SOFTWARE REQUIREMENTS SPECIFICATION AND TENDER PROPOSAL

FOR

WESTERN SYDNEY WELLNESS TRUST PROJECT

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EXECUTIVE SUMMARY

This report addresses the proposal PSI can offer to WSWT. PSI will construct a document that will overview the project and its objectives and where the business objectives will be met using PSI's professional judgement by creating an economical and feasible IT solution.

Key Personnel and Stakeholders

Key personnel and stakeholders are listed and how they each play their respective parts in the creation of the project. The key personnel and stakeholders section outlines external and internal stakeholders of the project, their effect on the project and assumptions like their availability. External stakeholders include the Ministry of Health, clients/patients, WSWT chief executive, WSWT business development director, WSWT professional care teams, patient referral organizations, while the internal stakeholders include PSI CEO, PSI project manager, PSI project development teams and PSI marketing teams.

Functional Requirements

The functional requirements outlined the requirements of the software features that help to meet the business objectives. The functional requirements are divided into three categories; user management, client management, and extra features as summarized below.

User Management

- Account Types – the WSWT System has three types of user accounts, Superusers, Administrators, and Users.
- User Registration – a user must be registered to use the WSWT System.
- Change Password – registered users can change their password in the WSWT System.
- Reset Password – if a registered user forgets the login password, he/she can reset the password in the WSWT System.
- Password Security - user passwords will be stored in a one-way encrypted format in the WSWT System.
- User Record Management - the superuser or authorized administrators can manage user records in the admin session of the WSWT System.
- SMS and Email Notifications - Users will receive SMS or email notifications when specific events happened, for example, an appointment notification.
- Login Retries – users who enter their passwords incorrectly for the first three times must wait for one minute to try again. If users enter incorrect passwords a series of ten times, the account should be blocked.

Client Management

- Client Types - there should be three types of clients, namely Social Care Client, Health Care Client, as well as Social and Health Care Client, in the WSWT System.
- Client Records – depending on the client types, a Social Care section or Health Care section would be added to the client record.
- Client Registration – when a new client is registered, there are certain steps to follow.
- Access Control of Client Records – the WSWT System follows the principle of least privilege. Users can only access the client information when they have access rights.
- Client Appointment Calendar – the client appointment calendar can be accessed by both the Social Care and Health Care team to avoid double booking and overlapping appointments.
- Reporting - statistical reports can be generated with selective criteria, such as reporting the total costs by month, by the department, by care type, or by outcomes.

Extra Features

- Access of Application - users can access the WSWT System with an internet-connected device such as computers or smartphones.
- Migrate Old Database Records – there should be two options, automatic or manual migration to migrate the legacy database to the WSWT System.
- System Security - the WSWT System should have a firewall component to block unauthorized access from external networks.

Non-functional Requirements

The non-functional requirements outlined the quantitative and qualitative requirements, which may include the scalability, performance, training, and other technical standards, of the software, which are listed as follows.

- Capacity and Performance - the WSWT System can handle at most 10 thousand users and 50000 requests simultaneously.
- Availability and Reliability - the WSWT System will run 24/7 and should be available 99.99% of the time in a year.
- System Scalability - the WSWT System can be scaled to handle a larger number of users and database records with minimal modification.
- Information Security - the WSWT System should conform to the ISO 27001 information security standard.
- Software Updates and Maintenance - software updates or maintenances should not interrupt the service for more than one hour.
- Database Backup - the WSWT System should automatically perform incremental backups every hour.
- User Training - a 3-day onsite user training course should be provided by Pinnacle Software.
- Technical Support - Pinnacle Software will provide one-month technical support after the project goes live.
- User Acceptance Test – the WSWT System will pass 100% of the user acceptance test before project commissioning.

Alternative Solutions

Solutions both alternative and recommended are given to WSWT and what resources will be required as well as the technology and work effort required, and arguments are presented within the recommended solution as to why this will be chosen over the other solutions. All three alternative solutions are proposed to use different cloud technologies to provide more protection to the WSWT's client data, to lower the maintenance cost, and to be more environmentally friendly. NoSQL database will not be a choice in our solutions. The reason is that the legacy systems of WSWT are using a relational database. In order to make the system migration easier and more consistent with the old format, relational databases will be used for the alternative solutions. The proposed solutions are outlined as follows.

Solution 1: IaaS - Microsoft Azure Cloud

- Operating System: Windows Server
- Database: Microsoft SQL Server
- Framework: ASP.NET
- Server Programming Languages: C#, CSS, JavaScript
- Mobile Application IDE and Languages: Xamarin

This solution proposes one of the market leaders of Infrastructure as a Service (IaaS), the Microsoft Azure Cloud as the WSWT System hosting platform. IaaS is good for organizations who do not want to maintain their IT

infrastructure, for example, server room, server hardware, network equipment, cooling system, etc., but want to have complete ownership and controls of the operating system, processes, applications, and the network environment.

The total development effort of this solution is estimated at 951 days and the development and training cost is about $52,351. If employing the CoCoMo formulae, this solution should take about 7.8 months to complete. The cloud subscription cost is about $99,849 per year. The payback projection of this solution shows that the investment payback will occur in year 5. The total investment return in 5 years is 29%, and it is predicted to have more than 20% return for a few years after that.

Solution 2 PaaS – Serverless AWS Lambda with Amazon Aurora

- Platform: AWS Lambda
- Database: Amazon Aurora with MySQL, PostgreSQL compatibility
- Server Programming Languages: Python, CSS, JavaScript
- Mobile Application IDE and Languages: Android Studio - Kotlin, Xcode - Swift

This solution proposes the emerging trend of cloud technology, Platform as a Service (PaaS) as the WSWT System hosting platform. In IaaS, organizations need to configure the OS, network environment, then install the required software, such as Apache web server and MySQL on the virtual cloud server before installing their applications on it. They also need to take care of the security and maintenance such as firewall configuration, OS updates, storage backup, etc. in IaaS. On the other hand, PaaS allows organizations to concentrate on developing and using applications without spending time and resources on managing the server. Furthermore, PaaS is easier than IaaS in the sense of adjusting computing resources for applications.

The total development effort of this solution is estimated at 921 days and the development and training cost is about $50,948. If employing the CoCoMo formulae, this solution should take about 7.7 months to complete. The cloud subscription cost is about $39,022 per year. The payback projection of this solution shows that the investment payback will occur in year 4. The total investment return in 5 years is 54%, and it is predicted to have more than 30% return for a few years after that.

Solution 3 Pinnacle Software Elastic SaaS

- Operating System and Packages: Linux, Apache, MySQL, PHP
- Database: MySQL
- Server Programming Languages: PHP, CSS, JavaScript
- Mobile Application IDE and Languages: Android Studio - Kotlin, Xcode - Swift

For IaaS, users need to take care of the configuration of the operating system and network environment, as well as installation and updates of software packages. For PaaS, users still need to deal with the configuration, installation and updates of the applications and database software. In this solution, the Pinnacle Software Elastic SaaS is proposed as the WSWT System hosting platform. SaaS is good for users who just want to use the application out of the box without the need to deal with the software installation, updates and configuration. The SaaS service provider, PSI will take care of the configuration, updates, and security of the system, as well as any future scalability if needed.

The total development effort of this solution is estimated at 886 days and the development and training cost is about $48,442. If employing the CoCoMo formulae, this solution should take about 7.6 months to complete. The cloud subscription cost is about $13,000 per year on a 5-year subscription basis. The payback projection of this solution shows that the investment payback will occur in year 4. The total investment return in 5 years is 60%, and it is predicted to have more than 40% return for a few years after that.

Recommended Solution

Solution 2 has a few advantages over Solution 1.

- PaaS is easier than IaaS in the sense of adjusting computing resources for applications.
- The two solutions are both supported by big-brand companies, but the pricing of PaaS is cheaper and more flexible price than IaaS.
- Open-source development solution will not be vendor lock-in.
- Return on investment is higher.

Based on the above reasons, we rule out Solution 1. Then let us compare Solution 2 and 3. The main differences between Solution 2 and 3 are:

A. With SaaS, users can use the application out of the box. No need to install and update the application.
B. Solution 3 has a much higher return on investment.
C. The hosting platform of Solution 2 is a proprietary Amazon solution, and that of Solution 3 is a LAMP solution which is supported by PSI and the development community.

Reason A and B are apparently good for WSWT, while reason C depends on if WSWT is willing to be "Amazon lock-in". If considering switching the hosted application to another platform, it may be easier for an open-source LAMP platform than the Amazon proprietary AWS Lambda platform.

Therefore, after considering all the factors, we recommend Solution 3 – Pinnacle Software Elastic SaaS to WSWT.

Project Approach

As stated in the section of Alternative Solutions, this project will take only 8 months to complete. The Waterfall approach in traditional project management is not practical in this project, because the step-by-step approach will take too long, and the Waterfall approach does not accommodate changes as good as the Agile approach. Therefore, PSI will employ a much more flexible Agile approach, which is commonly used in the software industry. Among all the popular methodologies of the Agile approach, PSI will use the Scrum due to its simplicity and effectiveness. With Scrum, the product development team will invite WSWT users to envision how the finished WSWT System should be.

Legal Considerations

WSWT is a health care service provider and it is funded by the government. Health care information is sensitive personal information. The process of handling this information is regulated by law. By using the WSWT System in Australia, WSWT needs to be aware that they abide by the Australian privacy laws and spam laws, which are mainly the Privacy Act 1988, Australian Privacy Principles, Health Records, and Information Privacy Act 2002 (NSW), Spam Act 2003, and Do Not Call Register Act 2006. Legal considerations are considered with the elimination of potential consequences by staying within legal frameworks to not place WSWT or PSI in any jeopardising positions.

Quality Assurance

During the project development phase, quality assurance features will be implemented that detail what quality management system will be used alongside practised management skills that will be displayed within multiple teams from PSI. PSI will incorporate the ISO 9000 quality management system to ensure the satisfaction of WSWT alongside customer and stakeholders. ISO 9000 has been a standard practice for over 30 years and can be tailored to meet specific needs depending on each project. ISO 9000 has seven management principles that will be applied to the project:

- Customer focus
- Leadership
- Engagement
- Process approach
- Improvement
- Evidence-based decision making
- Relationship management

To achieve the ISO 9000 quality of management, the use of the quality context triangle is incorporated into the phases of development:

- Data quality
- Code quality
- Model quality
- Process quality
- Management quality
- Quality environment

Within this document, PSI has stated the business objectives for both PSI and WSWT and how each company can benefit from a mutual relationship. Important personnel and stakeholders were listed and detailed about how they are involved in the process of creating the new system.

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INTRODUCTION

This report addresses the proposal PSI can offer to WSWT. Within this document, PSI will construct a document that will overview the project and its objectives and where the business objectives will be met using PSI's professional judgement by creating an economical and feasible IT solution.

Key personnel and stakeholders are listed and how they each play their respective parts in the creation of the project. The functional requirements outlined the requirements of the software features that help to meet the business objectives. The non-functional requirements outlined the quantitative and qualitative requirements, which may include the scalability, performance, training, and other technical standards, of the software. Solutions both alternative and recommended are given to WSWT and what resources will be required as well as the technology and work effort required, and arguments are presented within the recommended solution as to why this will be chosen over the other solutions. Methods of how the project will be approached will be listed and proficient justifications are given for why the project will be approached in such a manner. Legal considerations are considered with the elimination of potential consequences by staying within legal frameworks to not place WSWT or PSI in any jeopardizing positions. During the project development phase, quality assurance features will be implemented that detail what quality management system will be used alongside practised management skills that will be displayed within multiple teams from PSI.

This document was produced with the intention of creating a relationship between both companies by providing WSWT with tailor-made software solutions specifically crafted by IT professionals to handle the creation of a new system that will be accepted by key stakeholders and the userbase. The approach taken to build the document was to use first create a specification document outlining the requirements and objectives of both companies. The development division of PSI has cooperated in creating this document through various methods of discussions over a period and have used the email response to make edits to further suit WSWT's needs. PSI is optimistic that WSWT will make an excellent business partner that should not hesitate to contact if other tailor-made software solutions are required in the future.

PROJECT OVERVIEW AND OBJECTIVES

PSI has contacted WSWT with the reason of creating a cooperative partnership between the two companies. To obtain this collaboration, PSI is to meet WSWT's business objectives using an economical and feasible IT solution. There are multiple problems currently present in WSWT's procedures and systems. There are two legacy systems: social care and health care. These are not user friendly for staff to operate, the data entered is scattered and then combined into a statistical report by the central IT department without proper checks to ensure data consistency, and the health and social care professionals do not make use of the information in the first place. Referrals contain wildly varying information in both quantity and quality from a range of sources leaving it inconsistent and sometimes overbearing or condensed. The disciplines do not coordinate with each other when dealing with moving patients. This can lead to mistakes in scheduling with patients and create schedules which overlap with each other. Employees are not willing to share information because of potential human error and are concerned about the security of patients and clients in the case of a breach.

