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ROYAL MELBOURNE INSTITUTE OF TECHNOLOGY

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Assignment 3A

BUSINESS INVESTIGATION REPORT

Case Study: APEC Water

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EXECUTIVE SUMMARY

This report presents a comprehensive analysis of the business issues faced by APEC Water and proposes a technology solution to address the identified inefficiencies. Through the use of various analytical tools, including Rich Pictures, Business Process Modeling Notation (BPMN) diagrams, and a Fishbone diagram, key challenges were identified, such as ineffective communication between stakeholders, manual performance tracking, shipping errors, and delays in problem resolution.

To overcome these challenges, the report recommends implementing a centralized control system that integrates Oracle NetSuite as an Enterprise Resource Planning (ERP) solution, Amazon Web Services (AWS) Internet of Things (IoT) capabilities, and Nyckel AI's computer vision technology. This proposed solution aims to optimize operational efficiency, enhance quality control and compliance, and improve customer experience.

The report outlines the advantages of the proposed system, including cost-efficiency, optimized operations, improved quality control, and enhanced customer experience. However, potential disadvantages, such as customization costs, dependency on external services, and data privacy concerns, are also addressed.

A CATWOE analysis is conducted to understand the perspectives of various stakeholders, including customers, actors, owners, and environmental constraints. This analysis provides insights into stakeholder needs and expectations, facilitating informed decision-making.

Furthermore, the report includes Use Case diagrams, FURPS and MoSCoW analyses, project management tools (project scope checklist, stakeholder register, and Gantt chart), and a cost-benefit analysis. The cost-benefit analysis evaluates the financial implications, payback period, and return on investment (ROI) of the proposed solution.

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I. THE BUSINESS ISSUES

1. RICH PICTURE – OPPORTUNITIES IDENTIFICATION

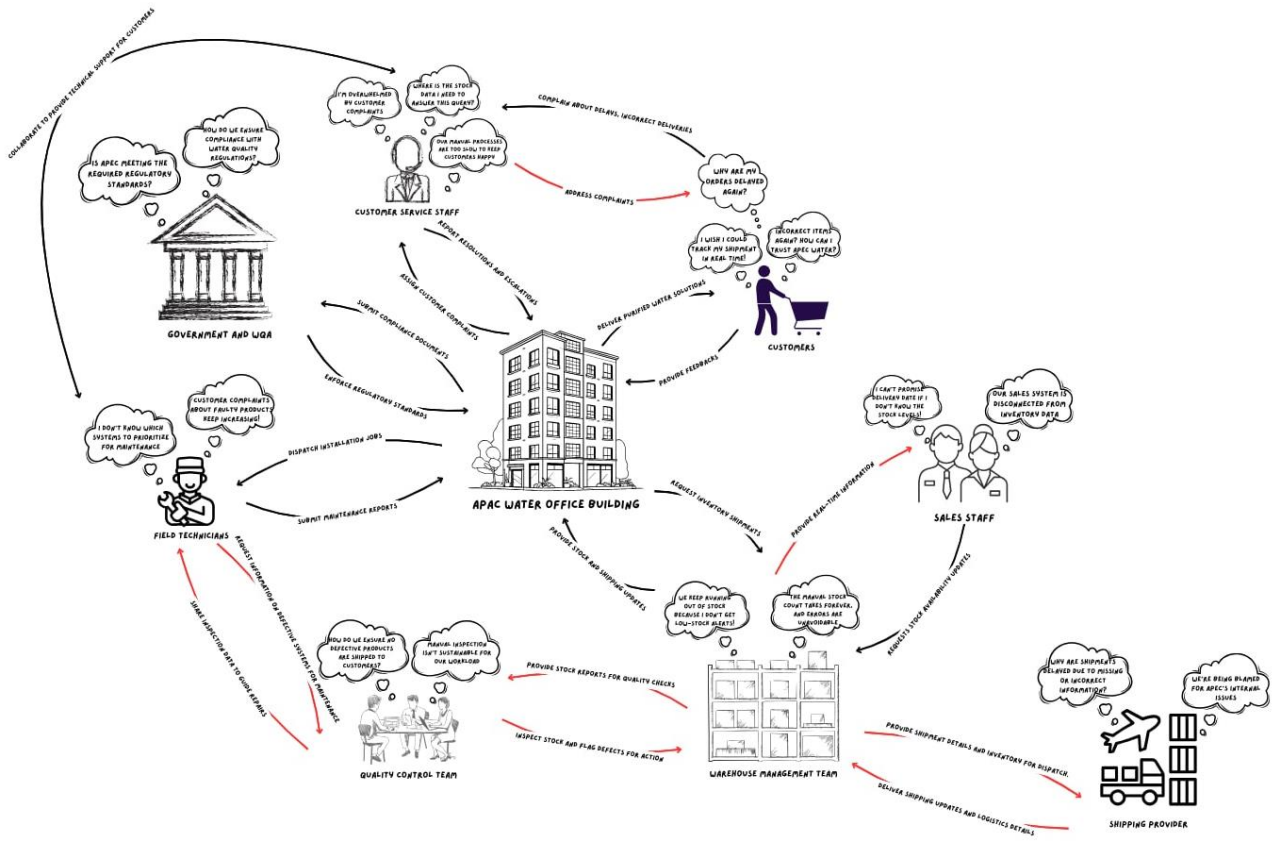


Figure 1: APEC Water's Rich Picture

1.1 WHAT IS RICH PICTURE?

A Rich Picture is a visual tool designed to present complex systems, processes, and stakeholder relationships holistically and intuitively. It serves as a means of capturing the diverse perspectives, concerns, and interconnections among stakeholders within a project. As discussed in Checkland and Poulter's work on soft systems methodology (Checkland and Poulter 2010), Rich Pictures are particularly effective for addressing "wicked problems," where stakeholders may have conflicting interests or priorities. By visualizing these aspects in a single diagram, the Rich Picture enables teams to grasp the broader context, identify key challenges, and explore actionable opportunities.

In the context of APEC Project Management, leveraging a Rich Picture allows project teams to place themselves in the stakeholders' positions, effectively understanding their concerns, priorities, and needs. This visualization approach encourages empathy, collaboration, and a shared understanding of the project's dynamics. For the APEC Water initiative, the Rich Picture is especially relevant as it aids in illustrating the interactions between customers, customer support, and field technicians, highlighting areas where the integration of this report's proposed systems could address existing inefficiencies. The tool serves as both a diagnostic and planning instrument, helping to align stakeholders' goals with actionable project outcomes.

1.2 APEC'S STAKEHOLDER NETWORK – RICH PICTURE VISUALIZE

The Rich Picture developed for APEC Water provides a detailed visualization of the stakeholders involved in its operations and their interrelations. By mapping these interactions, the diagram uncovers inefficiencies and identifies opportunities for optimization, particularly in the context of the proposed integration of this report's recommended technologies. The Rich Picture captures the network of stakeholders critical to APEC's operations, including customers, customer service teams, sales staff, warehouse management, quality control teams, APEC field technicians, shipping providers (e.g., FedEx), government agencies, and the Water Quality Association (WQA). Each stakeholder plays a distinct yet interconnected role, contributing to the organization's overall success.

Key insights from the visualization reveal several important dynamics. For instance, **customers**, as end-users of APEC's water filtration systems, rely heavily on efficient communication with customer service teams to report issues, request assistance, and provide feedback. **Customer service** staff act as intermediaries, diagnosing problems or escalating them to **field technicians**, who then ensure prompt on-site resolution. These interactions highlight the importance of seamless coordination among stakeholders, as delays or miscommunication can lead to customer dissatisfaction and operational inefficiencies.

Warehouse management and quality control teams are also pivotal in ensuring that only high-quality systems are dispatched to customers. The diagram shows their collaboration in identifying defective stock, managing inventory, and coordinating with shipping providers to deliver products efficiently. However, gaps in communication between these teams and external partners, such as logistics providers, can result in shipment delays or errors, underscoring the need for integrated systems.

Furthermore, the relationships between **APEC and regulatory bodies**, such as government agencies and the WQA, emphasize the importance of compliance with environmental and quality standards. Certifications from the WQA not only ensure adherence to industry benchmarks but also enhance customer trust and brand reputation.

The Rich Picture uses red arrows to signify pain points within the system. These include manual performance tracking by customers, leading to delayed issue identification; inefficiencies in warehouse-warehouse

communication, resulting in shipping errors; and incomplete diagnostic information provided to field technicians, causing delays in problem resolution. These inefficiencies present significant opportunities for improvement through the proposed integration.

