backlog: Functional requirements is the description of the things that are being produced.
- Updated backlog: Are the requirements found in the team meetings.

Meetings: There are three meeting types depending upon the stage of the sprint:

- Planning meeting: This is before the sprint is conducted.
- Daily meeting: Meeting conducted at the beginning of the day.
- Review meeting: The meeting that is completed at the end of each sprint to determine if the sprint is completed or not.

Phases

The work will be divided into sprints and each sprint is allocated to a PSI team. The functional and non-functional requirements will be identified and then divided according to the time taken to finish each. The sprints will have documentation about elements listed above. There are five phases in the sprint plan which include:

Plan: This consists of the processes that are related to estimating and planning tasks. This will include an estimation on how long it will take to finish the sprint. Goals, stakeholders, and functional requirements will also be determined. Issues identified during testing will be documented and plans to rectify this issue will be done

immediately.

Design: The product will be designed in multiple phases during the sprints. Team members will identify the system design and how several aspects of the interface link together. This can be separated according into two section which include software design and user interface design. This may also include design of website, graphical modelling, and other aspects of programming architecture.

Develop: The product will be developed according to the design requirements. All things will be coded in this period and the work will be checked in the following stages. The team in charge of a specific sprint will finish the production of the functional requirements contained in that sprint.

Test: The work will be tested, and issues such as bugs and compatibility will be identified immediately. This ensures that errors will have minimal damage to the business because they will be rectified early. Non-functional requirements will be tested if applicable.

Deploy: The product will be deployed to the team and if applicable to the HAA.

Review: The product owner and team members will review the product and determines if the product conforms and complies with the requirements. If the product has met with the requirements it will move to the next stage or the sprint may go through another iteration.

Refer to Appendix 1.1 for Sprint Chart.

Burndown Charts

Burndown charts will be used as means to measure how the project is progressing. The information in the burndown chart allows the team to make necessary adjustments to ensure that the project is on track.

Schedule

The schedule will follow closely the sections identified in the programming aspect of the project analysis (See alternative solutions: Technologies and Resources). These products include the database, interface, and network/integration programming. A team will be allocated a single sprint and each sprint will contain the functional requirements. Planning and Review meetings will occur bi-monthly while the daily meeting will happen twice a day.

Database Sprint: The database sprint will contain the functional requirements that are dedicated to database programming. Team Brisbane will handle this sprint.

Interface Sprint: The interface sprint will contain the functional requirements dedicated to interface and design programming. Team Bangalore will handle this sprint.

Network/Integration Programming Sprint: The networking and integration programming functional requirements will be completed here. Term Perth will handle this sprint.

Sprint Diagram Release Schedule

	Sprint 1	Sprint 2	Sprint 3
Roles	Product Owner: Michael Scrum Master: Deven Team: Team Brisbane	Product Owner: Agram Scrum Master: Sid Team: Team Bangalore	Product Owner: Mathieus Scrum Master: Summa Team: Team Perth
Artifacts	Functional Requirements/Sprint Backlog: <ul style="list-style-type: none"> • FUNC-01 • FUNC-05 • FUNC-08 • FUNC-10 Updated Backlog: <ul style="list-style-type: none"> • To be added • To be added 	Functional Requirements/Sprint Backlog: <ul style="list-style-type: none"> • FUNC-02 • FUNC-03 • FUNC-04 • FUNC-07 • FUNC-09 • FUNC-11 Updated Backlog: <ul style="list-style-type: none"> • To be added • To be added 	Functional Requirements/Sprint Backlog: <ul style="list-style-type: none"> • FUNC-06 • FUNC-12 Updated Backlog: <ul style="list-style-type: none"> • To be Added • To be added
Meetings	Planning meeting: <ul style="list-style-type: none"> • PL-01 • PL-02 Daily meeting: <ul style="list-style-type: none"> • PLD-01 • PLD-02 Review meeting: <ul style="list-style-type: none"> • PLR-01 • PLR-02 	Planning meeting: <ul style="list-style-type: none"> • PL-01 • PL-02 Daily meeting: <ul style="list-style-type: none"> • PLD-01 • PLD-02 Review meeting: <ul style="list-style-type: none"> • PLR-01 • PLR-02 	Planning meeting: <ul style="list-style-type: none"> • PL-01 • PL-02 Daily meeting: <ul style="list-style-type: none"> • PLD-01 • PLD-02 Review meeting: <ul style="list-style-type: none"> • PLR-01 • PLR-02

LEGAL CONSIDERATIONS

There are four major legal considerations that the PSI must take into consideration:

- Personal Information Handling
- Email Handling
- Trademark use
- Copyright

The 1988 Privacy Act

Overview

A business that turns over less than 3 million dollars is not covered under the Privacy Act. However, the privacy acts still cover businesses that are “trading in personal information”. This is any business who discloses personal information to someone else for a benefit, service, or advantage. This applies to the HAA, and they must abide by the Australian Privacy Principles that govern the standards rights and obligations of handling information.