PSI can offer a varying possibility of solutions to handle the aforementioned problems. The legacy systems will be removed entirely and replaced with a tailor-made system by PSI. The social care data records and health care data records will remain separate on the same database system and improve user-friendliness. This can be achieved by using an ISO quality standard to address human factors and ergonomic issues that may be present in the workplace of WSWT. Data entered will be compiled by management before being combined into a statistical report to ensure data quality remains consistent and to check for any human error beforehand. The new systems will display the information in the reports creating by the IT department to both social care and health care workers to their personal accounts in a clean and precise manner so that the workers may bring up a client or customer's reports whenever needed. Using the new system, PSI will create a specialized form for WSWT that will allow WSWT to send to external sources such as Centrelink and doctors before referring a person in need of care to WSWT. This will create greater consistency between the external sources to contain the amount of varying information in both quality and quantity, as well as guarantee that when a client is directed to a local trust office, that the employees will have the correct training and resources to take care of them. The system will also include a method for each discipline to follow, with varying differences when needed. Once again, this is to sort the consistency issue when it comes to assessing patients and recording information. Schedules will no longer be overlapped as dates will be recorded when a patient is available and not available to reduce human error. Security concerns are nulled by incorporating standard security features into the new system to protect patients and clients against any malicious attacks against hackers so that the software may continue to function correctly under any potential risk.

By removing the legacy systems and instead of creating new systems by using an ISO quality standard, user-friendliness can improve with the addition of training if WSWT sees the benefit of doing so. Simplicity, cleanliness, intuitiveness, and reliability are all factored when creating a new system so that the interface is not overly complex, well-organized, requires minimal explanation, and does not cause frustration for the user. Data being passed onto management before compilation improves the accuracy of data and reduces chances for error as another party can overview the inputted data before sending it off to IT. This allows for final edits to be made to increase the consistency of input data and can be sent back if the data input is not sufficient. By providing more detail within data entry, the health and social care professionals are more inclined to make use of this information handed to them as it will be of more benefit than if they would ignore it. By reducing the varying information from external sources and instead of setting a focus found in referrals, WSWT employees will be able to sort clients more effectively because only employees that have right training and qualification would get handed the right client without the need to keep on moving patients around. This ties in with coordination between disciplines as each discipline will now have a systematic approach where each discipline goes through similar steps to avoid overlap between schedules as well as the opportunity to communicate more effectively between the disciplines. Security features are implemented using features such as access control, where it will ensure that only the eligible users may have access to the resources in that part of a certain system. The implemented security within the system has the reliability to protect assets from attacks that may result in the loss of said data. The security also ensures that routine backups are made available if the original data becomes lost or inaccessible.

This project is important for both WSWT and PSI as it is the beginning of a relationship between the two companies. WSWT has the problems set out and PSI has the ability and resources to handle the issues that have been discerned. As a tailor-made software company, PSI has professional development teams at the ready to handle whatever issues may be of concern to WSWT. From the above-mentioned problems, it is important that WSWT completely develop a new system to ensure efficiency in the workplace as it currently stands information that could be beneficial goes unused and coordination appears to be in a disorganized state. With the implementation of a new system by PSI, these issues could be fixed by a professional team with established communications between the two companies to create an ideal system and gain a new business partner for future endeavours.

KEY PERSONNEL AND STAKEHOLDERS

		Role	Assumptions	Influences
External	Ministry of Health	• They manage government-funded health care service providers to ensure that they comply with the regulations. WSWT is one of them. • WSWT need to provide statistical reports to them periodically. • WSWT receives funding from the government. They are the authority to approve this funding.	• They can provide ideas on how the IT system of the healthcare service providers should handle patients' information such that it complies with the regulations. • They are available on-demand for the consultation.	• WSWT must send analysis reports to them. WSWT System will affect the quality of these reports. And the reports may affect the funding from the government. • The WSWT System must comply with the regulations about handling the patients' data and the privacy of patients. Otherwise, if any violation of the regulations is found, the Ministry of Health may be involved.
	Clients or Patients	• They receive healthcare or social care services from WSWT.	• They will not access the WSWT System so that they will not provide any idea or input for the project.	• Their personal information will be stored in WSWT System. The security and confidentiality of the system will increase to reduce the possibility of a data breach, that might affect their privacy or even daily lives. • The WSWT System may improve the efficiency and quality of the WSWT services delivered to them.
	WSWT Chief Executive, Jim James	• He is the decision-maker in WSWT. He decides the vision, strategy, and resource distribution in WSWT.	• He will not be involved in the development of the project, but he will be reported the progress and any major issues about the project. • He will be available throughout the SDLC of the project.	• He is the decision-maker to decide to invest in the project or not. • If the project starts, his decision will have significant influences on the development of the project.

External	WSWT Business Development Director, Robert Northy	• He will be the contact person of WSWT about the project. • He will report the progress, issues, and any decisions about the project to the Chief Executive, Jim James.	• He will provide input and ideas, especially the ideas from Jim James to the project. • He can be consulted by PSI about any questions or issues of the project, during the periods of the project tender, project development, and the completion of the project. • He will be available throughout the SDLC of the project.	• He will go through the project proposal and specification. After getting approval from Jim James, he can decide who wins the tender. • His decision will have significant influences on the development of the project.
	WSWT Professional Care Teams (Adult Care, Mental Health Care, Child Care)	• They are the main users of the WSWT System. • They will be involved in the testing of the WSWT System.	• They will provide ideas and feedback throughout the SDLC of the project.	• They will take the training courses provided by PSI and will give feedback about the training courses. • They will affect the design and features of the final product by providing feedback to the development team.
	Patient Referral Organizations (Centrelink, medical doctors, hospitals)	• They refer clients or patients to WSWT.	• They will not access the WSWT System so that they will not provide any idea or input for the project.	• The deployment of the WSWT System may improve the efficiency and quality of the referral services.
Internal	PSI CEO	• He is the decision-maker of PSI. He decides the vision, strategy, and resource distribution in PSI.	• He will not be involved in the development of the project, but he will be reported the progress and any major issues about the project. • He will be available throughout the SDLC of the project.	• He will not be directly involved in the project, but his decision will largely affect the project. For example, he would decide to dismiss a development team.

Internal	PSI Project Manager	• He provides updates to every party involved in the project on the progress and gets feedback from the client and inform the group on the client's/management's thoughts on the progress.	• He will be available throughout the SDLC of the project.	• He will be directly involved in the project. He manages the schedule and resources of the project; thus, his decision will largely affect the project.
	PSI Project Development Teams	• They are developers, engineers, and other executives responsible for the development of the project.	• They will be available throughout the SDLC of the project.	• The project will employ the Scrum approach so that the development team will have frequent communications with the users and both of them will decide the design and features of the final product.
	PSI Marketing Division Team	• They are responsible to contact WSWT to obtain the information of the project tender.	• They will not provide any input or ideas to the development of the project.	• They may provide a suggestion about the schedule and pricing of the project.

FUNCTIONAL REQUIREMENTS

In this section, the functional requirements are divided into three categories, which are client management, user management as well as extra features.

User Management

The user management of the WSWT System will follow the principle of least privilege. Users should only be granted the least access right to the database system by default. This section will define the corresponding details of the functional requirements.

FR-UM01 – Account Types

Function Summary

There should be at least three types of user accounts, namely Superusers, Administrators, and Users, in the WSWT System.

- **Superusers** are responsible to grant or revoke privileges to administrators. When the WSWT System launches for the first time, it should request the user to enter a login name and password to register a superuser account. This superuser account will have all rights of the system, which include but not limited to deleting all database records or registering any other users as a superuser. The superuser account can grant the same or fewer rights to other administrator accounts.
- **Administrators** are responsible to grant or revoke privileges to other users and manage user and client records, such as creating and deleting records. If the superuser grants an administrator the right to read or update the client's Social Care records, the administrator can only grant other users with the same or fewer rights. That means the administrator cannot grant a user the access right to read or update a Health Care record of a client.
- **Users** are responsible to read and update client records. They do not have the right to register or grant rights to other users. But their roles can be changed by administrators or superusers, such that they become administrators or superusers. Users should have various levels of access rights of client records. They can be granted a right to read a client's Health Care records but not the client's Social Care record, or they can be granted a right to read client A's records but no other client's records.

Reasoning for Requirement

The security and privacy control of client's information should be strengthened and consistent. Currently, all this information in WSWT is filed and stored in scattered local offices. The client information should not be accessed by a staff that left WSWT. Staff should only get access to a minimum amount of client information that is enough for doing their jobs.

FR-UM02 – User Registration

Function Summary

Other than the superuser, every user must be registered using the WSWT System. Only the superuser and administrator accounts can register new users in the WSWT System. The registration process should ask for the username, email address, phone number, department, position, and other information. After registration, an email with a one-time password should be sent to the user's email address. The user needs to change the one-time password during their first login. After changing the password, the user account is activated.

Reasoning for Requirement

The client information should not be accessed by staff that left WSWT. Staff should only get access to the least amount of client information for doing their jobs. Fresh staff should have their accounts created easily by the administrator, such that they can start working on the first day.

FR-UM03 – Change Password

Function Summary

Registered users can change their passwords in the WSWT System. The user profile page of the application should have a link named "change password" to direct the user to a page to change their password. The page should ask for the "old password," "new password" and "confirm the new password." If the "old password" is correct and the "new password" is the same as the "confirm the new password," the new password is activated and the old password becomes invalid. The system will force the user into changing their password into a 'strong' password by having them use a mixture of symbols, numbers, lower and uppercase characters. The website should remind the user to save their password somewhere safe after they have finished creating their new password. An email should be sent to the user email to notify the user that the password has been changed.

Reasoning for Requirement

Users may want to change their passwords from time to time. However, users tend to change their passwords to simplistic passwords that are easy to remember. This may eventually lead to potential data breaches if a third party attempts to access the user's account. Email notification is a method to notify the user that the password is changed.

FR-UM04 – Reset Password

Function Summary

If a registered user forgets the login password, the user can reset the password in the WSWT System. The login page of the application will have a link named "forgot password" to direct the user to a page to reset their password. The page should ask for the username, email address, and phone number. If the information is correct, two-factor authentication will be employed to verify the user's identity. An SMS with a random code will be sent to the user's mobile phone. If the user has entered the correct code on the page, an email with a one-time password will then be sent to the user's email. The user needs to enter this one-time password in the system. The one-time password should only be valid for 5 minutes. The user needs to change this one-time password when the user logs in again, otherwise, the user should be forced to logout. The one-time password will become invalid after 5 minutes and the old password will remain unchanged.

Reasoning for Requirement

Users may forget their passwords from time to time. Two-factor authentication should be incorporated into the application to verify that it is the user trying to regain their password and not a third party. SMS and Email verification is the most frequent practice in the IT industry to verify a user.

FR-UM05 – Password Security

Function Summary

User passwords will be stored in a one-way encrypted format in the WSWT System. This one-way encryption guarantees that all user passwords are protected and impossible to be revealed by anyone, even with the superuser and administrators.

Reasoning for Requirement

The security and privacy control of client's information should be strengthened and consistent. A one-way encrypted password will be used for the WSWT System because it is the current industry standard to achieve data security. With a one-way encrypted password, it is up to the user to handle how they store their password. If they have forgotten their password, they will not be able to email or call the IT department to recover their forgotten password as not even the superuser and systems administrators will have access to the user's password, instead, they should follow the reset password function stated above.

FR-UM06 – User Record Management

Function Summary

The superuser or authorized administrators can manage user records in the admin session of the WSWT System. They can create or delete a user account, change the access level, and edit other information of a user account.

Reasoning for Requirement

Staff should only get access to a minimum amount of client information that is enough for doing their jobs. Managing users allows superusers and authorized administrators to manage resources based on a staff member's needs and role. For example, child protection officers would not need access to users' Health Care records.

The client information should not be accessed by a staff that left WSWT and fresh staff should have their accounts created easily by system administrators, such that they can start working from the first day.

FR-UM07 – SMS and Email Notifications

Function Summary

Users will receive SMS or email notifications when specific events happened. Users can also select which events trigger email notifications in the settings page of the application. These events include but are not limited to appointment notifications, changes of client's profile, changes of appointments, registration of new clients, new messages, etc. To send SMS and emails to the correct user, the WSWT System will use the user's mobile phone number and email address that is already stored in the system when the user is registered.

Reasoning for Requirement

The WSWT System should notify staff of notable events and appointments. As SMS and emails are a formal method of communication between the workplace, it is vitally important that the correct SMS and email notifications get sent to the correct employees to remind them of notable events.

FR-UM08 – Login Retries

Function Summary

Users who enter their passwords incorrectly for the first three times must wait for one minute to try again. If they enter incorrect passwords a series of ten times, the account should be blocked by the system and need to have a superuser or administrator account to unblock it.