2. BUSINESS PROCESS MODELING NOTATION (BPMN) DIAGRAM

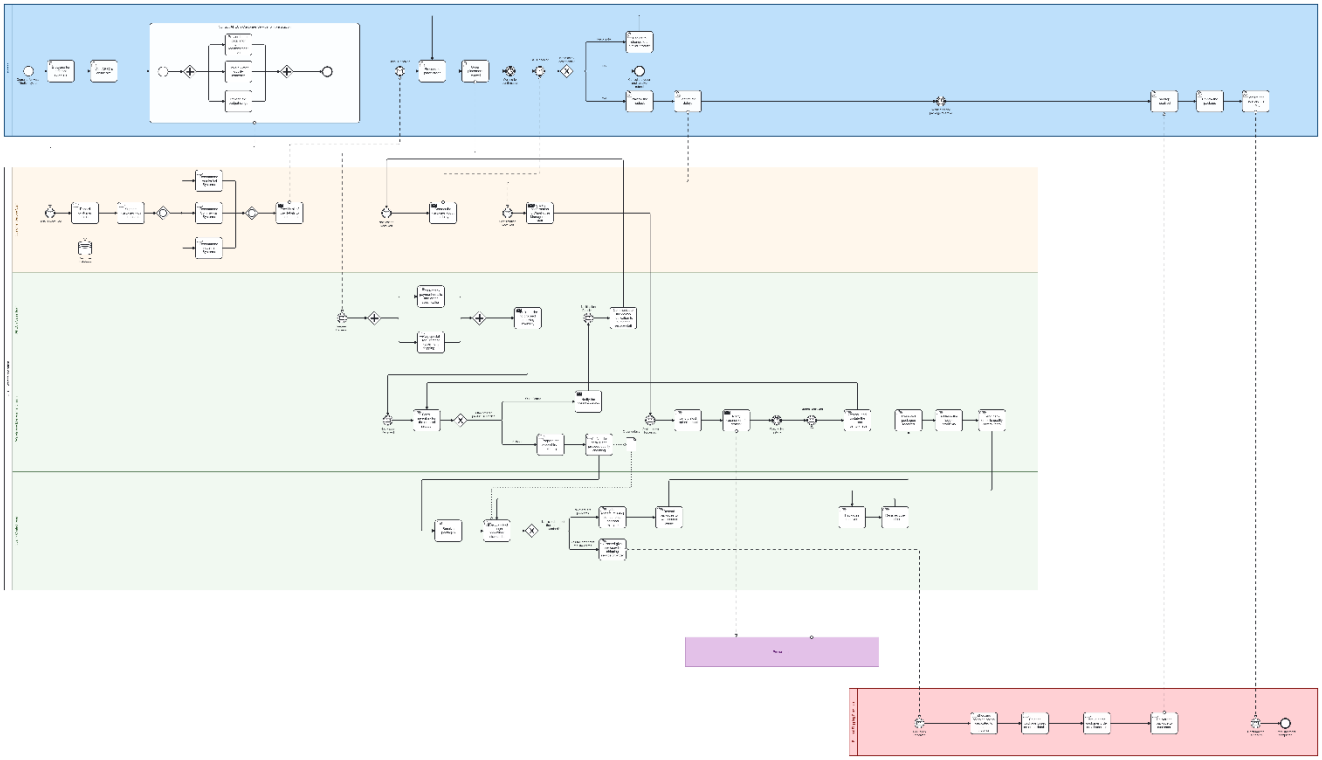


Figure 2: APEC Order processing' Business Process Modelling Notation (BPMN) Diagram (Link to external site: https://modeler.camunda.io/share/16572ff2-a3a3-4156-a588-a92a71435dc7)

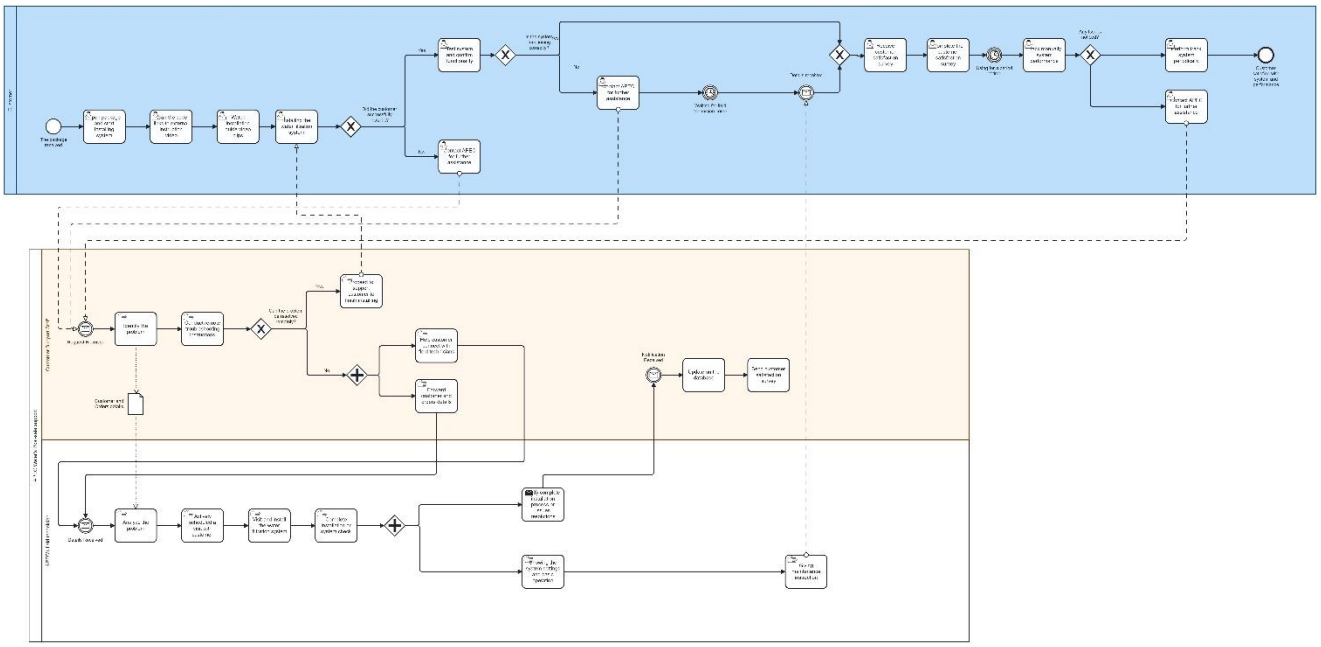


Figure 3: APEC Post-Sale Support Business Process Modelling Notation (BPMN) Diagram (Link to external site: https://modeler.camunda.io/share/7e550a2d-8b49-4e1a-a091-5cc581813758)

3. FISHBONE DIAGRAM – PROBLEM IDENTIFICATION ANALYSIS

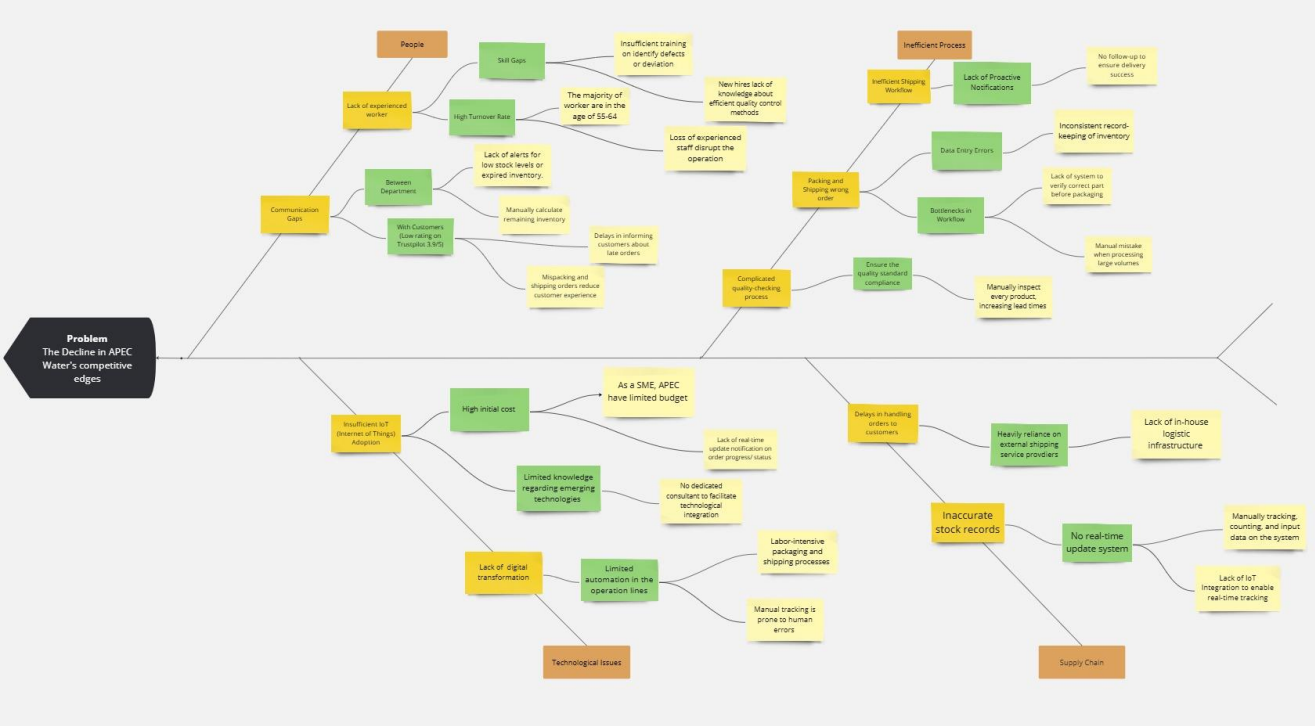


Figure 4: APEC Fishbone Diagram (Link to external site: https://miro.com/app/board/uXjVLAUGAXQ=/?share_link_id=409119939790)

3.1. People:

Inefficiencies in human resources have significantly on the competitive advantages of APEC Water

With a high turnover rate due to the majority of the workforce in this water industry is the age range of 55-64, and a skill gap caused by insufficient training on quality control and new hires, this has resulted in the lack of experienced workers in APEC Water, which is potentially disrupting APEC's operations

Moreover, there is a lack of efficient means of communication between the department and customers. Regarding communication between departments, this is being hindered by the absence of automated tracking, and alerting stock level, and some processes are done manually. These labor-intensive processes are prone to human errors, preventing streamlining the process and slowing down the information flow.

For customer interaction and engagement being shown through the rating platform, the inefficiency is caused by delays in informing customers about the orders' status and incorrectly packing the order.