HAA considerations and Responsibilities

Open and transparent management of personal information: The HAA must take necessary steps to ensure that it implements practices that complies with the Australian Privacy Principles.

Anonymity and pseudonymity: The individuals and customers may have the option of not identifying themselves or of using a pseudonym.

Collection of personal information: The HAA must only collect information that is necessary for one of the HAA’s functions or activities. The HAA must gather consent before the information is collected.

Dealing with unsolicited personal information: The HAA must destroy personal information held if it is deemed that it was not handled according to APP 3.

Notification of the collection of personal information: The HAA must get consent to collect information from an individual if it has been collected by an individual other than the person in question. This person must notify the individual about the way the information is being handled.

Use or disclosure of information: The HAA must only use the information for the purpose that was intended. If the use of the information is other than the consent which it has given, then that individual must be consented.

Direct marketing: The personal information held by the HAA must not be used for the purpose of direct marketing. Exceptions apply when the individual is aware of the circumstances surrounding the information disclosure.

Cross-border disclosure: Before handling information to individuals across the border the HAA must confirm that the recipient must also abide by the Australian privacy laws.

Adoption, use or disclosure of government related identifiers: The use of government related identifiers must not be used as the identifier of an individual in their own system.

Quality of personal information: The HAA must take necessary steps to ensure that the information they possess is accurate and up to date. Any information disclosed must be checked to be up to date before sending it out.

Security of personal information: The HAA must protect the personal information held of its customers from misuse, interference, and unauthorized access.

Access to, and correction of, personal information: The HAA must give access to personal information held if the individual requests it from them.

Correction of personal information: When personal information about clients and staff is inaccurate and outdated, the HAA must be able to take the reasonable steps to ensure that it is corrected. The HAA must update information if notified by clients.

PSI Considerations and Responsibilities

This section is concerned with the implications the regulation has on the design of the software. The system must be designed so that the HAA can meet its legal obligations.

- Database entries must be modifiable so that errors can be corrected.
- Access controls need to be implemented.
- Database information can be retrieved at will.
- Database entries are removable on request.
- Database backups needed to ensure that information requests by clients can be acted upon
- Any services which are hired like cloud-based services need to abide by Australian Privacy Laws
- Security Protection against possible attacks

- Database form design must allow for pseudonym alternative to name.
- Database form design must not store information that is not needed for the HAA's operational requirements.

Penalties

Privacy Act could amount to \$2.1 million per breaches, per day. This also includes a maximum penalty of up to \$420000.

The 2003 Spam Act

Overview

The HAA emails their customers and business associates on a regular basis. Emails are regulated under the 2003 Spam Act. There are legal considerations that need to be made by both the PSI and HAA. The information in this section will help the PSI create a system that accommodates for these legal requirements.

HAA considerations and Responsibilities

Confirmation: You must have permission from the person to send them emails. There are two types of confirmation:

- Expressed: When the person knows that they will receive emails from you because they have been asked.
- Inferred: The person has knowingly given you their address and it is expected that they would think that you will be sending them these emails.

Identification of the sender: In the sent message the HAA must identify themselves as the sender. Which includes

- The business name.
- Contact details of the business.

Opt-in/Opt-out: It must be easy for customers to opt-out of the electronic mailing list. The instructions must be easy to understand and present on the email. The opt-out must be completed within 5 working days. They must not be charged a fee.

Other: The HAA cannot send out emails to clients that is from a list that was created by email harvesting software.

PSI Considerations and Responsibilities

This section is concerned with the implications the regulation has on the design of the software. The system must be designed so that the HAA can meet its legal obligations.

- Clients, Customers, and other businesses must have database information about opt-in/opt-out status.
- The database should immediately update the status of the client if the opt-in/opt-out request is pressed on the email.
- Emails should use the information in the database to determine if they should be sent.
- The database must not be updated by email harvesting software.