Reasoning for Requirement

The security and privacy control of client's information should be strengthened and consistent. The delay of entries of incorrect passwords and blocking accounts will minimize the risk of brute-force attacks to the WSWT System. A brute-force attack is a hacking technique that submits many computer-generated passwords trying to log in and get access to a system.

Client Management

The client management of the WSWT System will follow the principle of least privilege. Users should only be granted the least access right to the client records by default. This section will define the corresponding details of the functional requirements.

FR-PM01 – Client Types

Function Summary

There should be three types of clients namely, Social Care Client, Health Care Client, as well as Social and Health Care Client, in the WSWT System.

Social Care Client are clients who receive Social Care service from WSWT. Their records should only be accessed by authorized Social Care professionals, authorized administrators, and the superuser.

Health Care Client are clients who receive Health Care service from WSWT. Their records should only be accessed by authorized Health Care professionals, authorized administrators, and the superuser.

Social and Health Care Client are clients who receive both Social and Health Care service from WSWT. Their records should only be accessed by authorized Social and Health Care professionals, authorized administrators, and the superuser.

Reasoning for Requirement

The security and privacy control of client's information should be strengthened and consistent. Currently, all this information in WSWT is filed and stored in scattered local offices. The client information should not be accessed by a staff who left WSWT. Staff should only get access to client information that is enough for doing their jobs.

FR-PM02 – Client Records

Function Summary

Client records should at least contain two sections. The first section is the client's details such as name, gender, age, home address, telephone number, email address, and so on. The second section is the appointment calendar of the client.

If the client is a Social Care client, an additional Social Care section should be added to the client's record. The Social Care section should have a standard format for all cases. It should contain the referral, assessment, care type, care plans, reviews, costs, outcomes, appointments, and other notes, of a client.

If the client is a Health Care client, an additional Health Care section should be added to the client's record. The Health Care section should have a standard format for all cases. It should contain the referral, assessment, care type, care plans, details of Health Care activities, reviews, costs, outcomes, appointments, and other notes, of the client.

If the client is a Social and Health Care client, a Social Care section and a Health Care section should be added to the client's record.

Reasoning for Requirement

Staff should be able to easily access data from a joint system, rather than two separate Social Care and Health Care systems.

The client records should be recorded and retrieved easily. They should have consistent standards and format. Now all these documents are handwritten by professionals and filed locally.

FR-PM03 – Client Registration

Function Summary

Only the superuser and administrator accounts can register new clients in the WSWT System. The registration process should ask for information about the referral, assessment, care type, care plans, details of Health Care activities, reviews, costs, outcomes, appointments, and other notes, of a client. Once a client account is created, only the superusers or administrators can delete the account.

After a client account is created, the superusers or administrators can appoint professional care teams to handle the client's case, and grant access to the teams to access this client record. Without granting access, no users can access this client record.

Reasoning for Requirement

There should be centralized management of client records. Now referrals direct clients to local Trust offices. Sometimes the local offices do not have suitable professionals to handle the case and thus must forward the client to other offices.

FR-PM04 – Access Control of Client Records

Function Summary

Only the superuser should have all access rights on all client records, which include the personal details section, Social Care section, and the Health Care section. Other authorized administrators and authorized users should only be able to access the least amount of information for doing their jobs. For example, the Social Care professional team can only access the personal details and the Social Care sessions, but not the Health Care session, of their clients. The access rights of a user can be granted or revoked by an administrator or superuser (refer to the above section, User Management).

Reasoning for Requirement

The care plans and outcome of the client should be recorded and retrieved easily. They should have consistent standards and format. Now all these documents are handwritten by professionals and filed locally.

Staff should be able to report their activities on the WSWT System to reduce mistakes, which is now entered by clerks from the staff's written reports.

FR-PM05 – Client Appointment Calendar

Function Summary

The client appointment calendar can be accessed by both the Social Care and Health Care team to avoid double booking and overlapping appointments. To protect the client's privacy, the client calendar should only show the date and time of the appointments but not the details of the appointment. Before making an appointment with a client, staff should check the client appointment calendar to ensure no other appointments have been booked with the client at the appointed time.

Reasoning for Requirement

Currently, there is no coordination between different professional care teams in WSWT. Different teams may visit the same client on the same day and time. Having a client appointment calendar will allow staff to be more organized whilst removing doubt from their mind, wondering if they have an appointment with a client, or if another staff member does.

FR-PM06 – Reporting

Function Summary

The superusers and administrators can generate statistical reports with selective criteria, such as reporting the total costs by month, by the department, by care type, or by outcomes.

Reasoning for Requirement

Smooth the process for reporting the mandatory statistical data to the Ministry of Health in the federal government. This will allow staff to easily process the required data for both the Social Care and the Health Care department. By allowing easier and user-friendly systems for reporting, human error will be reduced due to the integration of the two systems. For the Health Care department, the objective would be easier to create statistical analysis' of collecting data and uncovering trends of the data gathered by the Health Care workers. The Social Care department would

seek for a successful recording of the outcome of the type of care performed and would change the method of filing these systems from handwritten and locally to computerized and online.

Extra Features

FR-EF01 – Access of Application

Function Summary

Users can access the WSWT System with an internet-connected device such as computers or smartphones. A secure end-to-end encrypted connection for accessing client data will be used as it will securely connect the users to the WSWT System.

Users should not have access to information that they did not originally have access to in the office whilst working out of the office. No unencrypted information of a client should be transferred to and stored in a user's device.

Reasoning for Requirement

Professional care teams often work outside the office. They should be able to access a client record securely even if they are not in the office. End-to-end encryption is important for a user because it will prevent unwanted tampering by WSWT, PSI, and potentially third parties such as hackers.

FR-EF02 – Migrate Old Database Records

Function Summary

Only the superuser or authorized administrators can access the database system of the WSWT System. There should be two options to migrate the legacy database to the WSWT System. The first option is automatic migration, in which the application automatically updates records in the WSWT database with the legacy records. The second option is manual migration. The application allows the authorized users to query the WSWT database records and display them in a spreadsheet format. So that the authorized user can update the WSWT database records manually with the legacy database records.

Reasoning for Requirement

If a new system is in use, the old database records should be migrated to the new system easily. The reason to migrate old database records is that having a legacy system running separately slows down the pace of work, system performance is poor, and keeping maintenance is costly. As technology grows, the legacy system remains still and may cause incompatibility issues with emerging technology.

Having an automated migration is recommended over a manual migration because it takes time to completely transfer potentially millions of files over and is split in waves, forcing employees to repeat the same action multiple times to completely transfer said files. However, users can still choose manual migration if they only want to migrate specific database records.

FR-EF03 – System Security

Function Summary

The WSWT System should have a firewall component to block unauthorized access from external networks. In addition to the traditional port-based firewall, this firewall component will detect the location, IP address, and MAC address of every device which accesses the WSWT System. If it finds any abnormal operations, for example, an export large amount of client records, the firewall component will put the device into a suspicious list, until the superuser or administrator confirms this device is safe.

The definitions of abnormal operations can be configured by the superusers in the WSWT System setting.

Reasoning for Requirement

The security of client's information is vitally important to WSWT hence, it must be strengthened. Other than using user authentication to protect the system from unauthorized access from the trusted internal network, the WSWT System should also have a security measure to block unauthorized access from untrusted external networks.

NON-FUNCTIONAL REQUIREMENTS

NFR01 – Capacity and Performance

Success Conditions

The WSWT System will be able to handle at most 1000 users simultaneously. The system will be able to process at most 1000 requests of accessing database records simultaneously.

The response time of simple database queries, for example searching, updating, creating, or deleting a single record, should be within one second. The response time of complicated queries, for example searching clients with keywords or different criteria, should be within two seconds.

These response times are measured from the time the system receiving a user's request to the time that the system giving the result, and do not include the application page loading time.

How to Achieve

The WSWT System should provide enough processing power and network speed to fulfil the requirement. Furthermore, the system will monitor its system resource usage. If a certain threshold is reached, a notification will be sent to the PSI's engineer, who is responsible to resolve the issue and report the problem to the development team.

Reasoning for Requirement

WSWT has 3000 staff located in 50 offices. Assuming every staff access the system database at the same time, the largest possible requests should not be more than 3000 at any given time. The response time of one second for a simple query and three seconds for a complicated query is the standard of a database system. When calculating a system's performance, some metrics need to be measured such as capacity and response time. The WSWT System should handle 10 thousand users to ensure its capacity. The response time needs to calculate how long it takes to perform specific tasks such as waiting and transmission. If a user needs to wait over 5 seconds and transmission takes over 5 seconds to process a simple task, then it would not be acceptable for daily usage.

NFR02 – Availability and Reliability

Success Conditions

The WSWT System will be available 99.99% time of the year and will be up 7 days a week. The downtime for the system will be scheduled and unscheduled checks on the system. There will be maintenance checks on the system such as patches to the software that may require a restart. The unscheduled downtime may involve power outages or network failures.

How to Achieve

The system will monitor its system resource usage. If an abnormal usage level is reached, a notification will be sent to the system administrator, who is responsible to fix the problem by, for example restarting some process, rebooting the system, etc.

Reasoning for Requirement

WSWT receives client referrals 24/7. If an urgent case is received, it will be placed at the top of the priority list and is to be handled immediately. If the system does not retain a 99.99% availability, urgent cases may either get lost in the process or stack on top of each other creating a stressful environment for staff.

NFR03 – System Scalability

Success Conditions

The WSWT System can be scaled to handle a larger number of users and database records with minimal modification. However, as PSI is a tailor-made software company, it does not handle hardware. WSWT must factor in their hardware situation as networking will take up physical space in offices and will consume electrical power.

How to Achieve

The WSWT System should scale its processing power, memory, network facility, and storage volume easily such that it can handle more users and database records with little modification.

Reasoning for Requirement

WSWT currently has 3000 staff located in 50 offices. Along with their expansion in the future, the WSWT System may need to handle more users and clients. It is up to WSWT to determine how many users and employees will be using the system at the same time, as the current userbase is 3000 staff spaced across 50 offices, it is important to have a scalable network so WSWT can continue to grow without currently impacting the performance of the current userbase.

NFR04 – Information Security

Success Conditions

The design, development, and implementation of the WSWT System should conform to the ISO 27001 information security standard. PSI will employ the following security measures to ensure the client data is protected.

- The WSWT System should have all data transfer and storage encrypted.
- The system should be protected by security measures like anti-virus detection.
- All data of the WSWT System will be stored in Australia. No data will be transferred overseas.

How to Achieve

PSI will employ experts who have many years of experience in designing health care software. They will ensure the design, development, and implementation of the WSWT System complied with the standards of the IT industry and health care industry.

Reasoning for Requirement

The security and privacy control of client's information should comply with the health care industry standards and government regulations. Cisco's data presents that 40% of health care organizations can encounter thousands of security issues daily. Privacy is of the utmost importance when it comes to the health sector. Clients cannot comfortably provide their sensitive information knowing that their information may be part of a security breach. With minimal security, WSWT may lose both existing and current clients.

NFR05 – Software Updates and Maintenance

Success Conditions

In the event of software updates or maintenances, PSI should notify WSWT in advance. Major updates should be rolled out every 2 months, with minor updates rolling out every month until either all system bugs are debugged, system feedback runs out or the system needs maintenance checks. Maintenance should take no longer than 1 hour every checkup to ensure the system is operational as soon as possible so urgent cases can be prioritized.

How to Achieve

When it is time to update WSWT's system, PSI will run a review of the system and website. If a software update is required, PSI will identify the requirements needed to upgrade using professional expertise and communicating with WSWT's recommendations. PSI will notify the date of the software update or maintenance to WSWT, who's responsibility is to communicate this update or maintenance with employees and clientele. In the case of system failure, a backup of the old system is created to be safe and secure. PSI will trial the new update before officially shipping it to WSWT to identify if any coding or database conflicts are causing errors.

Reasoning for Requirement

WSWT receives client referrals 24/7, where urgent cases must be handled immediately. Software updates help to keep security in check by repairing security holes that may cause vulnerabilities in the system. Software updates could also protect classified information that could be used to identify individuals. Outside of security purposes, software updates will generate the latest features that could improve the stability and speed of the system or create a quality-of-life service for employees and clients by patching out software bugs.

NFR06 – Database Backup

Success Conditions

The WSWT System should automatically perform incremental backup of the database records every hour. All backups should be encrypted and kept for at least one year.

How to Achieve

PSI will create an automatic database backup system daily to run every hour. If a file has not been touched within a year, it is automatically disposed of to reduce redundant data and save storage space.

Reasoning for Requirement

WSWT has a long history to serve its clients. The vast amount of client information is precious to WSWT. Having a disaster contingency plan is essential. Otherwise, if WSWT loses client data and information, it sets a negative precedent on the company, constantly backing up the database will safeguard the company's reputation by appearing more responsible and competitive over competitors.

NFR07 – User Training

Success Conditions

A 3-day onsite user training course should be provided by PSI before the commissioning of the WSWT System. After the training, the training videos, as well as other training materials, will be handed over to WSWT for the use of future training.