3.2. Inefficient Process:

Overall APEC Water's operational processes are significantly hindered by the inefficiency in the quality standard compliance process as every product must undergo manual inspection. This is caused by the lack of means for verifying the water filtration system (model, designs, quality) before packing. Moreover, some manual mistakes when processing large volumes of orders create bottlenecks and low data consistency resulting from manual data input, this has led to further mistakes in packing and shipping, which negatively impact customer satisfaction when experiencing APEC Water's service. Another factor contributing to the dissatisfaction of customers is the lack of proactive notification and real-time updates, which limit the visibility of customers into the orders' shipment progress.

3.3. Technological Issues:

Regarding the technology domain, APEC Water's technological integration is considered efficient, which results in a decrease in APEC Water's competitive edge. Although the water industry can be significantly elevated by leveraging emerging technologies including Internet-of-things (IoT), there is a shortage and insufficient IoT adoption. This is largely due to budget constraints as APEC Water is an SME and limited digital literacy as there are no dedicated technology consultants to facilitate the adoption. Moreover, APEC Water's digital transformation was hindered by the lack of automation in operation, which is further caused by all the labor-intensive processes.

3.4. Supply Chain:

The core efficiencies in APEC Water's supply chain are caused by the lack of in-house logistic infrastructure, which further resulted in the dependence on external shipping service providers. This reduces APEC's flexibility and control over the shipment of packages to the customers' hand. Furthermore, the manual inventory management practices, in addition to the lack of IoT capabilities have prevented real-time inventory updates. This has resulted in the mismatch in record-keeping and further delays and human errors in the order fulfillment process.

II. THE SOLUTION AND USE CASES

1. SOLUTION IDEATION/ FORMATION

Implementing a centralized control system would be recommended for APEC Water to thoroughly address the core inefficiencies identified through the Rich Picture, BPMN Diagram and Fishbone analysis.

Regarding the inefficiencies in the workforce, a centralized system can bridge the skills gaps by providing a unified training platform, where training materials will be provided based on their roles and responsibilities (NetSuite n.d.a). Moreover, automating tasks such as order processing or item inspecting would reduce the workload for aging workers, which would improve job satisfaction and potentially lower the turnover rate. Furthermore, improving communication efficiency between departments by integrating real-time update inventory tracking and automated low-stock alerts. This reduces the delays and human errors in manual stock calculation, automating the information flow.

For customer engagement strategy, a centralized system can help customers keep track of their orders by allowing customers to gain visibility into order preparation and shipment progress, enabling real-time notification for any disruptions or possible delays in the processes. Moreover, a customer portal can be provided to assist customers in tracking the performance of all installed systems, providing proactive post-sale support to ensure a seamless customer experience.

In the matter of order processing practice, complying with quality standards and packing orders processes can be streamlined by introducing automated error detection before packing and order verification capabilities. These enhancements could minimize the frequency of incorrect packing and improve order fulfillment, which further increases customer satisfaction. As mentioned earlier, a centralized system providing real-time visibility into inventory management also brings isolated data into a unified platform, increasing the consistency in data type and record-keeping of stock.

2. PROPOSED TECHNOLOGIES SOLUTION

2.1 WHAT IS IT?

Based on the above rationale, the implementation of Oracle NetSuite as a centralized system integrated with IoT capabilities from AWS IoT cloud service and Artificial Intelligence (AI) with computer vision abilities from Nyckle is highly recommended for an SME in the retail industry like APEC Water

Oracle NetSuite is an affordable ERP (Enterprise Resource Planning) solution that provides a suite of applications to manage inventory, operations, etc. (NetSuite n.d.b). This will become an ideal solution for APEC Water as the system provides real-time stock updates and automated low-stock alerts will address the core inefficiencies in inventory management. Coming with NetSuite Guide Learning, the

system provides a role-based process guide to upskill the employees, therefore, reducing the skill gaps and turnover rate (NetSuite n.d.c). Moreover, customer relations management (CRM) tools were also being integrated into Oracle NetSuite, providing a more personalized experience for customers during the pre-sale, on-sale, and post-sale phases (Biel 2023).

Figure 5: Oracle NetSuite's functionalities (Modh 2023)

Nyckel AI's real-time monitoring capabilities from computer vision further augment operations by enabling automated product verification, error detection, and ensuring accuracy at scale (Akhtar and Martha 2024; Weston 2023). In addition to this, AWS IoT's capabilities could be enhanced by precisely tracking APEC Water filtration systems' performance, which streamlines the quality assurance process and improves post-sale customer support.

Together, these technologies create a proactive, automated environment that minimizes efficiencies while digitally transforming APEC Water's operations.

2.2 ADVANTAGES AND DISADVANTAGES OF PROPOSED SYSTEM

2.2.1 PROPOSED SYSTEM'S ADVANTAGES

Ensures Cost-Efficiency and Complicated in-house IT infrastructure

Cost considerations are crucial for SMEs like APEC to adopt cloud-based services from external technology solution providers. As the business transforms its operations digitally, APEC shifts its capital expenditures (CAPEX) to ongoing operational expenditures (OPEX) due to subscription costs. This helps SMEs have access to enterprise-grade technology while eliminating substantial upfront investments and introducing a more predictable budgeting plan (Mkhize et al. 2024)

Optimize operational efficiency

The implementation of Oracle NetSuite will introduce automation in manual tasks and any labor-intensive process. This could streamline processes in every aspect of the company operations from customer service workflow and inventory management to quality control workflow and packing process.

Along with AWS IoT and Nyckel's computer vision, the integration allows real-time monitoring of filtration products during both manufacturing and customer installations, providing instance feedback on the systems' performance and reducing human inspections.

Improve Quality Control and Compliance

All APEC's water filtration systems must comply with US national standards for water treatment such as NSF/ANSI 58 standards which reverse osmosis systems reduce the contaminants that are regulated by Health Canada and EPA (NSF n.d.). By utilizing the proposed system with IoT sensors, APEC Water can benefit from real-time monitoring of turbidity, pH, and temperature, enabling prompt abnormalities detection (Alshami et al. 2024). This will facilitate timely corrective actions and further enhance quality control.

Enhance customer experience when using the Service

Order fulfillment processes can be enhanced through a centralized system that enables APEC to gain real-time visibility into the inventory, moreover, computer vision can detect and verify the right parts when packing, reducing the incorrect order packing.

In the installation and utilization phase of customers, AWS IoT allows them to monitor systems' performance remotely through an application that compiles all of the installed products. This equips APEC Water with proactive customer support.

2.2.2 PROPOSED SYSTEM'S DISADVANTAGES

Encounter customization costs for filtration-specific needs and hidden expenses.

During the development phases, APEC might need to customize the system to address its specific industrial needs and unique operational processes. This could result in some additional customization costs and hidden costs including data migration or employee training costs (Mkhize et al. 2024). For

instance, implementing Nyckel's computer vision would require training costs for the reverse osmosis – APEC's product detection capability and training costs for employees to operate or maintain it.

Dependency on external services

Leveraging Oracle NetSuite, AWS IoT, or Nyckel technologies whereas they are external platforms can make APEC Water highly reliant on these vendors. Moreover, the possibility of cloud downtime could disrupt the company's performance (Mkhize et al. 2024). For instance, as the IoT system constantly tracks APEC's water filtration system once installed, if there is any malfunction or system downtime of the IoT's service providers, APEC cannot provide their post-sale support remotely and effectively.

Data privacy and security concerns

The lack of active control and flexibility makes approximately 50% of businesses report that privacy is their greatest concern when making decisions using cloud-based services (Nagahawatta et al. 2024). As APEC may collect some sensitive data regarding their customers including personally identifiable information, and health-related data (indirectly)… any data breaches could damage APEC's reputation.