Penalties

The penalties vary depending upon the circumstance and are due in order based up on:

- Based up on civil penalty provisions.
- Those instituted by the federal court.

The court can make other types of orders:

- Direct payment of compensation to a victim.
- Directing payment to the commonwealth up to an amount that was benefited. from the misuse of email functions.

The 1995 Trade Marks Act

Overview

A registered trademark is accepted as Intellectual Property in Australia. Proof of goods and services must be provided by the trademark owner if the trademark is unregistered.

HAA Considerations and Responsibilities

Registration: According to Australian law, it is the responsibility of the Organization to register their goods/services in an appropriate class.

- Said goods or services can be classed with multiple classes if necessary.
- Regulations may provide the classes for the services / goods under the Act.
- When a product is registered, the owner has exclusive rights to use the Trademark or give permission for others to use the Trademark.
- A Trademark is a personal property.

Infringement: If there is an infringement, it is the responsibility of the organization to make inquiries and contact the infringer or defendant as a sign of good faith.

- Infringement is done when the sign or mark is deceptively close to the infringed mark, as well as holding the same class of the mark.
- There is no infringement to unregistered trademarks, or if the mark can be proved to be used in good faith (see 122 of Act).
- The defendant may take the matter to court by using a prescribed court that may hear the action.

Offences: It is the responsibility of the Organization to remain honest in their trademarks and follow the legal procedure. Offences include:

- Falsifying or removing a Trademark.
- Falsely apply a registered Trademark to a product.
- Making a die, machine or instrument that is likely to be used for committing an offence.
- Drawing Trademarks to commit an offense.
- Possessing or disposing things used for Trademark offences.
- Using or selling goods with false Trademarks.
- Aiding and abetting offences.
- False representations in Trademarks.
- Disobeying a summons.
- Creating false entries in the register.
- Refusing to give evidence.

PSI Considerations and Responsibilities

- The PSI must use the registered trademark or a trademark that is uniquely identifiable to the HAA and not to any other organization within Australia.
- This trademark may be present on reports or the web interface.
- The PSI must use the suitable trademark in all aspects of reports, interfaces, emails, and websites.

Penalties

Penalties vary depending on the offence, but most offences will occur Penalty points from 10 to over 550. A *penalty unit* consists of a \$210 fine in the Crimes Act 1914. Some offences like creating a false entry will incur prison time for the responsible party.

The 1968 Copyright Act

Overview

The software that will be created by the PSI is protected by copyright. This includes the documentation that accompanies the software that is being produced. To qualify for copyright the people who produced the work must prove that they have used their skill to produce the work without copying someone else's work. The copyright does not require any form of registration, it is protected as soon as the work has been completed.

HAA Considerations and Responsibilities

- The HAA will make an infringement when it uses, copies, reproduces, and communicates the software without the authority given by the PSI in the license agreement.
- The copying of the work must be a fair dealing under the Copyright Act 1968
- The HAA can if they wish to make copies, backups, testing and correction for the purpose of improving the quality of the software for the intended use.
- To look over the license agreement before it signs off on the agreement.
- The HAA is obligated to use the software according to the license agreement.
- A reasonable portion of an adaptation of the work is classed as a fair dealing if it is not less than 10 pages and 10% of the number of the pages, that is, copying the basic idea of the software is not classified as an infringement.

PSI Considerations and Responsibilities

The PSI has exclusive right to:

- Copying the software
- Publishing
- Communicating the product to public
- Updating and modifications to the software
- Renting the software to other organizations
- The license to do all the above

The copyright will give the PSI the right to control what the HAA can and cannot do with the software.

The PSI must:

- The PSI must construct a license agreement that specifies the terms and conditions of the use of the software.

- The agreement must not go outside the context of the law with regards to the conditions it imposes on the HAA, and the HAA is not legally obliged to adhere to conditions that are outside the boundary of the law.
- The license must be given to the HAA.
- The PSI must get a signature that the HAA is aware and agree to the terms and conditions in the license agreement.

Penalties

A *penalty unit* consists of a \$210 fine in the Crimes Act 1914. Penalties are dependent on the situation and change according to whether the infringement was caused by an individual or corporation. A person may be fined a maximum of 550 penalty units for an infringement. For importation of material can incur a maximum of 650 penalty units. A corporation can acquire a maximum penalty of 5 times that of the maximum penalty. Penalties can result in a maximum of \$115 500 fine for individuals and \$577 500 for corporations. This can also result in a prison term of 5 years.