How to Achieve

The training course shall be divided into a few topics, 1. enquires and management of client records, 2. user management and access control, and 3. general maintenance and extra features. The training shall be conducted by the PSI engineers and take place at the head office of WSWT.

Reasoning for Requirement

Since the emergence of modern technologies in recent years, the WSWT System will be significantly different from the legacy systems of WSWT. The staff of WSWT should have a full understanding of new features of the system that will enormously improve the working process and improve employee performance.

An employee with the necessary training will perform greater than an employee without. Training allows an employee to understand what their role in the company is and in turn create competence. Training also addresses weaknesses in employees, this is especially so when moving from an old system to a new system. By training current staff rather than hiring fresh staff, productivity will increase over the 3-day onsite course thus improving the quality standard of WSWT.

NFR08 – Technical Support

Success Conditions

PSI will provide one-month technical support after the project goes live. A general technical support inquiry will be provided by phone and email 24/7. If issues cannot be resolved remotely, an on-site investigation will be provided by PSI engineers within 24 hours.

How to Achieve

PSI will have trained engineers available for WSWT whenever technical issues may arise. Technical support may range from phone calls, emails, or on-site examination. PSI's engineers will provide superior problem-solving abilities to ensure all the required technology is working effectively. The engineers will also display flexibility in their work period as problems may emerge during irregular working periods.

Reasoning for Requirement

A software company is no software company if the users are not able to use the product. PSI needs to have engineers during PSI's business time in case any issues pop up. PSI as the creator of the WSWT system is responsible to help WSWT to handle all the technical issues that arise from the system. Technical support also provides an extended relationship with PSI and WSWT to help each other grow as differing companies.

NFR09 – User Acceptance Test

Success Conditions

The WSWT System should pass 100% of the user acceptance test before project commissioning. Once the user needs and requirements are met, and PSI and WSWT can meet the acceptance criteria, the new system will be able to go live. Each user test should last around 60-90 minutes as users may get tired and it becomes increasingly difficult to run usability tests that last more than 2 hours.

How to Achieve

The new system needs to meet the design guidelines as stated by WSWT during its developmental period. Once the test server is available, it needs to respond correctly to different user inputs, perform its functions within an acceptable time, is usable by every type of user that will use the system is inclusive of disabilities, and achieve the result that stakeholders desire.

Reasoning for Requirement

60–90-minute intervals are recommended as it will allow the user to behave naturally in the test environment, just as a user will behave outside the test environment. It is more important to observe a user in what they do more than what they say as subjective findings do not contribute much to data collection. The goal is to gather as much feedback as possible within these timeframes to help observe design issues and flaws within the system as the earlier a problem is identified, the easier and less expensive it will be to fix.

ALTERNATIVE SOLUTIONS

Currently, WSWT is using two legacy in-house servers for their social care and health care systems. An inhouse server has a disadvantage of not only high maintenance cost but also increases the risk of data loss due to accidents such as power outage, fire, and human errors. A cloud server can provide more protection to the client data, and the maintenance cost is much lower. Furthermore, compared to an in-house server, a cloud server is more environmentally friendly, because the vendor centralizes all the server management, thus they use the hardware resources more efficiently.

That said, the inhouse server solution has an advantage of complete ownership and control of the server hardware and network environment. But the costs of maintenance of the servers, network equipment, and cooling system may be too high to justify an inhouse server solution, let alone the need for taking care of the system security. Therefore, we suggest, in all three alternative solutions, use different cloud technologies to provide more protection to the WSWT's client data, to lower the maintenance cost, and to be more environmentally friendly.

Since one of the key requirements of this project is to let WSWT professional care teams access the WSWT System when they are outside the office. These three alternative solutions will use various web technologies to meet that requirement. The WSWT System will benefit from the web technologies from making development easier and being more sophisticated for devices with different screen sizes. Since WSWT is located in Sydney, the project will be managed by our Sydney office. The major software developments will be handled by our development teams in Brisbane and Perth. Other minor developments will be handled by our development teams in Bangalore, India.

For the database selection, NoSQL database will not be a choice in our solutions. The reason is that the legacy systems of WSWT are using a relational database. In order to make the system migration easier and more consistent with the old format, relational databases will be used for the alternative solutions.

Solution 1: IaaS - Microsoft Azure Cloud

Solution Overview

This solution proposes one of the market leaders of Infrastructure as a Service (IaaS), the Microsoft Azure Cloud as the WSWT System hosting platform. IaaS is good for organizations who do not want to maintain their IT infrastructure, for example, server room, server hardware, network equipment, cooling system, etc., but want to have complete ownership and controls of the operating system, processes, applications, and the network environment.

The Microsoft development platform has the advantage of fully supported by Microsoft, which provides very sophisticated software development tools to make software developments much easier than other open-source solutions, especially when developing applications for the Windows platform. The Microsoft SQL Server is suitable for systems that require high security, for example, the healthcare system.

The ASP.NET has a long history of being one of the most popular web development frameworks. Microsoft also provides a complete solution for developing mobile-friendly websites with C#. Furthermore, with the mobile SDK, Xamarin, which is also part of the ASP.NET, developers can easily build a native mobile application to connect to a website which is built on ASP.NET. ASP.NET is open source, which combined with mixed licenses, that includes MIT License and Apache License 2.0, however some third-party ASP.NET frameworks may need proprietary software licenses.

In this solution, the WSWT System will run on an Azure D16 v3 instance with 16 cores CPU, 64GB RAM, 400GB Temporary storage, 8192GB SSD. This configuration is supposed to be enough for the WSWT System to handle the performance requirement mentioned in the non-functional requirements.

Technology and Human Resources Required

Application Platform:
Instance: Azure D16 v3 (16 cores CPU, 64GB RAM, 400GB Temporary storage, 8192GB SSD)
Server Location: Australia East
Operating System: Windows Server
Database: Microsoft SQL Server
Desktop Client: HTML5 Web Browser
Mobile Client: Android, IOS

Development Platform:
Framework: ASP.NET (Mixed License: Proprietary Software, MIT License, Apache License 2.0)
Development Tool: Visual Studio Professional 2019
Server Programming Languages: C#, CSS, JavaScript
Mobile Application IDE and Languages: Xamarin

Methodologies
PSI employed the Delphi technique to estimate the effort of the project. PSI has very experienced estimators from development teams in Perth, Brisbane, and Bangalore, India. The project was broken down into project deliverables and the estimators examined the effort of every project deliverable and then give their estimates. The estimates were then distributed to other estimators and let them correct their estimates until they had a consensus about the final estimates.

Labour Costs

Job Position	Salary per year	*Productive hourly rate
**Project Manager	$120,000	$83
Senior Developer	$130,000	$90
***Developer	$17,000	$12
Technical Writer	$110,000	$76
System Engineer	$90,000	$62
Database Administrator	$90,000	$62

*The productive hourly rate is salary per year ÷ 52 weeks ÷ 4 days (working days minus holidays and sick leaves, etc.) ÷ 8 hours, then add 15% overhead (administration, learning curve, meeting, etc.). For example, a project manager with a salary of $120,000 per year, then the productive hourly rate = ($120,000 ÷ 52 weeks ÷ 4 days ÷ 8 hours) x 1.15 = $83 per hour.
** The project manager in Sydney will be in a full-time position to supervise the whole project's life cycle.
*** The developer's salary is based on the salary of the PSI's development teams in Bangalore, India.

Development Efforts

| | IDs | Deliverables | Effort in days | | | | | Total Effort in days | Costs |
			Project Manager	Senior Developer	Developer	Technical Writer	System Engineer		
Documentation	1	Project plan and schedule estimates	10	10	0	12	0	32	$2,640
	2	Functional Design Documents	10	20	20	10	0	60	$3,621
	3	Software Design Documents	20	40	40	20	0	120	$7,243
	4	Quality Assurance Plan	5	3	5	10	0	23	$1,503
	5	User Acceptance Test Plan	5	5	10	5	0	25	$1,361
	6	System Migration Plan	8	2	5	5	10	30	$1,904
	7	Deployment Plan	10	3	5	5	15	38	$2,471
	8	User Manuals	10	3	5	15	0	33	$2,298
	9	User Training Documents	5	2	8	10	0	25	$1,449
Development	10	Server and Network Configuration	2	2	5	0	9	18	$964
	11	Database	5	10	20	0	0	35	$1,548
	12	System logic	5	15	10	0	0	30	$1,880
	13	Database API	5	15	10	0	0	30	$1,880
	14	System API	5	15	10	0	0	30	$1,880
	15	Web User Interface	5	10	10	0	0	25	$1,431
	16	Android client application development	8	15	40	0	0	63	$2,481
	17	IOS client application development	8	15	40	0	0	63	$2,481
Quality Assurance	18	Functional and Performance Testing	5	10	10	0	10	35	$2,053
	19	System Testing and Trial Run	5	10	20	0	20	55	$2,792
Training	20	User training course	2	0	10	0	10	22	$905
	21	Administrator training course	2	0	10	0	10	22	$905
Deployment	22	System migration	2	0	10	0	20	32	$1,527
	23	Pilot deployment and review	5	10	20	0	20	55	$2,792
	24	Live deployment	5	5	20	0	20	50	$2,343
							Total:	951 days	$52,352

The total effort of this solution is 951 days and the development and training cost is $52,351. If employing the CoCoMo formulae, the elapsed time is about 2.5 x (951 ÷ 30)$^{0.33}$ = 7.8 months. That means this solution should take about 7.8 months to complete.

Technology Costs:

WSWT has about 3000 staff to serve 2 million people living in Western Sydney. The following configuration of the cloud server is capable to support thousand concurrent database transactions.

Vendor: Microsoft Azure	Price	
Items	Per Month	Per Year
Instance: D16 v3, 16 cores CPU, 64GB RAM, 400GB Temporary storage	$422.08	$5,064.96
Operating System: Windows Server	$737.69	$8,852.28
Database: SQL Server Enterprise	$6,013.74	$72,164.88
Storage: Standard SSD 8192GiB	$1,147.25	$13,767.00
Total:	$8,320.76	$99,849.12

Source: https://azure.microsoft.com/en-au/pricing/calculator/

Cost Benefit Analysis

This section will divide the costs and benefits of the solution into four categories, which are tangible benefits, tangible costs, intangible benefits, and intangible costs. Assessing and comparing each category will give objective measures that help to make the best decision for us.

Tangible Benefit:
- No server maintenance labour - the cloud server in this solution has no hardware maintenance cost. The current two legacy systems used in WSWT may need about six full-time system engineers to maintain. For a system engineer with an average salary of $90,000. The cost is about 6 x $90,000 = $540,000
- No server hardware depreciation – The cost of setting up a typical server room with servers and network equipment, plus cooling system is about $500,000. For 20% depreciation, which is about $100,000 per year.
- No electricity for servers and cooling system – a typical server room may have an electricity expense of about $2400 per month, which is $2400 x 12 = $28,800 per year.
- No rent of a server room – the area of a typical server room is about 20 square meters. These 20 square meters of office area in Western Sydney may rent about $200 per week. So, the total cost is $200 x 52 weeks = $10,400 per year.

Tangible Cost:
- Development and training courses – as the calculation listed in the section of Efforts, the total cost is $52,351.95.
- Cloud subscription and software license costs - as the calculation listed in the section of Technology Costs, the cost is $99,849.12 per year.
- System maintenance – the WSWT System in this solution needs about two full-time database administrators to maintain. For each database administrator with an average salary of $90,000. The cost is about 2 x $90,000 = $180,000 per year.
- WSWT employees' wages in 3-day training - assume that one-third of the WSWT 3000 staff need to access the database, and every one of these 1000 staff will take a 3-day training course provided by PSI. Assuming the salary per week of each WSWT employee is the same as the average salary in Australia, which is $1713.9. The total cost of 1000 staff taking the 3-day training is about 1000 x $1713.9 x 3 ÷ 5 = $1,028,340 Source: Australian Bureau of Statistics https://www.abs.gov.au/statistics/labour/earnings-and-work-hours/average-weekly-earnings-australia/latest-release
- Development tools – the development will need 20 software licenses of Visual Studio Professional 2019, which costs $796 each. The total cost is 20 x $796 = $15,920. The mobile application development tool Xamarin is open source and free to use.
Source: Microsoft Shop Business https://www.microsoft.com/en-au/p/visual-studio-professional-2019/dg7gmgf0f6q1?activetab=pivot:overviewtab

Payback Projection

According to the above estimated tangible costs and benefits, a payback projection table is shown below.