3. CATWOE ANALYSIS

APEC Water (Board of Director)					
Customers	**Actors**	**Transformation**	**Worldview**	**Owners**	**Environment**
Shareholders and other stakeholders, including employees, customers, and regulatory bodies.	Board members making strategic decisions and evaluating company performance.	The process involves setting strategic objectives, approving budgets, and monitoring organizational performance to align with APEC's mission and vision.	To oversee and guide APEC Water's strategic direction, ensuring profitability, sustainability, and regulatory compliance for the benefit of shareholders and other stakeholders.	APEC Water	Adherence to corporate governance frameworks, such as the Sarbanes-Oxley Act (SOX) for transparency and accountability, and ISO 26000: Guidance on Social Responsibility to ensure ethical business practices.
Customers					
Customers	**Actors**	**Transformation**	**Worldview**	**Owners**	**Environment**
The end-users who purchase APEC Water filtration systems.	Customer support staff, sales staff, and technicians facilitating the customer experience.	The process involves ensuring timely order fulfillment, effective water filtration, and comprehensive customer support before, during, and after purchase.	Customers want efficient and reliable water filtration solutions, along with seamless pre-sale, on-sale, and post-sale experiences.	APEC Water	Adherence to the Safe Drinking Water Act (SDWA, U.S. Public Law 93-523) and NSF/ANSI Standards 42, 53, and 58 for water filtration systems.
Customer Support					
Customers	**Actors**	**Transformation**	**Worldview**	**Owners**	**Environment**
APEC Water's customers seeking assistance with their purchases or system performance.	Customer support representatives using real-time CRM tools and centralized systems.	The process involves utilizing tools like **Oracle NetSuite** to provide faster response times, track customer interactions, and resolve issues proactively.	Customer support exist to address customer inquiries and issues efficiently, ensuring a positive customer experience that builds loyalty and trust in the APEC brand.	APEC Water Management Team	Compliance with the Consumer Protection Act (15 U.S.C. §§ 2301–2312) and adherence to FTC guidelines for product warranties and customer service.
Sales Staff					
Customers	**Actors**	**Transformation**	**Worldview**	**Owners**	**Environment**
Prospective and returning buyers of water filtration systems.	Sales personnel using CRM tools and conducting outreach efforts.	The process involves automating sales tracking and customer management through Oracle NetSuite CRM to create seamless pre-sale and on-sale experiences.	Sales staff exist to attract new customers and retain existing ones by providing personalized product recommendations and maintaining strong customer relationships.	Sales department heads at APEC Water.	Adherence to the Truth in Advertising Act (15 U.S.C. § 45) and industry best practices for ethical sales techniques.
Warehouse Management Team					
Customers	**Actors**	**Transformation**	**Worldview**	**Owners**	**Environment**
Internal stakeholders such as sales teams and external shipping providers.	Warehouse staff managing inventory and logistics.	The process involves implementing real-time inventory tracking and automated low-stock alerts to minimize errors and delays.	The warehouse team exists to manage inventory efficiently, ensuring accurate stock levels and timely fulfillment of customer orders.	APEC Water's supply chain managers.	Compliance with ISO 9001:2015 (Quality Management Systems) and OSHA regulations for warehouse safety (29 CFR 1910).
Quality Control Team					
Customers	**Actors**	**Transformation**	**Worldview**	**Owners**	**Environment**
End-users relying on safe and effective water filtration systems.	Quality control inspectors using AI tools for monitoring product quality.	The process involves automated product testing, error detection, and verification processes to maintain high-quality standards.	The quality control team exists to ensure that all APEC Water products meet performance and safety standards, minimizing customer complaints and returns.	APEC Water's production management team.	Compliance with NSF/ANSI Standards 42, 53, and 58 and EPA regulations under the Safe Drinking Water Act.
APEC's Field Technician					
Customers	**Actors**	**Transformation**	**Worldview**	**Owners**	**Environment**
APEC customers requiring on-site services like installation or repairs.	Field technicians using IoT tools for system diagnostics and maintenance.	The process involves using IoT-integrated systems for real-time monitoring and diagnostics, enabling proactive servicing.	Field technicians exist to ensure the proper installation and maintenance of water filtration systems, guaranteeing optimal performance and customer satisfaction.	APEC Water's operations team.	Adherence to the National Electrical Code (NEC) and ANSI/ASME safety standards for plumbing and water systems.
Shipping Service Providers (FedEX)					
Customers	**Actors**	**Transformation**	**Worldview**	**Owners**	**Environment**
APEC Water and its end-users awaiting product deliveries.	FedEx logistics staff handling APEC shipments.	The process involves leveraging automated tracking systems to provide real-time updates and minimize delivery delays.	Shipping providers exist to deliver APEC Water products to customers promptly and safely, ensuring a seamless end-to-end customer experience.	APEC Water and FedEx as service partners.	Adherence to the International Air Transport Association (IATA) standards and the U.S. Department of Transportation (DOT) regulations for shipping.
Government					
Customers	**Actors**	**Transformation**	**Worldview**	**Owners**	**Environment**
The general public relying on safe and sustainable practices.	Regulatory agencies like the EPA and FTC monitoring compliance.	The process involves APEC Water complying with regulations such as the Safe Drinking Water Act (SDWA) for water quality, the Clean Water Act (CWA) for environmental impact, and the Federal Trade Commission Act (FTC Act) for ethical business practices.	Government regulatory bodies exist to enforce laws ensuring product safety, environmental sustainability, and fair market practices.	APEC Water's compliance and legal teams.	Legal frameworks under the SDWA, CWA, and FTC Act.
Water Quality Association (WQA)					
Customers	**Actors**	**Transformation**	**Worldview**	**Owners**	**Environment**
Industry stakeholders and consumers looking for certified water filtration products.	WQA assessors and auditors.	The process involves certifying APEC Water products under NSF/ANSI standards and conducting periodic quality checks.	The WQA exists to uphold high standards for water filtration products, ensuring that consumers receive safe and effective solutions.	WQA's board and certification committees.	Compliance with NSF/ANSI 42, 53, and 58 standards and WQA's Gold Seal Certification program.

Figure 6: APEC Water's CATWOE analysis

3.5. WHAT IS CATWOE ANALYSIS?

CATWOE is an analytical tool derived from systems thinking, designed to explore and evaluate complex problems by considering the perspectives of all stakeholders involved. The acronym stands for Customers, Actors, Transformation process, Worldview, Owners, and Environmental constraints, with each element shedding light on different dimensions of a system. According to Basden et al. (2004), CATWOE facilitates structured thinking by mapping out relationships and priorities, which aids in decision-making and problem resolution.

In the context of APAC Project Management, CATWOE offers a systematic approach to identifying stakeholder needs, aligning objectives, and addressing organizational challenges. By utilizing CATWOE, APAC Water can gain a clearer understanding of internal and external dynamics, enabling the organization to design solutions that are not only effective but also inclusive of diverse viewpoints. This approach is especially relevant as APAC Water integrates advanced technologies like Oracle NetSuite ERP and AWS IoT to optimize its operations. The CATWOE framework ensures that these

initiatives are strategically aligned with the expectations of stakeholders, regulatory compliance requirements, and sustainability goals.

The timing of this analysis is critical, as the company is undergoing significant transformation to enhance its competitive edge in the green economy. Employing CATWOE now allows APAC Water to proactively address potential bottlenecks, streamline workflows, and foster trust among its stakeholders by demonstrating an empathetic and comprehensive understanding of their concerns.

3.6. APAC STAKEHOLDERS UNDERSTANDING – CATWOE EXPLANATION

The CATWOE analysis for APAC Water reveals crucial insights into the roles, responsibilities, and expectations of its stakeholders, providing a foundation for informed decision-making. Each element of CATWOE uncovers specific dynamics that shape the company's operations:

- Customers: The analysis highlights that APAC Water's end-users demand efficient, reliable, and seamless water filtration solutions. Their expectations extend beyond product performance to include superior pre- and post-sales support. Meeting these demands requires adopting a customer-centric approach, supported by advanced tools for proactive issue resolution.
- Actors: This category includes customer support teams, sales representatives, field technicians, and warehouse staff who play pivotal roles in delivering customer satisfaction. The CATWOE analysis identifies opportunities to enhance interdepartmental coordination and equip actors with robust tools, such as centralized data systems, to improve response times and service quality.
- Transformation Process: This element focuses on the workflows that convert inputs, such as customer inquiries or maintenance requests, into tangible outcomes. The analysis reveals inefficiencies in areas like inventory management and service scheduling, which can be mitigated through the integration of IoT-enabled sensors and ERP systems to automate and streamline processes.
- Worldview: From a broader perspective, the company's commitment to sustainability and innovation is integral to its brand identity. This worldview aligns with the expectations of customers, regulators, and industry associations, reinforcing APAC Water's reputation as a leader in green technologies and ethical practices.
- Owners: The board of directors and senior management are responsible for steering the company toward strategic goals. The CATWOE framework underscores their role in ensuring that operational changes are not only compliant with regulations but also aligned with long-term objectives, such as achieving sustainability benchmarks and market growth.

- Environmental Constraints: External factors, including legal requirements and market dynamics, significantly influence APAC Water's operations. The analysis identifies the need for adaptive strategies that address these constraints while maintaining operational efficiency and customer satisfaction.

This CATWOE analysis provides a comprehensive understanding of APAC Water's ecosystem, enabling the company to anticipate challenges and capitalize on opportunities. By addressing stakeholder-specific concerns, the analysis contributes valuable insights to this report, offering actionable recommendations for improving workflows, fostering trust, and enhancing overall performance. For example, integrating Oracle NetSuite ERP can resolve issues in inventory management, while IoT-enabled tools can improve diagnostic accuracy for field technicians.