QUALITY ASSURANCE

Overview

A quality management plan has been constructed to outline tests and management structures used in the process of development, including quality assurance, control, and acceptance. This strategy is employed primarily through the software development life cycle using the SCRUM methodology. The SCRUM methodology that will be used has been designed to conform with the IEEE STD 730-2014 software quality assurance standard. Section ANNEX F of the IEE-STD 730-2014 software quality assurance standard details the adaptation of the AGILE methodology as an acceptable IEE quality assurance standard.

Quality Management

The qualities about the system are defined clearly in the functional and non-functional requirements. Assurance is the justification that a claim about a quality of the system has been achieved. There are four major principles for quality assurance in the PSI standard are:

- **Fit-for-purpose:** The PSI will make sure the product is fit for this purpose.
- **Compliance:** The PSI will design the product in accordance with regulation and law (derived from the legal requirements stipulated in the legal consideration section of this document)/
- **Conformance:** The PSI will ensure that the system will conform to the qualities detailed in the product specification (derived from agreements in the contract). Metrics will be used to ensure that the product meets the standards.
- **Right-the-first-time:** The PSI will have systems in place to ensure that any errors will be rectified immediately to reduce its economic impact.

The IEE-STD 730 2014 software quality assurance standard ensures that these four points are implemented through controls and processes. These processes and controls are incorporated into the SCRUM software development life cycle and detailed in the next section.

Control and Processes

Quality control is the process of reviewing the products and determining if they meet the requirements. The Software Quality Assurance Processes in the IEEE STD 730-2014 standard include:

- **Verification**
- **Validation**
- **Review**
- **Audit and Inspection**

The PSI will utilize a cost-effective and efficient approach to determine when these checks and tests are taken. These are done periodically in the software lifecycle at each respective sprint and is done in the testing and review phase of the sprint.

SDLC SCRUM methodology and Quality management system

The sprints contain the necessary processes that ensure continuous testing, inspection, verification, validation, audits, review, and integration. This will be documented throughout the project life cycle and is explained in more detail in the documentation section.

SCRUM is a reactionary system that grants flexibility to change. A part of the product will be completed in the sprints and the product will be evaluated at the end of the sprint through the team leader review. The product owners of the sprint can monitor the progress and provide input during the meetings to ensure the product is meeting the standards required.

Any non-conformance issues that have been raised can either be re-worked or new requirements inserted as a new set of backlogs. Checks will also be made to determine that the product complies with legal requirements. A risk management plan will be generated for every phase of the product life cycle.

Documentation

Programmers and designers shall be creating documentation and reports for each component of the product at each point in the life cycle. Reports are completed during the inspections the team leaders undertake during the sprint. The documentation will complete a log and a report sheet is completed using a quality control review form (refer Team Leader Review section). Testing documentation will include the test case completion form and a risk-management assessment form will be used to identify and mitigate risks. There will also be other documentation that will have the following information:

- Product specification document
- Issues, constraints, and risks
- Verification and Validation Documentation
- Review and Auditing Reports
- Acceptance forms and documentation to be completed at the end of the project

Team Leader Review

The team leader will review the work of the developers during and at the end of each sprint. A structured approach will be under-taken during the review to verify and validate that the product complies and conforms to the specification. The team leader will also find and rectify errors in source codes during the completion of the sprints. The team leader will use the following quality review form to make these checks:

Quality Control Review Form

QUALITY CONTROL REVIEW FORM						
Object:						
Sprint Owner/Team Leader:						
Date:	Signed:	Date:				
Lodger:	Approved:	Date:				
Location	Details	Class	Fixed		Recheck	
			Initials	Date	Initials	Date

Testing

Rigorous testing is conducted during the sprint and any issues can be brought up during the meetings. The tests will use the quantifiable values in the non-functional requirements to ensure conformance. The structure of the sprint ensures that any errors that are identified in the software can be rectified immediately. This will test the different components of the product which include constraints, capacity, security, and input / output to users. Test cases will be generated for each specific function to determine if the system possesses the qualities stated. A test case example is demonstrated in the following table below:

Test-Case completion form

Test Case	Test Case Name	Owner	Steps	Input Data	Expected Data	Output Data	Status
TC-001	Test Date for user input birthday on user sign up form	Adam	<ul style="list-style-type: none"> Select date Enter Date Submit 	01/08/1988	NO ERROR MESSAGE AND FORM SUBMITS	NO ERROR MESSAGE AND FORM SUBMITS	SUCCESS
TC-002	Test Date for user input birthday on user sign up form	Adam	<ul style="list-style-type: none"> Select date Enter Date Submit 	01/08/1988	ERROR MESSAGE AND FORM DOES NOT SUBMIT	ERROR MESSAGE AND FORM DOES NOT SUBMIT	SUCCESS
TC-003	Test Date for user input birthday on user sign up form	Adam	<ul style="list-style-type: none"> Select date Enter Date Submit 	00/98/121	NO ERROR MESSAGE AND FORM SUBMITS	ERROR MESSAGE AND FORM DOES NOT SUBMIT	FAILED
TC-004	Test Date for user input birthday on user sign up form	Adam	<ul style="list-style-type: none"> Select date Enter Date Submit 	02/08/1988	NO ERROR MESSAGE AND FORM SUBMITS	NO ERROR MESSAGE AND FORM SUBMITS	SUCCESS

Risk Management

This risk management plan details identified risks and threats during software production. This will contain information about the level of threat, and possible solutions to mitigate the risk. The iterative approach undertaken by the SCRUM methodology enables quick risk identification. The early identification can mitigate risks by analyzing each risk, prioritizing them, and creating actions plans. Below is the description of the risk management list used to handle risks.

Risk management assessment form

Reference	Name	Date Raised	Likelihood	Consequence	Description	Treatment summary	Status	Date close
001	Unauthorised access	4/05/2021	Low	High	Hackers may attempt to get into the system through website	Create authorisation and authentication on all levels and do not allow any users to access the database	Closed	4/05/2021
002	Server heating	4/05/2021	Low	Medium	Servers may overheat and short circuit	Those responsible for keeping the servers must keep	Closed	4/05/2021

						server room at around 18 degrees Celsius		
003	Server damage	6/05/2021	Low	High	If the servers get damaged, there may be loss of information and downtime in the database	Ensure redundant servers are available to alleviate downtime as well as backups to minimise loss of information.	Closed	6/05/2021

Acceptance

In the IEEE-730-2014 section 5.4.4.1 stipulates that the PSI must make sure that the product fully satisfies the contractual requirements and are acceptable to the HAA before the product is delivered. The outcome of this activity includes the following:

- Product acceptance conditions are documented.
- Confirmation that product conforms to the product requirements.
- Non-conformance is established where applicable.
- The HAA must acknowledge that the product meets the contractual obligations before the delivery.

To achieve this, the testing of constraints and component performance at the end of the project is necessary. This will be documented into the report which include:

- Test name, including name of test giver.
- Test description
- Expected outcome.
- Actual outcome.
- Changes or possible solutions
- Assumptions made.

CONCLUSION

This document provides an analysis of HAA's organisation and stakeholders as well as multiple solutions to the current IT problem.

It was found that HAA needed a new IT system based on the case study and HAA objectives provided. This IT system will need an integrated DBMS that connects and communicates with HAA's current website. A list of stakeholders was also constructed to display roles in the system in HAA, PSI and external factors.

Based on the analysis of the case study, functional and non-functional requirements were identified and considered in the solutions to make sure that the resulting product will be suitable to HAA and adhere to their business case. Legal considerations like Copyright, Trademark, Spam and Privacy acts were also analysed to help establish safe and ethical approaches to the new IT solution.

Taking the above analysis of the product as well as HAA, three product designs were constructed as possible solutions: Renting servers from a third party, purchase of servers for an inhouse database, and Renting Cloud space from third parties.

Each product design underwent a cost / benefit analysis with basic estimates created with the CoCoMo Method, Programming Method and Delphi Method. These estimates provided the cost of the product, which was processed with a payback and NPV estimates over the course of five years.

It was recommended that PSI would use an AGILE SCRUM project approach to develop the project based on the objectives of HAA and PSI as well as extensive Quality Assurance with emphasis on the IEEE standard of software products.

Out of the solutions, Microsoft Azure Aiven Solution 1 was recommended to the HAA. Solution 1 has the highest return of investment rate of 124.21% over a five-year period. It also provides suitable maintenance and security through a robust system with an emphasis on reliability and easy maintenance as compared to the others.

The immediate next action will now involve the team presenting the case to the HAA board. This will contain a summary of the solutions that will be recommended and the project approach that will be used to achieve it. The PSI will then make the necessary preparations for full-fledged development in the event the HAA choose to accept the tender.

APPENDIX

1.1 Sprint Chart