	Interest rate:	5%				
	Items	**Year**				
		1	2	3	4	5
Savings	Server maintenance labour	$0.00	$540,000.00	$540,000.00	$540,000.00	$540,000.00
	Server hardware depreciation	$0.00	$100,000.00	$100,000.00	$100,000.00	$100,000.00
	Electricity for servers and cooling system	$0.00	$28,800.00	$28,800.00	$28,800.00	$28,800.00
	Rent of a server room	$0.00	$10,400.00	$10,400.00	$10,400.00	$10,400.00
Costs	Development and training courses	($52,351.95)	$0.00	$0.00	$0.00	$0.00
	Cloud subscription and software licence	$0.00	($99,849.12)	($99,849.12)	($99,849.12)	($99,849.12)
	System maintenance	$0.00	($180,000.00)	($180,000.00)	($180,000.00)	($180,000.00)
	WSWT employees' wages in 3-day training	($1,028,340.00)	$0.00	$0.00	$0.00	$0.00
	Development tools	($15,920.00)	$0.00	$0.00	$0.00	$0.00
	Total Savings - Costs	($1,096,611.95)	$399,350.88	$399,350.88	$399,350.88	$399,350.88
	Net Present Value	($1,096,611.95)	$380,334.17	$362,223.02	$344,974.31	$328,546.96
	Cumulative Savings - Costs	($1,096,611.95)	($716,277.78)	($354,054.76)	($9,080.46)	$319,466.50
Return on investment in 5 years:		29%				

Other than tangible costs and benefits, the intangible ones also need to be considered. In the following section, we will examine the intangible costs and benefits.

Intangible Benefits:

- Improve efficiency over divided legacy systems – the social care system and the health care system currently used in WSWT are two separated and independent systems, which have the problem of not using the hardware resources economically, and not matching with the operational efficiency of a combined system.
- Improve the quality of client data records and analysis reports – the legacy systems in WSWT have problems of not having enough information about a patient. This solution will provide better data format and structure of the client data records, thus generate better analysis reports.
- Reduce redirecting clients to other offices due to the lack of a reliable information system – the legacy systems are not accessed by the professional care team such that they do not know the detailed information of the client before meeting them.
- Highly secure database – Microsoft SQL Server has a long history providing enterprises with highly secure database software, which is fully supported by Microsoft and is better than other open-source software.

Intangible Costs:

- Costs of resistance to change – WSWT employees may resist the change to the new system. If the resistance cannot be handled correctly, the costs of resistance might offset the benefit brought from the new system.

- Information security risks – no matter how secure a system is, it cannot prevent insiders to hack into the system. The administrators of the WSWT System can intentionally release the client database records to the public or leave loopholes for other people to get access to the system. That said, all activities of the database access will be recorded in log files. These log files can only be accessed by the superuser, who should be the gatekeeper of the system security.

Justification of the Solution

The payback projection above shows that the investment payback will occur in year 5. The total investment return in 5 years is 29%, and it is predicted to have more than 20% return for a few years after that. The tangible benefits are larger than the tangible costs. If comparing the intangible benefits and the intangible costs, since the intangible costs are also applicable to other IT solutions, the intangible benefits brought from the WSWT system are also far more important than the intangible costs.

Both the tangible and intangible returns are significant, therefore, this solution is justified.

Constraints and Assumptions

There are a lot of constraints and assumptions made in the above estimation:
- The vendor may change the price of their products.
- The net present value in the payback projection is calculated by using the average business lending rate in Australia, which is about 5%. The change in interest rate will affect the result of the payback projection.
- The performance of the hardware and technology in this solution may not meet the expectation of users. The hardware configuration or technology may need to be upgraded.
- There may be an additional charge from the vendor if there are higher than normal usage and network traffic on the WSWT System.
- Desktop and mobile devices need to meet minimum hardware requirements to use the WSWT system. The minimum hardware requirements are not listed in the solution since there are too many different devices in the market. However, as a rule of thumb, devices built within the last 3 years should be able to use the WSWT System.
- The effort and the elapsed time are estimated by employing the Delphi technique and CoCoMo formulae. These estimates can be very different from reality due to the limitation of the Delphi technique and the CoCoMo formulae.
- The wage of WSWT employees in the cost benefit analysis is based on the Australian average salary. The change in the salary or the change in the number of people for the job will largely affect the result of the payback projection.
- The cost of setup and maintenance of a server room, the rent of the space for the server room, and the electricity costs of the servers and cooling systems are all estimated based on the average usage. Changes in these costs will also change the result of the payback projection.

Solution 2 PaaS - Serverless AWS Lambda with Amazon Aurora

Solution Overview

This solution proposes the emerging trend of cloud technology, Platform as a Service (PaaS) as the WSWT System hosting platform. In IaaS, organizations need to configure the OS, network environment, then install the required software, such as Apache web server and MySQL on the virtual cloud server before installing their applications on it. They also need to take care of the security and maintenance such as firewall configuration, OS updates, storage backup, etc. in IaaS. On the other hand, PaaS allows organizations to concentrate on developing and using applications without spending time and resources on managing the server. Furthermore, PaaS is easier than IaaS in the sense of adjusting computing resources for applications.

AWS Lambda is one of the big-brand market players in PaaS. Just like other PaaS, it charges customers for how much and how long the application spent the computing resources, which is often on a pay as you go basis so that organizations can pay less during lower usage hours. AWS Lambda has a wide range of integration choices to connect the WSWT System to other popular web applications, such as Google Calendar, Gmail, Facebook, etc. This provides a great deal of flexibility for the WSWT System since it can easily synchronize data to other applications. For example, other than email and SMS appointment notification, the WSWT System can also send notifications to Gmail or Google Calendar.

This solution uses Python as the server development programming language. Python is a very popular in the development community due to its simplicity, open-source and versatile nature. Instead of using C#, using Python for web applications has the advantage of not being vendor lock-in. Python is open source and is supported by diverse platforms and cloud vendors, for example, AWS Lambda does not support C# but Python. Therefore, it is much easier to move or scale a Python application to other platforms if needed.

Amazon Aurora is a database engine which is developed by Amazon to achieve much higher performance than a traditional relational database. The features like database deletion protection and auto load balancing make Amazon Aurora more superior than other options. Last but not the least, Amazon Aurora is fully compatible with MySQL and PostgreSQL, that makes migration of legacy system database much easier.

Technology and Human Resources Required

The following technologies will be used for development in this solution.

Application Platform:
Platform: AWS Lambda
Database: Amazon Aurora with MySQL, PostgreSQL compatibility
Server Location: Asia Pacific (Sydney)
Desktop Client: HTML5 Web Browser
Mobile Client: Android, IOS

Development platform:
Development Tools: Visual Studio Code, AWS Amplify
Server Programming Languages: Python, CSS, JavaScript
Mobile Application IDE and Languages: Android Studio - Kotlin, Xcode - Swift

Methodologies
The methodologies used to estimate the effort and cost in this solution will be the same as Solution 1. PSI employed the Delphi technique to estimate the effort of the project. PSI has very experienced estimators from development teams in Perth, Brisbane, and Bangalore, India. The project was broken down into project deliverables and the estimators examined the effort of every project deliverable and then give their estimates. The estimates were then distributed to other estimators and let them correct their estimates until they had a consensus about the final estimates.

Labour Costs

Job Position	Salary per year	*Productive hourly rate
**Project Manager	$120,000	$83
Senior Developer	$130,000	$90
***Developer	$17,000	$12
Technical Writer	$110,000	$76
System Engineer	$90,000	$62
Database Administrator	$90,000	$62

*The productive hourly rate is salary per year ÷ 52 weeks ÷ 4 days (working days minus holidays and sick leaves, etc.) ÷ 8 hours, then add 15% overhead (administration, learning curve, meeting, etc.). For example, a project manager with a salary of $120,000 per year, then the productive hourly rate = ($120,000 ÷ 52 weeks ÷ 4 days ÷ 8 hours) x 1.15 = $83 per hour.

** The project manager in Sydney will be in a full-time position to supervise the whole project's life cycle.

*** The developer's salary is based on the salary of the PSI's development teams in Bangalore, India.

Development Efforts

	IDs	Deliverables	Effort in days					Total Effort in days	Costs
			Project Manager	Senior Developer	Developer	Technical Writer	System Engineer		
Documentation	1	Project plan and schedule estimates	10	10	0	12	0	32	$2,640
	2	Functional Design Documents	10	20	20	10	0	60	$3,621
	3	Software Design Documents	20	40	40	20	0	120	$7,243
	4	Quality Assurance Plan	5	3	5	10	0	23	$1,503
	5	User Acceptance Test Plan	5	5	10	5	0	25	$1,361
	6	System Migration Plan	8	2	5	5	10	30	$1,904
	7	Deployment Plan	10	3	5	5	15	38	$2,471
	8	User Manuals	10	3	5	15	0	33	$2,298
	9	User Training Documents	5	2	8	10	0	25	$1,449
Development	10	Server and Network Configuration	1	2	2	0	0	5	$286
	11	Database	4	8	15	0	0	27	$1,227
	12	System logic	5	15	10	0	0	30	$1,880
	13	Database API	5	15	10	0	0	30	$1,880
	14	System API	5	15	10	0	0	30	$1,880
	15	Web User Interface	5	10	10	0	0	25	$1,431
	16	Android client application development	8	15	40	0	0	63	$2,481
	17	IOS client application development	6	13	35	0	0	54	$2,077
Quality Assurance	18	Functional and Performance Testing	5	10	10	0	10	35	$2,053
	19	System Testing and Trial Run	5	10	20	0	20	55	$2,792
Training	20	User training course	2	0	10	0	10	22	$905
	21	Administrator training course	2	0	10	0	10	22	$905
Deployment	22	System migration	2	0	10	0	20	32	$1,527
	23	Pilot deployment and review	5	10	20	0	20	55	$2,792
	24	Live deployment	5	5	20	0	20	50	$2,343
							Total:	921 days	$50,948

The total effort of this solution is 921 days and the development and training cost is $50,948. If employing the CoCoMo formulae, the elapsed time is about 2.5 x $(921 \div 30)^{0.33}$ = 7.7 months. That means this solution should take about 7.7 months to complete.

Technology Costs:
The price of the Amazon PaaS can be divided mainly into two parts, the AWS Lambda and Amazon Aurora. Other negligible charges will be ignored in the following calculation.

AWS Lambda Pricing
Requests $0.2 per 1 million requests
Duration $0.0000166667 for every GB-second

Assuming every staff in WSWT access the WSWT System once every minute at most, and after office hours usage is negligible, then it is 1 x 60 minutes x 8 hours x 22 days = 10560 requests per month per staff. Therefore, the worst-case scenario is all 1000 staff accessing the system 10560 times every month, which is in a total of 10 million requests every month. If the application process needs 500MB of memory to run and lasts 2 milliseconds on every request, then the cost of the AWS Lambda is $157.89 per month.

Vendor: Amazon AWS	Price	
Items	**Per Month**	**Per Year**
AWS Lambda	$157.89	$1,894.68
Instance: db.r5.4xlarge, vCPU: 16, Memory: 128GiB, Network Performance: Up to 10Gigabit	$2,652.00	$31,824.00
Database Storage: 2 TB, 100 reads/writes per seconds	$442.00	$5,304.00
Operating System Included	$0.00	$0.00
Database Software Included	$0.00	$0.00
Total:	**$3,251.89**	**$39,022.68**

Source: AWS Lambda Pricing https://aws.amazon.com/lambda/pricing/#AWS_Lambda_Pricing
Amazon Aurora Pricing https://calculator.aws/#/createCalculator/amazonAuroraMySQL?nc2=h_ql_pr_calc

Cost Benefit Analysis

Tangible Benefit:
- Pay as you go plan – unlike the Microsoft IaaS in Solution 1, the AWS Lambda and Amazon Aurora charge customers on a pay as you go basis. The estimated costs of those services in the above section are based on the worst-case scenario. Suppose the average usage is 75% of that worst-case estimate, the cost will be 25% lower.
- No server maintenance labour - the cloud server in this solution has no hardware maintenance cost. The current two legacy systems used in WSWT are supposed to need about six full-time system engineers to maintain. For a system engineer with an average salary of $90,000. The cost reduction is about 6 x $90,000 = $540,000.
- No server hardware depreciation – The cost of setting up a typical server room with servers and network equipment, plus cooling system is about $500,000. For 20% depreciation, the cost reduction is about $100,000 per year.
- No electricity for servers and cooling system – a typical server room may have an electricity expense of about $2400 per month, which is $2400 x 12 = $28,800 per year.
- No rent of a server room – the area of a typical server room is about 20 square meters. These 20 square meters of office area in Western Sydney may rent about $200 per week. So, the total cost is $200 x 52 weeks = $10,400 per year.

Tangible Cost:
- Development and training courses – as the calculation of total cost listed in the above section Development Efforts, the total cost is $50,948.

- Cloud subscription and software license costs - as the calculation listed in the section of Technology Costs, the cost is $39,022 per year.
- System maintenance – the WSWT System in this solution needs about two full-time database administrators to maintain. For each database administrator with an average salary of $90,000. The cost is about 2 x $90,000 = $180,000 per year.
- WSWT employees' wages in 3-day training - assume that one-third of the WSWT 3000 staff need to access the database, and every one of these 1000 staff will take a 3-day training course provided by PSI. Assuming the salary per week of each WSWT employee is the same as the average salary in Australia, which is $1713.9. The total cost of 1000 staff taking the 3-day training is about 1000 x $1713.9 x 3 ÷ 5 = $1,028,340
Source: Australian Bureau of Statistics https://www.abs.gov.au/statistics/labour/earnings-and-work-hours/average-weekly-earnings-australia/latest-release
- Development tools – the Visual Studio Code and Android Studio is open source and free to use. Xcode comes with macOS for free.