4. ROOT DEFINITION

4.1 USE CASE DIAGRAMS

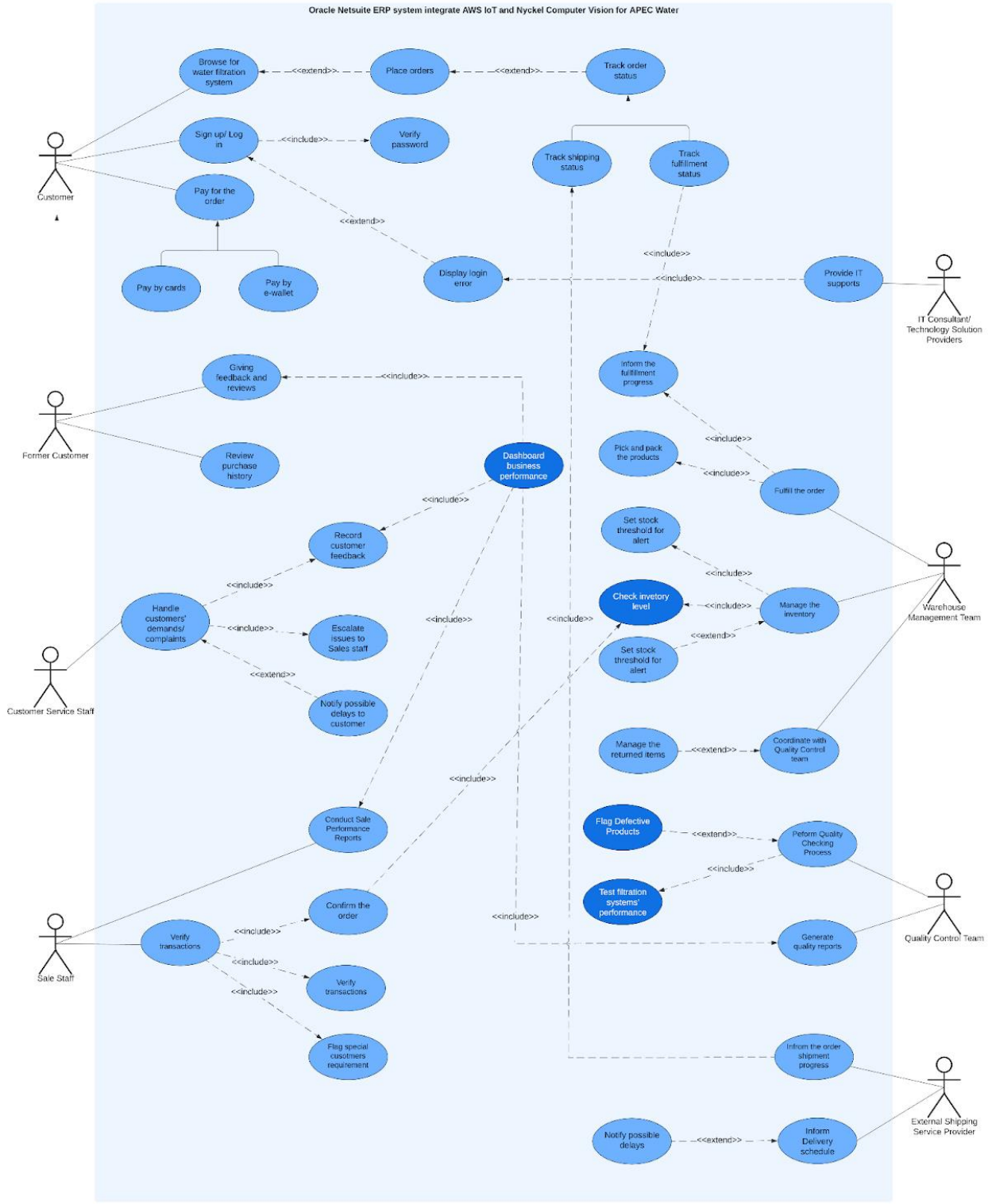


Figure 7: APEC Ordering Process's Use Case Diagram (Source: Author)

Figure 7 illustrates the interaction between various actors regarding the APEC order fulfillment process in the proposed system boundary. The primary actors who will initiate the process are Customers (child actors: Former Customers), Customer Service Staff, and Sales Staff. While there

will be secondary actors who will actively react to primary actors' actions: IT Support, Warehouse Management Team, Quality Control Team, and External Shipping Service Providers.

Customers will interact with the system by logging into their accounts, browsing water filtration systems on the customer portal, and placing orders. The orders will be confirmed by Sales Staff to ensure the delivery of orders. Customers will then deposit or fully pay for the orders by various methods that are offered by the system including pay by card or e-wallet. Former Customers who have already experienced the service can leave a review on the products or review the previous purchases. Customer Support Staff are responsible for storing customer feedback for further conducting data analysis and enhancing business performance. If there are any unexpected system issues arise, the Technology Solution Providers will provide IT support to resolve them.

Received the order placement and payment from customers, Sales Staff will verify the transaction and flag any special requirements from customers. Then the orders will be informed to the warehouse management team to fulfill the order, in case the orders cannot be fulfilled, data on the stock will be automatically updated and customer service staff will actively contact customers to inform possible delays.

For the order fulfillment process, the warehouse management team will monitor the inventory level and order from procurement if low-stock alerts are triggered. If the current stock level can process the orders, the correct products followed by the customer orders will be picked and sent to the quality control team. Any defects or abnormalities regarding the testing products' performance processes being recognized will be sent back to the warehouse management team to address the problems, ensuring that they meet standardized quality when it comes to customers' hands. Every process in the process of fulfilling orders will be tracked and updated for customers to gain visibility in the preparing order processes

The final products will be sent to the external shipping service providers where order shipping progress will be constantly updated for customers to track.

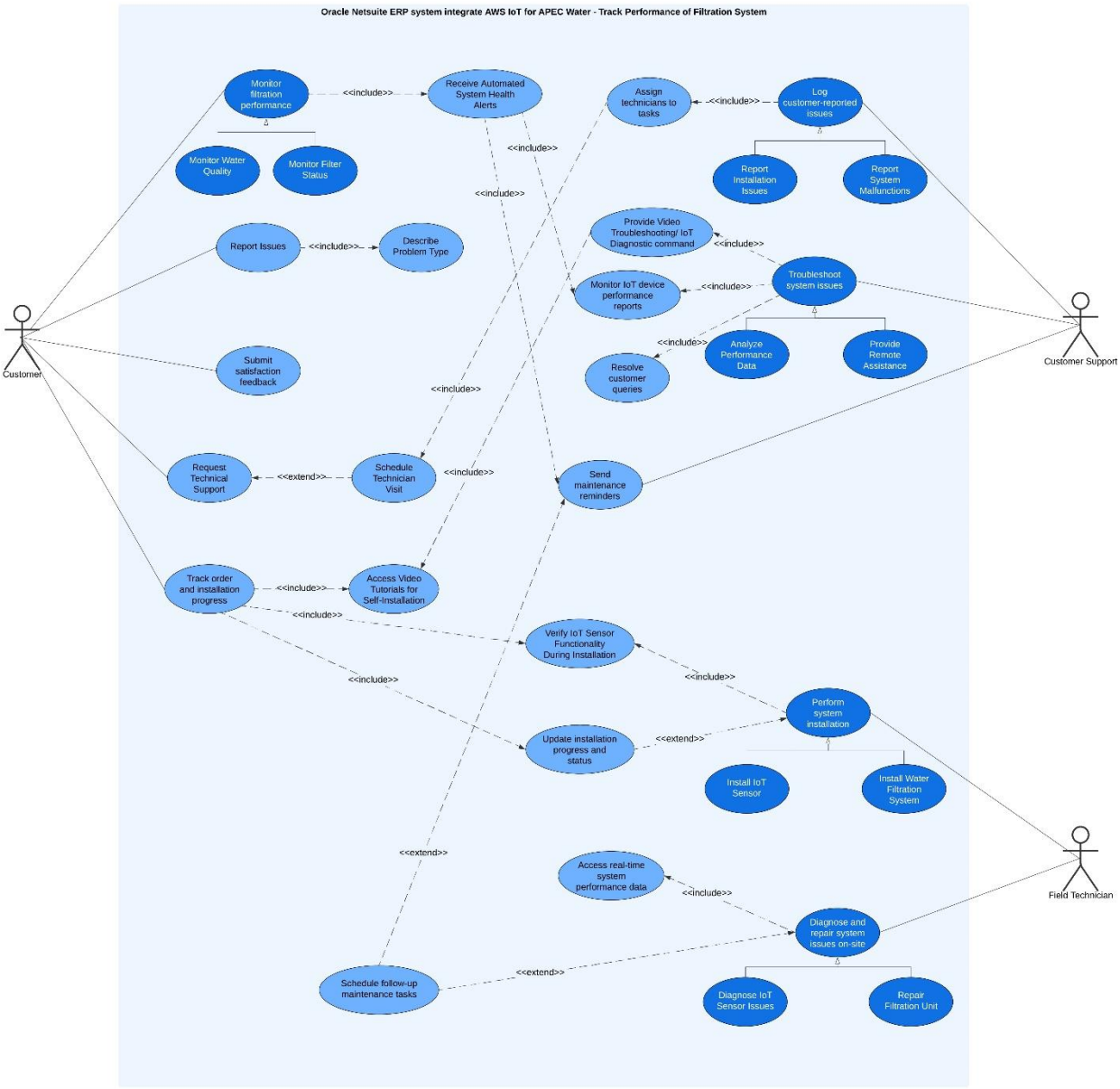


Figure 8: APEC Post-sale support's Use Case Diagram (Source: Author)

Figure 8 illustrates the interactions among key stakeholders involved in APEC's post-sale support process, highlighting how the system facilitates seamless communication and efficient service delivery. The primary actor in this framework is the Customer, supported by secondary actors such as Customer Support Staff and Field Technicians. These stakeholders interact dynamically with the system and each other to ensure customer satisfaction and operational efficiency.

Customers interact with the system primarily to monitor the performance of their water filtration units using IoT-enabled features. Through the system, customers can track filtration status, receive real-time IoT alerts, and report issues such as device malfunctions or installation problems. Additionally, customers are encouraged to provide feedback, including completing satisfaction surveys, which

contributes to service improvement. For any ongoing installations, customers can view progress updates and receive notifications directly from technicians.

Customer Support Staff play a crucial role in resolving customer concerns by logging and classifying issues reported via the system. They also assist customers remotely, using tools like video troubleshooting and IoT diagnostic commands to address performance-related concerns without requiring physical visits. When necessary, support staff can schedule technician visits, ensuring appointments are confirmed with the customer. Furthermore, they maintain and update customer records, including storing historical performance data, which enables personalized support and future analytics.

Field Technicians interact with the system during on-site visits for installations, repairs, or maintenance tasks. They are responsible for setting up new systems, which include installing IoT sensors and configuring water filtration units. For repair tasks, technicians diagnose and address system issues by testing components, resolving IoT sensor faults, or repairing filtration units. After completing their tasks, technicians update the system with the current status and provide confirmation of service completion, ensuring all relevant stakeholders remain informed.

The interactions among these stakeholders are streamlined through system features. For instance, customers can report issues and request assistance, while receiving real-time updates from customer support and technicians. Customer Support Staff, in turn, use the system to log customer concerns and automatically schedule technician visits based on diagnostic data. Field technicians rely on the system to access device history, receive service assignments, and update records following repairs or installations.