Payback Projection

According to the above estimated tangible costs and benefits, a payback projection table is shown below.

	Interest rate:	5%				
	Items	**Year**				
		1	2	3	4	5
Savings	Pay as you go plan	$0.00	$9,755.67	$9,755.67	$9,755.67	$9,755.67
	Server maintenance labour	$0.00	$540,000.00	$540,000.00	$540,000.00	$540,000.00
	Server hardware depreciation	$0.00	$100,000.00	$100,000.00	$100,000.00	$100,000.00
	Electricity for servers and cooling system	$0.00	$28,800.00	$28,800.00	$28,800.00	$28,800.00
	Rent of a server room	$0.00	$10,400.00	$10,400.00	$10,400.00	$10,400.00
Costs	Development and training courses	($50,948.32)	$0.00	$0.00	$0.00	$0.00
	Cloud subscription and software licence	$0.00	($39,022.68)	($39,022.68)	($39,022.68)	($39,022.68)
	System maintenance	$0.00	($180,000.00)	($180,000.00)	($180,000.00)	($180,000.00)
	WSWT employees' wages in 3-day training	($1,028,340.00)	$0.00	$0.00	$0.00	$0.00
	Development tools (open source)	$0.00	$0.00	$0.00	$0.00	$0.00
	Total Savings - Costs	($1,079,288.32)	$469,932.99	$469,932.99	$469,932.99	$469,932.99
	Net Present Value	($1,079,288.32)	$447,555.23	$426,243.07	$405,945.79	$386,615.03
	Cumulative Savings - Costs	($1,079,288.32)	($631,733.09)	($205,490.01)	$200,455.77	$587,070.81
Return on investment in 5 years:		**54%**				

Other than tangible costs and benefits, the intangible ones also need to be considered. In the following section, we will examine the intangible costs and benefits.

Intangible Benefit:

- Improve efficiency over divided legacy systems – the social care system and the health care system currently used in WSWT are two separated and independent systems, which have the problem of not using the hardware resources economically, and not matching with the operational efficiency of a combined PaaS system.

- Improve the quality of client data records and analysis reports – the legacy systems in WSWT have problems of not having enough information about a patient. This solution will provide better data format and structure of the client data records, thus generate better analysis reports.
- Reduce redirecting clients to other offices due to the lack of a reliable information system – the legacy systems are not accessed by the professional care team such that they do not know the detailed information of the client before meeting them.
- PaaS has an advantage over IaaS, in the sense that users do not need to take care of the OS and network configuration, which saves the users a lot of resources from system maintenance.
- AWS Lambda has a wide range of choices of integrations with other popular web applications, such as Google Calendar, Gmail, Facebook, etc. This provides a great deal of flexibility for the WSWT System to easily synchronize data to other applications.
- The server development language, Python is a very popular programming language due to its simplicity and versatile nature. Instead of using C#, using Python for web applications has the advantage of not being vendor lock-in.
- Python is open source and is supported by diverse platforms and cloud vendors.

Intangible Costs:
- Software bugs might trigger huge usage of the cloud function, as a result causing high expenses on the AWS bill. Therefore, using this solution, the AWS usage must be monitored, and the limit must be set properly.
- It may not be as easy as IaaS to switch the hosting of an application to another PaaS vendor since they are not fully compatible with each other.
- Costs of resistance to change – WSWT employees may resist the change to the new system. If the resistance cannot be handled correctly, the costs of resistance might offset the benefit brought from the new system.
- Information security risks – no matter how secure a system is, it cannot prevent insiders to hack into the system. The administrators of the WSWT System can intentionally release the client database records to the public or leave loopholes for other people to get access to the system. That said, all activities of the database access will be recorded in log files. These log files can only be accessed by the superuser, who should be the gatekeeper of the system security.

Justification of the Solution

The payback projection above shows that the investment payback will occur in year 4. The total investment return in 5 years is 54%, and it is predicted to have more than 30% return for a few years after that. The tangible benefits are larger than the tangible costs. If comparing the intangible benefits and the intangible costs, the intangible benefits brought from the WSWT system are also far more important than the intangible costs.

Both the tangible and intangible returns are significant, therefore, this solution is justified.

Constraints and Assumptions

There are a lot of constraints and assumptions made in the above estimation:
- The vendor may change the price of their products.
- The net present value in the payback projection is calculated by using the average business lending rate in Australia, which is about 5%. The change in interest rate will affect the result of the payback projection.
- The performance of the hardware and technology in this solution may not meet the expectation of users. The hardware configuration or technology may need to be upgraded.
- There may be an additional charge from the vendor if there are higher than normal usage and network traffic on the WSWT System.

- Desktop and mobile devices need to meet minimum hardware requirements to use the WSWT system. The minimum hardware requirements are not listed in the solution since there are too many different devices in the market. However, as a rule of thumb, devices built within the last 3 years should be able to use the WSWT System.
- The effort and the elapsed time are estimated by employing the Delphi technique and CoCoMo formulae. These estimates can be very different from reality due to the limitation of the Delphi technique and the CoCoMo formulae.
- The wage of WSWT employees in the cost benefit analysis is based on the Australian average salary. The change in the salary or the change in the number of people for the job will largely affect the result of the payback projection.
- The cost of setup and maintenance of a server room, the rent of the space for the server room, and the electricity costs of the servers and cooling systems are all estimated based on the average usage. Changes in these costs will also change the result of the payback projection.

Solution 3: Pinnacle Software Elastic SaaS

Solution Overview

For IaaS, users need to take care of the configuration of the operating system and network environment, as well as installation and updates of software packages. For PaaS, users still need to deal with the configuration, installation and updates of the applications and database software.

In this solution, the Pinnacle Software Elastic SaaS is proposed as the WSWT System hosting platform. SaaS is good for users who just want to use the application out of the box without the need to deal with the software installation, updates and configuration. The SaaS service provider, PSI will take care of the configuration, updates, and security of the system, as well as any future scalability if needed.

The WSWT System in this solution will run on a Pinnacle Elastic SaaS instance with 16 cores CPU, 64GB RAM, 1TB SSD, which has the same hardware configuration as Solution 1 Microsoft Azure Cloud. This configuration is supposed to be enough for the WSWT System to handle the performance requirement mentioned in the non-functional requirements.

Technology and Human Resources Required

The following technologies will be used for development in this solution.

Application Platform:
Instance: Pinnacle Elastic SaaS, 16 cores CPU, 64GB RAM, 1 TB SSD
Server Location: Sydney Australia
Operating System and Packages: Linux, Apache, MySQL, PHP
Database: MySQL
Desktop Client: HTML5 Web Browser
Mobile Client: Android, IOS

Development Platform:
Development Tools: Visual Studio Code
Server Programming Languages: PHP, CSS, JavaScript
Mobile Application IDE and Languages: Android Studio - Kotlin, Xcode - Swift

Methodologies
The methodologies used to estimate the effort and cost in this solution will be the same as the above solutions.
PSI employed the Delphi technique to estimate the effort of the project. PSI has very experienced estimators from

development teams in Perth, Brisbane, and Bangalore, India. The project was broken down into project deliverables and the estimators examined the effort of every project deliverable and then give their estimates. The estimates were then distributed to other estimators and let them correct their estimates until they had a consensus about the final estimates.

Labour Costs

Job Position	Salary per year	*Productive hourly rate
**Project Manager	$120,000	$83
Senior Developer	$130,000	$90
***Developer	$17,000	$12
Technical Writer	$110,000	$76
System Engineer	$90,000	$62
Database Administrator	$90,000	$62

*The productive hourly rate is the salary per year ÷ 52 weeks ÷ 4 days (working days minus holidays and sick leaves, etc.) ÷ 8 hours, then add 15% overhead (administration, learning curve, meeting, etc.). For example, a project manager with a salary of $120,000 per year, then the productive hourly rate = ($120,000 ÷ 52 weeks ÷ 4 days ÷ 8 hours) x 1.15 = $83 per hour.

** The project manager in Sydney will be in a full-time position to supervise the whole project's life cycle.

*** The developer's salary is based on the salary of the PSI's development teams in Bangalore, India.

Development Efforts

	IDs	Deliverables	Effort in days					Total Effort in days	Costs
			Project Manager	Senior Developer	Developer	Technical Writer	System Engineer		
Documentation	1	Project plan and schedule estimates	10	10	0	12	0	32	$2,640
	2	Functional Design Documents	10	20	20	10	0	60	$3,621
	3	Software Design Documents	20	40	40	20	0	120	$7,243
	4	Quality Assurance Plan	5	3	5	10	0	23	$1,503
	5	User Acceptance Test Plan	5	5	10	5	0	25	$1,361
	6	System Migration Plan	8	2	5	5	10	30	$1,904
	7	Deployment Plan	10	3	5	5	15	38	$2,471
	8	User Manuals	10	3	5	15	0	33	$2,298
	9	User Training Documents	5	2	8	10	0	25	$1,449
Development	10	Server and Network Configuration	1	1	1	0	0	3	$185
	11	Database	2	4	8	0	0	14	$619
	12	System logic	5	15	10	0	0	30	$1,880

	13	Database API	5	5	10	0	0	20	$981
	14	System API	5	5	10	0	0	20	$981
	15	Web User Interface	5	10	10	0	0	25	$1,431
	16	Android client application development	8	15	40	0	0	63	$2,481
	17	IOS client application development	6	13	35	0	0	54	$2,077
Quality Assurance	18	Functional and Performance Testing	5	10	10	0	10	35	$2,053
	19	System Testing and Trial Run	5	10	20	0	20	55	$2,792
Training	20	User training course	2	0	10	0	10	22	$905
	21	Administrator training course	2	0	10	0	10	22	$905
Deployment	22	System migration	2	0	10	0	20	32	$1,527
	23	Pilot deployment and review	5	10	20	0	20	55	$2,792
	24	Live deployment	5	5	20	0	20	50	$2,343
							Total:	886 days	$48,442

The total effort of this solution is 886 days, and the development and training cost is $48,442. If employing the CoCoMo formulae, the elapsed time is about $2.5 \times (886 \div 30)^{0.33} = 7.6$ months. That means this solution should take about 7.6 months to complete.

Technology Costs:
The price of the PSI Elastic SaaS offered for this project is $13,000 per year on a 5-year subscription basis, which is $65,000 in total for 5 years. The price will include all software package and licenses needed to run the WSWT System.

Cost Benefit Analysis

Tangible Benefit:
- Much cheaper cloud service – other than the labour costs, the cloud service subscription and software licenses are the major expenses in this project. This solution offers a much cheaper option.
- No server maintenance labour - the cloud server in this solution has no hardware maintenance cost. The current two legacy systems used in WSWT are supposed to need about six full-time system engineers to maintain. For a system engineer with an average salary of $90,000. The cost reduction is about 6 x $90,000 = $540,000.
- No server hardware depreciation – The cost of setting up a typical server room with servers and network equipment, plus cooling system is about $500,000. For 20% depreciation, the cost reduction is about $100,000 per year.
- No electricity for servers and cooling system – a typical server room may have an electricity expense of about $2400 per month, which is $2400 x 12 = $28,800 per year.
- No rent of a server room – the area of a typical server room is about 20 square meters. These 20 square meters of office area in Western Sydney may rent about $200 per week. So, the total cost is $200 x 52 weeks = $10,400 per year.

Tangible Cost:

- Development and training courses – as the calculation of total cost listed in the above section Development Efforts, the total cost is $48,442.
- Cloud subscription and software license costs - as the calculation listed in the section of Technology Costs, the cost is $39,022 per year.
- System maintenance – the WSWT System in this solution needs about two full-time database administrators to maintain. For each database administrator with an average salary of $90,000. The cost is about 2 x $90,000 = $180,000 per year.
- WSWT employees' wages in 3-day training - assume that one-third of the WSWT 3000 staff need to access the database, and every one of these 1000 staff will take a 3-day training course provided by PSI. Assuming the salary per week of each WSWT employee is the same as the average salary in Australia, which is $1713.9. The total cost of 1000 staff taking the 3-day training is about 1000 x $1713.9 x 3 ÷ 5 = $1,028,340
  Source: Australian Bureau of Statistics https://www.abs.gov.au/statistics/labour/earnings-and-work-hours/average-weekly-earnings-australia/latest-release
- Development tools – the Visual Studio Code and Android Studio is open source and free to use. Xcode comes with macOS for free.

Payback Projection

According to the above estimated tangible costs and benefits, a payback projection table is shown below.

	Interest rate:	5%				
	Items		**Year**			
		1	2	3	4	5
Savings	Server maintenance labour	$0.00	$540,000.00	$540,000.00	$540,000.00	$540,000.00
	Server hardware depreciation	$0.00	$100,000.00	$100,000.00	$100,000.00	$100,000.00
	Electricity for servers and cooling system	$0.00	$28,800.00	$28,800.00	$28,800.00	$28,800.00
	Rent of a server room	$0.00	$10,400.00	$10,400.00	$10,400.00	$10,400.00
Costs	Development and training courses	($48,442.37)	$0.00	$0.00	$0.00	$0.00
	Cloud subscription and software licence	$0.00	($13,000.00)	($13,000.00)	($13,000.00)	($13,000.00)
	System maintenance	$0.00	($180,000.00)	($180,000.00)	($180,000.00)	($180,000.00)
	WSWT employees' wages in 3-day training	($1,028,340.00)	$0.00	$0.00	$0.00	$0.00
	Development tools (open source)	$0.00	$0.00	$0.00	$0.00	$0.00
	Total Savings - Costs	($1,076,782.37)	$486,200.00	$486,200.00	$486,200.00	$486,200.00
	Net Present Value	($1,076,782.37)	$463,047.62	$440,997.73	$419,997.84	$399,997.94
	Cumulative Savings - Costs	($1,076,782.37)	($613,734.75)	($172,737.02)	$247,260.82	$647,258.77
	Return on investment in 5 years:	**60%**				

Other than tangible costs and benefits, the intangible ones also need to be considered. In the following section, we will examine the intangible costs and benefits.

Intangible Benefit:

- Improve efficiency over divided legacy systems – the social care system and the health care system currently used in WSWT are two separated and independent systems, which have the problem of not using the hardware resources economically, and not matching with the operational efficiency of a combined SaaS system.
- Improve the quality of client data records and analysis reports – the legacy systems in WSWT have problems of not having enough information about a patient. This solution will provide better data format and structure of the client data records, thus generate better analysis reports.

- Reduce redirecting clients to other offices due to the lack of a reliable information system – the legacy systems are not accessed by the professional care team such that they do not know the detailed information of the client before meeting them.
- SaaS has an advantage over IaaS and PaaS, in the sense that users do not need to take care of the installation, configuration, updates of the operating system and software, which saves the users a lot of time and effort from system maintenance.
- The server development language, PHP is a very popular web server programming language due to its 25 years of history of specializing in web development.
- PHP is open source and is supported by diverse platforms and cloud vendors.

Intangible Costs:
- It may not be as easy as IaaS and PaaS to switch the hosted application to another SaaS vendor. However, PSI can offer system migration service on demand.
- Costs of resistance to change – WSWT employees may resist the change to the new system. If the resistance cannot be handled correctly, the costs of resistance might offset the benefit brought from the new system.
- Information security risks – no matter how secure a system is, it cannot prevent insiders to hack into the system. The administrators of the WSWT System can intentionally release the client database records to the public or leave loopholes for other people to get access to the system. That said, all activities of the database access will be recorded in log files. These log files can only be accessed by the superuser, who should be the gatekeeper of the system security.

Justification of the Solution

The payback projection above shows that the investment payback will occur in year 4. The total investment return in 5 years is 60%, and it is predicted to have nearly 40% return for a few years after that. The tangible benefits are larger than the tangible costs. If comparing the intangible benefits and the intangible costs, the intangible benefits brought from the WSWT system are also far more important than the intangible costs.

Both the tangible and intangible returns are significant, therefore, this solution is justified.

Constraints and Assumptions:

There are a lot of constraints and assumptions made in the above estimation:
- The vendor may change the price of the subscription plan after 5 years.
- The net present value in the payback projection is calculated by using the average business lending rate in Australia, which is about 5%. The change in interest rate will affect the result of the payback projection.
- The performance of the hardware and technology in this solution may not meet the expectation of users. The hardware configuration or technology may need to be upgraded.
- There may be an additional charge from the vendor if there are higher than normal usage and network traffic on the WSWT System.
- Desktop and mobile devices need to meet minimum hardware requirements to access the WSWT system. The minimum hardware requirements are not listed in the solution since there are too many different devices in the market. However, as a rule of thumb, devices built within the last 3 years should be able to use the WSWT System.
- The effort and the elapsed time are estimated by employing the Delphi technique and CoCoMo formulae. These estimates can be very different from reality due to the limitation of the Delphi technique and the CoCoMo formulae.

- The wage of WSWT employees in the cost benefit analysis is based on the Australian average salary. The change in the salary or the change in the number of people for the job will largely affect the result of the payback projection.
- The cost of setup and maintenance of a server room, the rent of the space for the server room, and the electricity costs of the servers and cooling systems are all estimated based on the average usage. Changes in these costs will also change the result of the payback projection.

RECOMMENDED SOLUTION

The above sections have introduced the three alternative solutions, along with the technologies they used, resources required, cost benefit analysis, justification as well as assumptions and constraints. This section will list the characteristics of these three solutions, evaluate them, and recommend the most appropriate one that suits WSWT's needs.

Solution 1 – IaaS Microsoft Azure Cloud

- Complete ownerships and controls of the operating system, processes, hosted applications, and the network environment.
- Sophisticated software development tools. Fully supported by Microsoft.
- Microsoft SQL Server is suitable for systems that require high security.
- Complete solution of developing web applications with ASP.NET, C#, and Xamarin.
- Development cost is slightly high. Elapsed time is slightly longer.
- The subscription price is high and inflexible. Return on investment is low.

Solution 2 – PaaS Serverless AWS Lambda with Amazon Aurora

- Complete ownerships and controls of the hosted application. No need to manage the operating system and network environment.
- Sophisticated software development tools supported by Microsoft, Amazon, Google and Apple.
- AWS Lambda integrates with other popular web applications.
- Amazon Aurora database is fully supported by Amazon. Suitable for systems that require high security.
- Complete solution of developing web applications with Python, JavaScript, Android Studio and Xcode.
- Development cost is moderate. Elapsed time is moderate.
- Pay as you go subscription price is moderate and flexible. Return on investment is moderate.

Solution 3 – Pinnacle Software Elastic SaaS

- Use the application out of the box. No need to manage the operating system, software, and network environment.
- Sophisticated software development tools supported by Microsoft, Google and Apple.
- The platform runs on Linux, Apache, MySQL, PHP. Supported by PSI and the developer community.
- Complete solution of developing web applications with PHP, JavaScript, Android Studio and Xcode.
- Development cost is slightly low. Elapsed time is slightly faster.
- The 5-year subscription price is very low. Return on investment is very high.

Our Recommendation:

Solution 2 has a few advantages over Solution 1.

- PaaS is easier than IaaS in the sense of adjusting computing resources for applications.
- The two solutions are both supported by big-brand companies, but the pricing of PaaS is cheaper and more flexible price than IaaS.
- Open-source development solution will not be vendor lock-in.
- Return on investment is higher.

Based on the above reasons, we rule out Solution 1. Then let us compare Solution 2 and 3. The main differences between Solution 2 and 3 are:

A. With SaaS, users can use the application out of the box. No need to install and update the application.
B. Solution 3 has a much higher return on investment.
C. The hosting platform of Solution 2 is a proprietary Amazon solution, and that of Solution 3 is a LAMP solution which is supported by PSI and the development community.

Reason A and B are apparently good for WSWT, while reason C depends on if WSWT is willing to be "Amazon lock-in". If considering switching the hosted application to another platform, it may be easier for an open-source LAMP platform than the Amazon proprietary AWS Lambda platform.

Therefore, after considering all the factors, we recommend Solution 3 – Pinnacle Software Elastic SaaS to WSWT.

PROJECT APPROACH

Overview

The head office of PSI is in Sydney Australia and PSI has development teams in three offices, which are Brisbane, Perth, and Bangalore India. This project will be overseen by a project manager in the Sydney office. The development will be carried out by development teams in Brisbane, Perth and Bangalore India. This section will discuss the project approach employed by this project, the purpose of the approach and how it is going to be implemented.

The functional and non-functional requirements have been outlined in this document. However, WSWT and PSI do not have a clear picture about how the functionalities will be implemented in the WSWT System, for example, how the user interface should be, the business process logic, the database schema, and so on. A Waterfall project approach is a step-by-step approach, one procedure must be completed before another procedure starts. If the Waterfall project management approach is used, these processes of discussion on how to implement the project will a significant time.

As stated in the section of Alternative Solutions, this project will take only 8 months to complete. The Waterfall approach in traditional project management is not practical in this project, because the step-by-step approach will take too long, and the Waterfall approach does not accommodate changes as good as the Agile approach. Therefore, PSI will employ a much more flexible Agile approach, which is commonly used in the software industry. Among all the popular methodologies of the Agile approach, PSI will use the Scrum due to its simplicity and effectiveness.

Scrum Methodology

With Scrum, the product development team will invite WSWT users to envision how the finished WSWT System should be. There will be three roles in the Scrum process, the Product Owner, the Scrum Master, and the Scrum Team. The Product Owner will incorporate user feedback about the product and manage and prioritize the product backlog, which contains Sprints, that is, functionalities of the product. The Scrum Master is like a project manager, who helps to facilitate the progress of the project, setup meetings, release schedule, and assigning resources. The Scrum Team is the development team that contains software developers, testers, administration executives, etc.

The Scrum procedures will be carried out in each SDLC stage as follows:

Initiating

- Product Owner helps to collect user stories, which are the features that end-users want, kind of a user's wish list of features, then prioritizes these user stories in the product backlog.
- The functional requirements shown in this document are only the high-level design of the product. The user stories will add more details to the features of the product.

Planning

- After deleting unnecessary user stories, Product Owner schedules the user stories and produces the release backlog. Product Owner divides the release backlog into Sprints. Each sprint is like a short duration (1-2 weeks) milestone which can be developed, tested, completed, and release.
- The ownership of each Sprint will be assigned to a Scrum team, who will be responsible for the development, testing, updates, quality assurance of the Sprint release.
- Scrum Master will create a Burndown Chart which is used for monitoring the completion of works. Y-axis is the remaining work in hours and X-axis is the days have passed. A line steadily declined towards the date of the deadline means the progress is on track. The slope of the line is the rate of progress. Days to completion = work remaining ÷ rate of progress.

Executing

- After getting user feedback, the Scrum Team will incorporate the change in the next release. The iterative cycle of release, feedback, and change will finally shape the product which is what users want.
- The Scrum team will invite WSWT users to envision how the finished WSWT System should be. Every Sprint release is a communication opportunity between developers and users, to work towards and shape the final product. The Sprints and release plan may be updated after every release.

Monitoring and Controlling

- Scrum Master will hold a Daily Scrum meeting every day, which is a short stand-up meeting for Scrum Team members to report progress and issues.
- Scrum Master will update the Burndown Chart and monitor if the project is on track. Any issues which affect the progress of the project should be tackled immediately.
- Scrum Master will monitor the quality, cost and execution of the product development, and should be aware of any risks and dependencies that have an impact on the progress.

Closing

- There are five major milestone releases shown in the table below, which are Sprint 2 (base release), Sprint 4 (beta 1), Sprint 5 (beta 2), Sprint 6 (beta 3), and Sprint 7 (pilot and final). After each milestone release, the project will go through a review process to examine if the delivered Sprints aligned with the expected quality and are there any improvements that can be made in the next release.
- The development will go through the iteration of the release and update cycle until all Sprints have satisfied the user requirements and acceptance test. Then the project will enter the pilot phase, that a few selected WSWT offices will use the WSWT System.
- In the pilot phase, the Scrum Team will gather the user feedbacks and fine-tune the WSWT System accordingly. Then release the final version of the WSWT System.
- After the final release is accepted by WSWT, the software, along with the training courses and all documents will be delivered to WSWT. The project is then completed.

Preliminary Sprint Release Plan

Sprint 1 Owner: Perth Team - FR-UM01 – Account Types - FR-UM02 – User Registration - FR-PM01 – Client Types - FR-PM03 –Client Registration	Sprint 2 (base) Owner: Perth Team - FR-UM06 – User Record Management - FR-PM02 – Client Records - FR-PM04 – Access Control of Client Records	Sprint 3 Owner: Perth Team - FR-UM03 – Change Password - FR-UM04 – Reset Password - FR-UM05 – Password Security - FR-UM08 – Login Retries - FR-EF03 – System Security
Sprint 4 (beta 1) Owner: Bangalore Team - FR-UM07 – SMS and Email Notifications - FR-PM05 – Client Appointment Calendar	Sprint 5 (beta 2) Owner: Brisbane Team - FR-PM06 – Reporting	Sprint 6 (beta 3) Owner: Bangalore Team - FR-EF01 – Access to Application

Sprint 7 (pilot and final) Owner: Brisbane Team • FR-EF02 – Migrate Old Database Records		

LEGAL CONSIDERATIONS

WSWT is a health care service provider and it is funded by the government. Health care information is sensitive personal information. The process of handling this information is regulated by law. By using the WSWT System in Australia, WSWT needs to be aware that they abide by the Australian privacy laws and spam laws, which are mainly the Privacy Act 1988, Australian Privacy Principles, Health Records, and Information Privacy Act 2002 (NSW), Spam Act 2003, and Do Not Call Register Act 2006. This section will outline the legal obligations and the possible consequences of violating these laws.