This interconnected framework ensures that every stage of the post-sale support process, from issue reporting to resolution, is integrated and transparent. By linking customers, support staff, and technicians through a centralized system, APEC not only enhances service quality but also fosters trust and reliability. This comprehensive approach underscores the organization's commitment to customer satisfaction and operational excellence.

4.2 FURPS AND MOSCOW ANALYSIS

4.2.1 WHY USE FURPS AND MOSCOW MODEL?

The FURPS model is an essential tool for assessing software quality in the project development phase. It ensures comprehensive coverage of system requirements by categorizing the requirements into

functionality, usability, reliability, performance, and supportability (Singh and Kassie 2018). This model can be used both as software requirements design and evaluation tools (Bitew and Singh 2019).

On the other hand, the MoSCoW model simplifies the decision-making process by providing a prioritization technique and categorizing requirements into (M) Must, (S) Should, (C) Could, and (W) Won't. This model can help the system fulfill the user requirements while ensuring the time and resource allocation are focused on the critical features (Nguyen 2022).

Therefore, by conjoining FURPS and MoSCoW together, stakeholders will be provided with a more comprehensive requirement-priority matrix, ensuring the stakeholders' engagement in the prioritization phase (Dyson 2019).

4.2.2 FURPS AND MOSCOW ANALYSIS

FURPS – MoSCoW Analysis					
		MoSCoW			
FURPS Requirements		**M**	**S**	**C**	**W**
F	**Functional**	**Must**	**Should**	**Could**	**Won't (For now)**
	Tracking stock (Inventory Management)	Real-time inventory tracking via Oracle NetSuite, AWS IoT, and Nyckel AI			
	Error Detection (Quality Control)	Real-time abnormalities flagging and report via AWS IoT and Nyckel AI			
	Water filtration systems' performance tracking	Constantly tracking and updating data of the performance via AWS IoT.			
	Customer portal for tracking installed products' performance	Real-time tracking abnormalities and alerts for customers of the installed devices via AWS IoT			
U	**Usability**	**Must**	**Should**	**Could**	**Won't**

	Dashboards for inventory and quality control	Being generated automatically based on the collected data, simple and intuitive for end-users			
	Training sessions for employees	Leverage role-based access control to provide training materials.			
R	**Reliability**	**Must**	**Should**	**Could**	**Won't**
	Accuracy of error detection	The accuracy of defect classification achieved through Nyckel's computer vision is approximately 95% (Nyckel n.d.)			
	System recoverability	Auto-backup data on the Oracle database multiple times a day			
P	**Performance**	**Must**	**Should**	**Could**	**Won't**
	Latency threshold for data synchronization	The tolerant delays in data updates onto the database are 5 seconds.			
S	**Support**	**Must**	**Should**	**Could**	**Won't**
	The growth of business/ system updates and maintenance			Ensure flexibility and customization to add new modules for industrial needs	
	Business legacy system	Allow the integration with APEC's current systems.			

Figure 9: FURPS and MoSCoW model for the proposed system

III. PROJECT MANAGEMENT

1. PROJECT SCOPE CHECKLIST

Categories	Details
Project Objective	Implement a centralized IT solution that includes Oracle NetSuite, AWS IoT Cloud, and Nyckel AI to improve APEC Water's operational efficiency, quality control, and customer experience.
Deliverables	**1. System Setup and Configuration:** • Installation of Oracle NetSuite ERP with inventory management, order processing, and CRM modules. • Deployment of AWS IoT sensors on filtration systems for real-time monitoring. • Integration of Nyckel AI for automated quality control using computer vision. **2. Customized Applications:** • Mobile app for customer order tracking and filtration system monitoring. • Employee training portal with role-specific learning guides. **3. Process Automation Features:** • Real-time stock updates and automated low-stock notifications. • Automated order verification and error detection during packing. **4. Quality Control Enhancements:** • AI-based detection of defective products during manufacturing. • IoT-enabled monitoring of water quality metrics (pH, turbidity, etc.). **5. Documentation and Training Materials:** • Comprehensive system user manuals for all departments. • Training modules for employees on system operations and maintenance. **6. Testing and Deployment Reports:** • Test case results for functionality and integration. • Deployment performance reports and feedback documentation.
Milestones	**1. Project Initiation** *(January 2025)* • Approve project scope, budget, and timeline. • Assign project roles and responsibilities. • Conduct business process analysis and stakeholder consultations. • Identify key inefficiencies in current operations. • Finalize technical requirements and integration specifications. • Kick-off vendor coordination with Oracle, AWS, and Nyckel. **2. System Development and Configuration** *(February 2025 - April 2025)* • Install and configure Oracle NetSuite ERP, including CRM, inventory, and order processing modules. • Develop workflows for automated inventory management and order processing. • Deploy IoT-enabled sensors for water filtration systems. • Configure AWS IoT cloud infrastructure for real-time data processing. • Implement Nyckel AI models for product defect detection. • Train AI models on product-specific configurations (e.g., reverse osmosis systems). • Develop a customer-facing mobile app for order tracking and system performance monitoring.

	• Build the employee training portal integrated with Oracle NetSuite Guide Learning. • Conduct end-to-end system configuration and integration of all components. **3. Testing and Validation** *(April 2025 - May 2025)* • Perform functional testing of individual components (ERP, IoT, and AI). • Validate ERP workflows, IoT sensor outputs, and AI defect detection. • Conduct integration testing to ensure seamless operation across platforms. • Resolve any system compatibility or data synchronization issues. • Run user acceptance testing (UAT) with feedback from stakeholders. • Document and address any remaining issues. **4. Training and Documentation** *(May 2025)* • Conduct employee training sessions on Oracle NetSuite, AWS IoT, and Nyckel AI tools. • Provide role-specific guides and interactive tutorials. • Distribute user manuals and finalize training modules based on feedback. • Test employees' ability to use the system with practical simulations. **5. Deployment and Monitoring** *(June 2025 - July 2025)* • Deploy the centralized system across APEC Water's operations. • Provide on-site support to address deployment issues. • Monitor system performance and refine configurations as needed. • Collect initial feedback from employees and customers. • Implement adjustments based on feedback and performance data. • Prepare and deliver the final project report to stakeholders.
Technical Requirements	- **System Compatibility:** Seamless integration of Oracle NetSuite, AWS IoT, and Nyckel AI. - **Data Synchronization:** Minimally delayed real-time data exchange. - **Cloud Infrastructure:** Scalable and reliable. - **IoT Sensors:** High-precision metrics for turbidity, pH, and temperature. - **Computer Vision:** AI tailored to reverse osmosis system error detection.
Limits	- **Customization Constraints:** Limited to critical operational needs. - **Vendor Dependency:** Reliance on Oracle, AWS, and Nyckel for updates and maintenance. - **Data Privacy and Security:** Basic compliance measures only. - **Scope Limitation:** Excludes global expansion or regions outside core operations. - **Hardware Procurement:** IoT sensors sourced by APEC Water.

Figure 10: Proposed system's project scope checklist table

2. STAKEHOLDER REGISTER

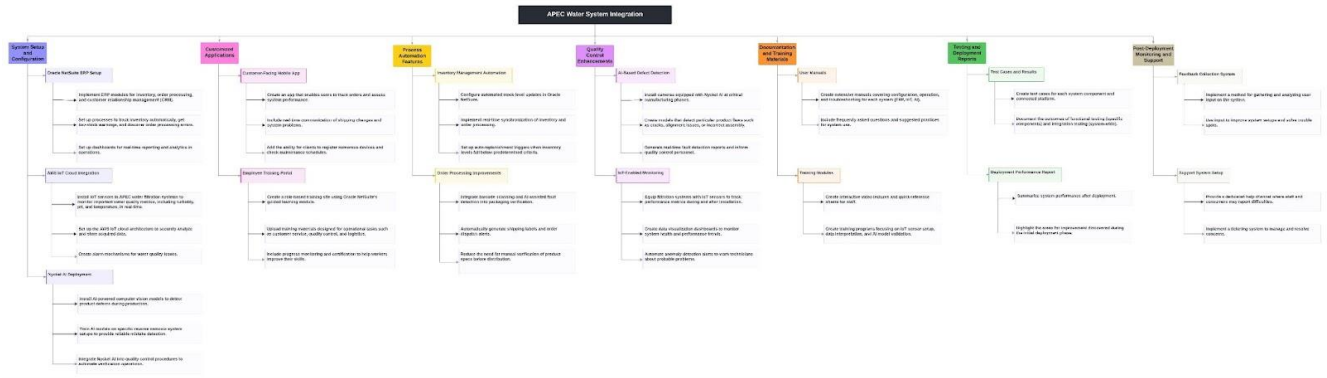


Figure 11: Proposed system's work breakdown structure diagram (Link to external site: https://lucid.app/lucidspark/83897543-e20e-44c1-a534-c95fc85737d3/edit?viewport_loc=-1059%2C202%2C4320%2C2460%2C0_0&invitationId=inv_d7ee986b-238c-4b9f-bb84-1eb077c9535f)

The APEC Water System Integration project's Work Breakdown Structure (WBS) offers a comprehensive structure of activities and deliverables that are intended to enable seamless execution. The project starts with **System Setup and Configuration**, which focuses on building basic technologies including Oracle NetSuite ERP for operational efficiency, AWS IoT sensors for real-time monitoring, and Nyckel AI for defect identification. Next, **Customized Applications** improve user engagement by providing a mobile app for consumer contact and a staff training site for efficient onboarding. **The Process Automation Features** area covers real-time inventory tracking, automated order processing, and mistake reduction, while **Quality Control Enhancements** use AI and IoT technologies to detect defects and monitor system performance. **Documentation and Training Materials** include user manuals and training modules to aid in system adoption. **The Testing and Deployment Reports** assure system dependability by doing thorough testing and performance analysis. Finally, **Post-Deployment Monitoring and Support** establishes feedback channels and support systems to ensure efficiency and handle issues that arise after launch. This precise framework guarantees that the project matches with the organization's goals, optimizes procedures, and produces a strong, user-friendly system.

3. STAKEHOLDER REGISTER

Name of Stakeholder	Designation	Department	Role in Project	Type of Stakeholder	Type of Communication	Expectation	Influence on Project Outcome
APEC Management Team	Business Leaders	Management	Project Sponsor	Internal	Email, Weekly Meetings, Reports	Project aligns with organizational goals, completed within budget and timeline	Influencer
IT Department	Technical Leads/Engineers	Software	Architects, Developers, System Support	Internal	Meetings, Reports, Online Tools	Seamless system integration and maintenance	Influencer
Customer Service Staff	Customer Support Agents	Customer Service	End-Users	Internal	Training Sessions, Feedback	Improved communication tools, streamlined workflows	Supporter
Quality Control Team	QC Inspectors	Quality Assurance	End-Users	Internal	Workshops, Reports	Automated error detection and enhanced product quality verification	Influencer
Field Technicians	Technicians	Field Services	Service Technicians	Internal	Mobile App, Training	Real-time monitoring tools for system performance tracking	Supporter
End-Customers	Clients	External	Key Stakeholders	External	Email Notifications, App Updates	Real-time order tracking, improved post-sale support	Influencer
Technology Vendors	Service Providers	Oracle, AWS, Nyckel	Solution Providers	External	SLA Meetings, Technical Support	Reliable system integration, ongoing support, and regular updates	Influencer

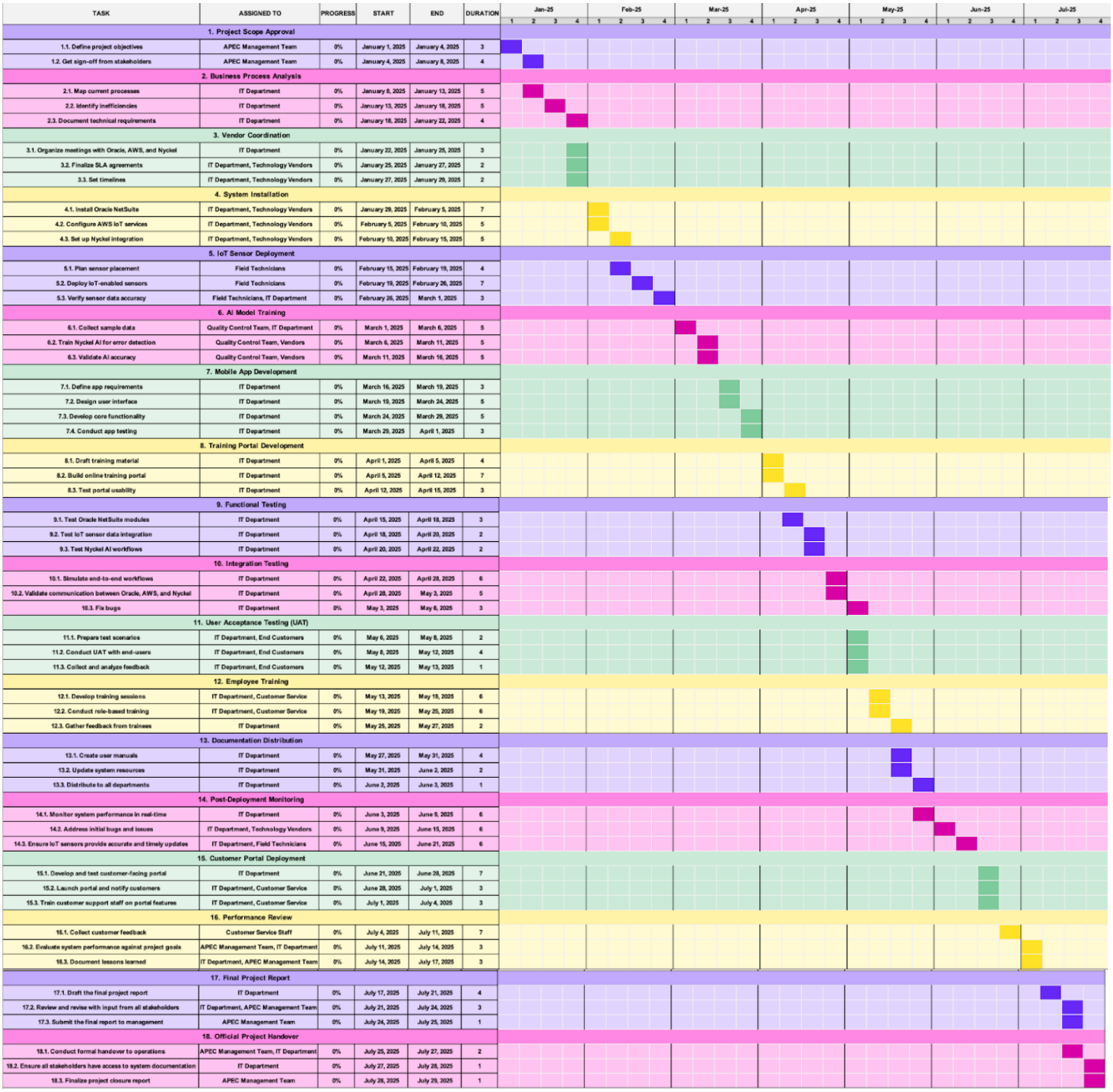
Figure 12: Proposed system's stakeholder register

The stakeholder register defines the project's major participants, including their responsibilities, communication preferences, expectations, and impact on the project's outcome. Stakeholders are organized by role and department. The **APEC Management Team**, as business executives and project sponsors from the management department, play an important role in synchronizing corporate goals and ensuring project completion within budget and timetable, making them essential influencers. The **IT Department**, comprised of technical leaders and engineers, is in charge of system integration and maintenance. Their roles as architects, developers, and system support make them key influences in ensuring flawless technical operations.

Customer Service Staff, functioning as end users, anticipate enhanced communication tools and simpler operations. They contribute to the project by offering comments during training sessions. Similarly, the **Quality Control Team** works on quality assurance with the goal of automating mistake identification and improving product verification. Their role as end users also provides them a significant voice in enforcing quality standards. **Field Technicians**, like service technicians in field services, need real-time monitoring tools to track system performance. They are supporters who rely on training and mobile applications to conduct their activities.

External stakeholders include **End-Customers**, who act as major influencers by requesting real-time order tracking and greater post-purchase assistance. Finally, **Technology Vendors**, such as Oracle, AWS, and Nyckel, serve as solution providers by guaranteeing consistent system integration, continuing support, and frequent upgrades. They have a substantial effect on the project's technical success. Communication with various stakeholders is tailored to their responsibilities, ranging from emails and reports to workshops and SLA meetings, ensuring that their expectations are met while remaining aligned with the project's goals.