Australian Privacy Principles and Privacy Act 1988

Legal Obligations

Collection

- When WSWT collects the patient's information, the information should be relevant to or it can facilitate the services they provide.
- Generally, WSWT must get their clients' consents for collecting their personal and health information, unless the following circumstances:
  - The data collection is authorized by law, for example, a patient has a certain type of diseases, such as AIDS. Then WSWT can collect the relevant information without getting the patient's consent and then report this information to the NSW Department of Health.
  - When it is a serious threat to a person's life or public safety, and the circumstance is impracticable to get the patient's consent to collect the information. For example, a patient is unconscious in a hospital due to a stroke, the hospital can collect the patient's information from his general practitioner in order to determine the best treatment for him.
- All personal information collected without getting consent from the patient must be destroyed or permanently de-identified.
- Patients have the right to be anonymity or de-identified in the WSWT System data records when getting the WSWT services. If it would affect the quality of services provided to the patients, WSWT should notify the patients.

Disclosure

- Unless getting the client's written consent, WSWT should not disclose their client's health information to other individuals, such as the client's employer.
- WSWT do not need to get the client consent to share their health information with other healthcare professionals for the treatment of the patient, but it should only be the necessary part of the information.
- If there is a need for the health care team to share the necessary part of the patient's health information with the social care team, WSWT should notify the patient.

Access

- The WSWT IT department needs to generate data analysis report periodically. The patient data records used for generating these reports should be de-identified.
- Using a patient's information for marketing purpose must obtain the patient's consent.

Storage

- While the WSWT System may use cloud storage service from other vendors to store the WSWT clients' health data, the vendor should also comply with the Australian Privacy Act. In all three alternative solutions, the cloud service providers are all located in Australia and comply with the Privacy Act. However, if WSWT decided to choose other cloud service providers, they should make sure that the cloud service provider complies with the Privacy Act.

Integrity

- WSWT should ensure the protection and integrity of the client's personal data in the WSWT System, to reduce the possibility of being lost, stolen or corrupted. WSWT should also ensure their clients' records are accurate, up to date and able to be retrieved at all time.

Security

- PSI should ensure that the WSWT System meets the requirements of the security standard defined in the Act about storing and sending clients' data. For example, the WSWT System uses encryption mechanism, such as HTTPS to transfer data and the firewall in the WSWT System will block unauthorized incoming requests.
- WSWT should be aware of destroying or de-identifing clients' data on WSWT System does not mean the data is permanently deleted. To meet the requirements of the Act about secure destruction of data, PSI will provide a function for WSWT to permanently delete a client record.
- The Act requires that WSWT must notify the authority if any data breach happens. All affected clients should also be notified about the event.
- WSWT must not use identifiers such as driver license numbers, Medicare numbers, names, phone numbers, etc. as database identifiers, such that someone could identify a person with the database ID.

Consequences of Violation

Organizations can be fined up to $1,700,000 for violating the laws.

Health Records and Information Privacy Act 2002 (NSW)

Legal Obligations
- The Privacy Act requires the patient medical records to be destroyed or de-identified permanently once it is no longer used for providing the healthcare service. However, in the jurisdiction of NSW, the Health Records and Information Privacy Act 2002 requires healthcare service providers to keep a child's medical records until he turns 25, and an adult's medical record for seven years. This act overrides the Privacy Act 1988.
- Whether it is in digital formats or hard copies, WSWT should provide a way to let patients get access their own, or their child's medical records upon requests. However, when it may lead to causing harm to other people, WSWT can refuse the request. For example, if there is a possibility of child abuse, WSWT can refuse the parent's request of accessing the child's medical record.
- Clients may request WSWT to amend their information on the database records. WSWT can make the amendment accordingly or refuse the request if the information provided by the client is false or misleading.

Consequences of Violation

The maximum penalty is 50 penalty units, which are equal to $5,500 per violation.

Spam Acts and Do Not Call Register Act 2006

Legal Obligations
- WSWT must not use clients' contact information, for example, email addresses or phone numbers, to send unsolicited messages to clients. On the other hand, if WSWT sends solicited messages to clients, the message should also include instructions to let the client unsubscribe.

Consequences of Violation

Organizations can be fined up to $220,000 for violating the laws.

QUALITY ASSURANCE

PSI will incorporate the ISO 9000 quality management system to ensure the satisfaction of WSWT alongside customer and stakeholders. ISO 9000 has been a standard practice for over 30 years and can be tailored to meet specific needs depending on each project. ISO 9000 has seven management principles that will be applied to the project:

- Customer focus
- Leadership
- Engagement
- Process approach
- Improvement
- Evidence based decision making
- Relationship management

By creating a customer-focused system, PSI will be able to position the organisational objectives set out alongside the customer needs and expectations. The method for doing so would involve utilising user testing for developmental areas of the system. The reason for this is to gather non-biased feedback from external users. This is important to the development of the system as it allows PSI to obtain true data about how the system is currently functioning and what needs to be improved, instead of biased feedback that may display an unwillingness to change.

The responsibility lies within PSI to create the system for WSWT and can only be done through rigorous leadership. Under such leadership guiding PSI, the implementation of the process approach will advance according to a set schedule using risk-based thinking through preventative actions placed by assessing any risk and mitigating said risks using industry-standard techniques such as failure mode and effects analysis (FMEA). The leadership will demonstrate their commitment to customer focus when designing the project by a complete understanding of what the customer requirements are to lead to satisfaction. This is presented throughout the stages of the process lifecycle to ensure that the team behind the project maintains focus and does not lose sight of what the original intention of the project is.

Engagement will ensure that the right people are suited for the right task when developing the system. This is the process where PSI is accountable for the development of the new system. Adhering to the quality of standard based on professional judgement, the responsibility falls upon PSI to make the correct decisions based on all stages of the project's lifecycle.

Process approach involves the responsible allocation of resources to the project. If proper testing and monitoring are not accomplished, the project becomes more expensive. The further the project is in the lifecycle; it becomes increasingly more expensive to fix if an error is detected early on. To prevent this, proper checking and investigating is done at every stage of the project lifecycle to ensure the system is working correctly alongside stable communication between PSI and WSWT to give regular updates on how the system is coming along and where the project is in the lifecycle.

Improvement is the continual improvement of PSI's performance not only for the project but for the entirety of the company. This is a permanent objective, with the project between PSI and WSWT being a factor towards that goal. By improving as a company, the individuals affected will also be improved, which includes stakeholders, employees and users.

Evidence based decision making will ensure that the data stored within WSWT's systems will be accurate and reliable, this includes the customer records, customer referrals, and employee records. By analysing the data used in the project lifecycle phases, the system will be created for optimal outcomes. Methods of gathering evidence can range from obtaining non-biased reviews from user testing to draw upon expertise and knowledge from stakeholders.

Relationship management is the mutual understanding between companies and individuals. A healthy relationship between WSWT and its stakeholders and PSI will allow easier identification of managing costs, optimising resources which will create value.

To achieve the ISO 9000 quality of management, the use of the quality context triangle is incorporated into the phases of development:

- Data quality
- Code quality
- Model quality
- Process quality
- Management quality
- Quality environment

Data quality will be managed through the Garbage in Garbage out a concept (GIGO) led by a data manager. GIGO will sanitize and clean up unnecessary data due to imprecision or incomplete data. By filtering the redundant data throughout the project lifecycle, the developmental cost will be cheaper, and the project will have a smoother execution which results in an easier-to-use system for the userbase.

Code quality will be achieved through the professional programming skills of PSI's software development team. By documenting the code, other individuals of the team and team leaders can cooperate to higher efficiency and ensure a cleaner code, which results in a highly efficient system for WSWT.

Model quality involves keeping the target audience in mind and will be led by a professional modelling team. A business to consumer model will be the model used in the development of the system. A business to consumer model allows the user to request support with referrals to the Trust, request care and request a care plan. As the new system has the goal of making work life easier for the employees of WSWT, the new system will remove the need for handwritten filed notes and instead move towards computerized inputs to successfully record the type of care and cost.

Process quality will manage how the models are created. Under a professional standard of management by the process engineer, the developmental budget and resources are thoroughly reviewed step-by-step and a schedule is created between PSI and WSWT to conduct meetings to give updates. A what-if analysis is conducted to theorise different variables, for example, "what if 75% of resources were allocated instead to this portion instead". Using what-if analysis' allows professional decisions to be made about the allocation of resources, which may be instead used for a different part of the project's lifecycle.

Management quality is led by the project manager. They will be responsible for managing the processes used in the creation of the model. Through thorough planning by cooperating with key stakeholders to create a project plan, they will also oversee the scope of the project, developmental cost, and potential risk involved. Through their judgement, they will execute the project by allocating the appropriate resources to the appropriate team and monitor the developmental phases of the project by providing feedback from stakeholders or a user testing area.

The quality environment will be the final phase before the end of the project lifecycle, led by the quality manager. This final step will ensure the product produced by PSI meets the quality standard before it is officially transferred to WSWT. The quality standard must achieve several goals: user and stakeholder expectations have been met, product specifications have been met, rejection or changes of proposals that do not meet the quality standard, and proper engagement between PSI and WSWT have been met.

After the project has achieved completion, PSI will finalize the transfer of every deliverable asked to a degree of professional judgement. Project completion will be successful once all affected users agree upon the result of the project; this involves WSWT's employees being more comfortable with the new system, stakeholders agreeing upon the deliverables, and the management of PSI. A project review is then commenced, which will review the successes,

failures, and challenges of the project and to allow identification of opportunities for improvement for both PSI and WSWT. This can include things such as objective completion, budget, and client satisfaction.

CONCLUSION

Within this document, PSI has stated the business objectives for both PSI and WSWT and how each company can benefit from a mutual relationship. Important personnel and stakeholders were listed and detailed about how they are involved in the process of creating the new system.

Functional and non-functional requirements are listed once more to give qualitative measurement using calculated approximations about how PSI will achieve the goals set out using the resources given by WSWT. Three solutions were proposed, with the third: Pinnacle Software Elastic SaaS being the solution of choice after meticulous discussions between PSI's development team. This was chosen over the others as it provides easier access of use and potential for gain is higher.

PSI has also listed how the project will be approached by which is the Scrum methodology that is based on the Agile principle. Legal considerations are discussed for developing such a project and how to abide by the law to prevent consequences of violating these legal considerations. PSI will use the ISO 9000 quality management system to assure quality has been met to a professional standard by incorporating the quality triangle into its developmental phases. Next actions involve waiting for a response from WSWT to see if collaboration can be performed between the two companies.

DEFINITIONS, ACRONYMS, AND ABBREVIATIONS

Agile Principles	Principles of a flexible approach to project development
Android Studio	A mobile application development tool developed by Google
API	Application Programmer Interface
ASP.NET	A web framework developed by Microsoft
Amazon Aurora	A cloud database service provided by Amazon
AWS Lambda	A serverless cloud service provided by Amazon
CoCoMo	Formulae used for estimating the elapsed time from the development effort
CSS, JavaScript, PHP	Open-source web programming languages
C#	A programming language developed by Microsoft
Delphi Technique	A method used for estimating development effort
Health Care System	The legacy IT system of the WSWT Health Care department
Health Care department/team	The Health Care Department of WSWT
HTML5	Hypertext Markup Language version 5
IaaS	Infrastructure as a Service, a cloud technology that frees users from the hassles of managing server hardware
IP address	Internet Protocol address can be used for locating a network device
ISO 9000	A quality management system developed by the International Standard Organization
Kotlin	An open-source programming language for Android applications
MAC address	Media Access Control address, used for identifying a network device
Microsoft Azure	Cloud services provided by Microsoft

Microsoft SQL Server	A proprietary relational database management system developed by Microsoft
MySQL, PostgreSQL	Relational database management systems
LAMP	Linux, Apache, MySQL, PHP
PSI	Pinnacle Software Inc.
PaaS	Platform as a Service, a serverless cloud service that frees users from the hassles of managing the OS
Python	Multipurpose open-source programming language
SaaS	Software as a Service, a cloud service that frees users from the hassles of managing the application
Scrum Methodology	A methodology that employs the Agile principles
SDK	Software Development Kit
SDLC	Software Development Lifecycle
Social Care System	The legacy IT system of the WSWT Social Care department
Social Care department/team	The Social Care department of WSWT
SSD	Solid State Disk
Swift	An open-source programming language for IOS applications
Xcode	A mobile application development tool developed by Apple
WSWT	Western Sydney Wellness Trust
WSWT Project	Western Sydney Wellness Trust Project
WSWT System	The system proposed by Pinnacle Software Inc for this project.
Xamarin	A mobile application development tool developed by Microsoft

24/7	24 hours a day, 7 days a week. All the time.