4. GANTT CHART



TASK	ASSIGNED TO	PROGRESS	START	END	DURATION
1. Project Scope Approval					
1.1. Define project objectives	APEC Management Team	0%	January 1, 2025	January 4, 2025	3
1.2. Get sign-off from stakeholders	APEC Management Team	0%	January 4, 2025	January 8, 2025	4
2. Business Process Analysis					
2.1. Map current processes	IT Department	0%	January 8, 2025	January 13, 2025	5
2.2. Identify inefficiencies	IT Department	0%	January 13, 2025	January 18, 2025	5
2.3. Document technical requirements	IT Department	0%	January 18, 2025	January 22, 2025	4
3. Vendor Coordination					
3.1. Organize meetings with Oracle, AWS, and Nyckel	IT Department	0%	January 22, 2025	January 25, 2025	3
3.2. Finalize SLA agreements	IT Department, Technology Vendors	0%	January 25, 2025	January 27, 2025	2
3.3. Set timelines	IT Department, Technology Vendors	0%	January 27, 2025	January 29, 2025	2
4. System Installation					
4.1. Install Oracle NetSuite	IT Department, Technology Vendors	0%	January 29, 2025	February 5, 2025	7
4.2. Configure AWS IoT services	IT Department, Technology Vendors	0%	February 5, 2025	February 10, 2025	5
4.3. Set up Nyckel integration	IT Department, Technology Vendors	0%	February 10, 2025	February 15, 2025	5
5. IoT Sensor Deployment					
5.1. Plan sensor placement	Field Technicians	0%	February 15, 2025	February 19, 2025	4
5.2. Deploy IoT-enabled sensors	Field Technicians	0%	February 19, 2025	February 26, 2025	7
5.3. Verify sensor data accuracy	Field Technicians, IT Department	0%	February 26, 2025	March 1, 2025	3
6. AI Model Training					
6.1. Collect sample data	Quality Control Team, IT Department	0%	March 1, 2025	March 6, 2025	5
6.2. Train Nyckel AI for error detection	Quality Control Team, Vendors	0%	March 6, 2025	March 11, 2025	5
6.3. Validate AI accuracy	Quality Control Team, Vendors	0%	March 11, 2025	March 16, 2025	5
7. Mobile App Development					
7.1. Define app requirements	IT Department	0%	March 16, 2025	March 19, 2025	3
7.2. Design user interface	IT Department	0%	March 19, 2025	March 24, 2025	5
7.3. Develop core functionality	IT Department	0%	March 24, 2025	March 29, 2025	5
7.4. Conduct app testing	IT Department	0%	March 29, 2025	April 1, 2025	3
8. Training Portal Development					
8.1. Draft training material	IT Department	0%	April 1, 2025	April 5, 2025	4
8.2. Build online training portal	IT Department	0%	April 5, 2025	April 12, 2025	7
8.3. Test portal usability	IT Department	0%	April 12, 2025	April 15, 2025	3
9. Functional Testing					
9.1. Test Oracle NetSuite modules	IT Department	0%	April 15, 2025	April 18, 2025	3
9.2. Test IoT sensor data integration	IT Department	0%	April 18, 2025	April 20, 2025	2
9.3. Test Nyckel AI workflows	IT Department	0%	April 20, 2025	April 22, 2025	2
10. Integration Testing					
10.1. Simulate end-to-end workflows	IT Department	0%	April 22, 2025	April 28, 2025	6
10.2. Validate communication between Oracle, AWS, and Nyckel	IT Department	0%	April 28, 2025	May 3, 2025	5
10.3. Fix bugs	IT Department	0%	May 3, 2025	May 6, 2025	3
11. User Acceptance Testing (UAT)					
11.1. Prepare test scenarios	IT Department, End Customers	0%	May 6, 2025	May 8, 2025	2
11.2. Conduct UAT with end-users	IT Department, End Customers	0%	May 8, 2025	May 12, 2025	4
11.3. Collect and analyze feedback	IT Department, End Customers	0%	May 12, 2025	May 13, 2025	1
12. Employee Training					
12.1. Develop training sessions	IT Department, Customer Service	0%	May 13, 2025	May 19, 2025	6
12.2. Conduct role-based training	IT Department, Customer Service	0%	May 19, 2025	May 25, 2025	6
12.3. Gather feedback from trainees	IT Department	0%	May 25, 2025	May 27, 2025	2
13. Documentation Distribution					
13.1. Create user manuals	IT Department	0%	May 27, 2025	May 31, 2025	4
13.2. Update system resources	IT Department	0%	May 31, 2025	June 2, 2025	2
13.3. Distribute to all departments	IT Department	0%	June 2, 2025	June 3, 2025	1
14. Post-Deployment Monitoring					
14.1. Monitor system performance in real-time	IT Department	0%	June 3, 2025	June 9, 2025	6
14.2. Address initial bugs and issues	IT Department, Technology Vendors	0%	June 9, 2025	June 15, 2025	6
14.3. Ensure IoT sensors provide accurate and timely updates	IT Department, Field Technicians	0%	June 15, 2025	June 21, 2025	6
15. Customer Portal Deployment					
15.1. Develop and test customer-facing portal	IT Department	0%	June 21, 2025	June 28, 2025	7
15.2. Launch portal and notify customers	IT Department, Customer Service	0%	June 28, 2025	July 1, 2025	3
15.3. Train customer support staff on portal features	IT Department, Customer Service	0%	July 1, 2025	July 4, 2025	3
16. Performance Review					
16.1. Collect customer feedback	Customer Service Staff	0%	July 4, 2025	July 11, 2025	7
16.2. Evaluate system performance against project goals	APEC Management Team, IT Department	0%	July 11, 2025	July 14, 2025	3
16.3. Document lessons learned	IT Department, APEC Management Team	0%	July 14, 2025	July 17, 2025	3
17. Final Project Report					
17.1. Draft the final project report	IT Department	0%	July 17, 2025	July 21, 2025	4
17.2. Review and revise with input from all stakeholders	IT Department, APEC Management Team	0%	July 21, 2025	July 24, 2025	3
17.3. Submit the final report to management	APEC Management Team	0%	July 24, 2025	July 25, 2025	1
18. Official Project Handover					
18.1. Conduct formal handover to operations	APEC Management Team, IT Department	0%	July 25, 2025	July 27, 2025	2
18.2. Ensure all stakeholders have access to system documentation	IT Department	0%	July 27, 2025	July 28, 2025	1
18.3. Finalize project closure report	APEC Management Team	0%	July 28, 2025	July 29, 2025	1

Figure 13: Proposed system's Gantt chart

The Gantt chart is a thorough, task-oriented elaboration of the Milestones indicated in the Project Scope Checklist. It splits the project into key tasks, further divided into particular sub-tasks, clarifying the work breakdown, allocated stakeholders, durations, and time constraints.

Structure and Approach

1. **Initial Setup and Planning (January–February):** Establish a clear foundation for project execution by aligning stakeholders, gathering requirements, and allocating resources.

- This phase focuses on preparation, including stakeholder alignment, requirements gathering, and resource allocation. Each task within this phase, such as **Stakeholder Consultation** and **Technology Vendor Coordination**, is designed to lay a solid foundation for subsequent phases.
- Assigned teams include **APEC Management**, **IT Department**, and **Technology Vendors**, ensuring coordination across all key stakeholders.

2. **Design and Development (March–April):** Create a detailed system design and develop core functionalities to address identified inefficiencies.
    - This phase emphasizes system design, CRM module customization, and IoT integration. Sub-tasks such as **Design System Architecture** and **Develop CRM Modules** reflect the technical implementation efforts.
    - Technical teams, including **IT Department**, **Field Technicians**, and **Warehouse Management**, collaborate to ensure that the system's design aligns with business needs.
3. **Testing and Integration (May):** Ensure the system meets quality standards through rigorous testing and seamless integration.
    - This phase includes rigorous testing, error fixing, and end-to-end system integration. Sub-tasks like **Pilot Testing with Sample Data** and **Resolve Integration Issues** focus on eliminating bugs and ensuring seamless functionality.
    - Stakeholders such as the **Quality Control Team** and **Technology Vendors** play pivotal roles in this phase.
4. **Deployment and Monitoring (June):** Roll out the system and ensure it functions effectively in real-world conditions.
    - Deployment is detailed through tasks like **System Rollout** and **Monitor System Performance in Real-Time**. Post-deployment tasks ensure any issues are promptly resolved, and real-time performance tracking is fully operational.
    - Customers, **Field Technicians**, and **Customer Service Staff** are actively engaged during deployment to ensure a smooth handover.
5. **Customer Portal and Feedback (June–July):** Enhance user experience through a customer-facing portal and collect insights for improvement.
    - Specific sub-tasks focus on **Deploying the Customer Portal, Training Support Staff,** and **Collecting Feedback**. These steps ensure that end-users experience the benefits of the new system.
6. **Performance Review and Closure (July):** Evaluate the project outcomes, document lessons learned, and hand over the system to operational teams.

- This phase **Evaluates the Project's Outcomes, Collects Lessons Learned,** and **Documents the Findings**. It concludes with the formal **Project Handover** and the **Final Report Submission**.

Key Features of the Gantt Chart

1. **Specificity of Sub-Tasks**
   - Each main task is broken down into actionable sub-tasks, ensuring nothing is overlooked.
2. **Duration and Timelines**
   - Each sub-task has a clearly defined start date, end date, and duration in days, ensuring accountability and progress tracking.
3. **Assigned Responsibility**
   - Stakeholders are clearly identified for each sub-task, ensuring ownership and accountability.
4. **Integration with Work Scope Timeline**
   - The Gantt chart provides a granular view of the broader timeline in the scope checklist, ensuring alignment between high-level milestones and actionable tasks.

IV. COST-BENEFIT ANALYSIS

1. COST ANALYSIS

Cost analysis						
	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Non-recurring costs						
ERP Licensing Setup	$25,000	$0	$0	$0	$0	$25,000
IoT Devices Setup	$10,000	$0	$0	$0	$0	$10,000
Consulting Services	$20,000	$0	$0	$0	$0	$20,000
Data Migration	$15,000	$0	$0	$0	$0	$15,000
Employee Training	$10,000	$0	$0	$0	$0	$10,000
Mobile App Development	$20,000	$0	$0	$0	$0	$20,000
Computer Vision Setup (N	$15,000	$0	$0	$0	$0	$15,000
AWS IoT Cloud Integration	$15,000	$0	$0	$0	$0	$15,000
Total non-recurring costs	$130,000	$0	$0	$0	$0	$130,000
Recurring costs						
IoT Subscription Fees	$12,000	$12,000	$12,000	$12,000	$12,000	$60,000
ERP Subscription Fees	$10,000	$15,000	$15,000	$15,000	$15,000	$70,000
Maintenance and Support	$10,000	$10,000	$10,000	$10,000	$10,000	$50,000
Continuous Training	$5,000	$5,000	$5,000	$5,000	$5,000	$25,000
AWS IoT Cloud Service Sub	$8,000	$8,000	$8,000	$8,000	$8,000	$40,000
Nyckel Computer Vision Su	$6,000	$6,000	$6,000	$6,000	$6,000	$30,000
Mobile App Maintenance	$5,000	$5,000	$5,000	$5,000	$5,000	$25,000
Total recurring costs	$56,000	$61,000	$61,000	$61,000	$61,000	$300,000
TOTAL COSTS	$186,000	$61,000	$61,000	$61,000	$61,000	$430,000

Figure 14: Proposed System's Cost Analysis

Two main categories of cost are included in the implementation. In Year 1, non-recurring costs are $165,000 with ERP licensing setup ($50,000), IoT devices setup ($10,000), consulting services ($30,000), data migration ($15,000), employee training ($10,000), mobile app development ($20,000), computer vision setup ($15,000), and AWS IoT cloud integration ($15,000) (Akhtar & Martha 2024). Device subscription costs ($12,000), ERP subscription costs ($15,000), maintenance and support ($10,000), staff training ($5,000), AWS cost ($8,000), Nyckel computer vision subscription ($6,000), and mobile app maintenance ($5,000) account for $61,000 of annual recurring costs (Weston 2023; Alshami et al. 2024).

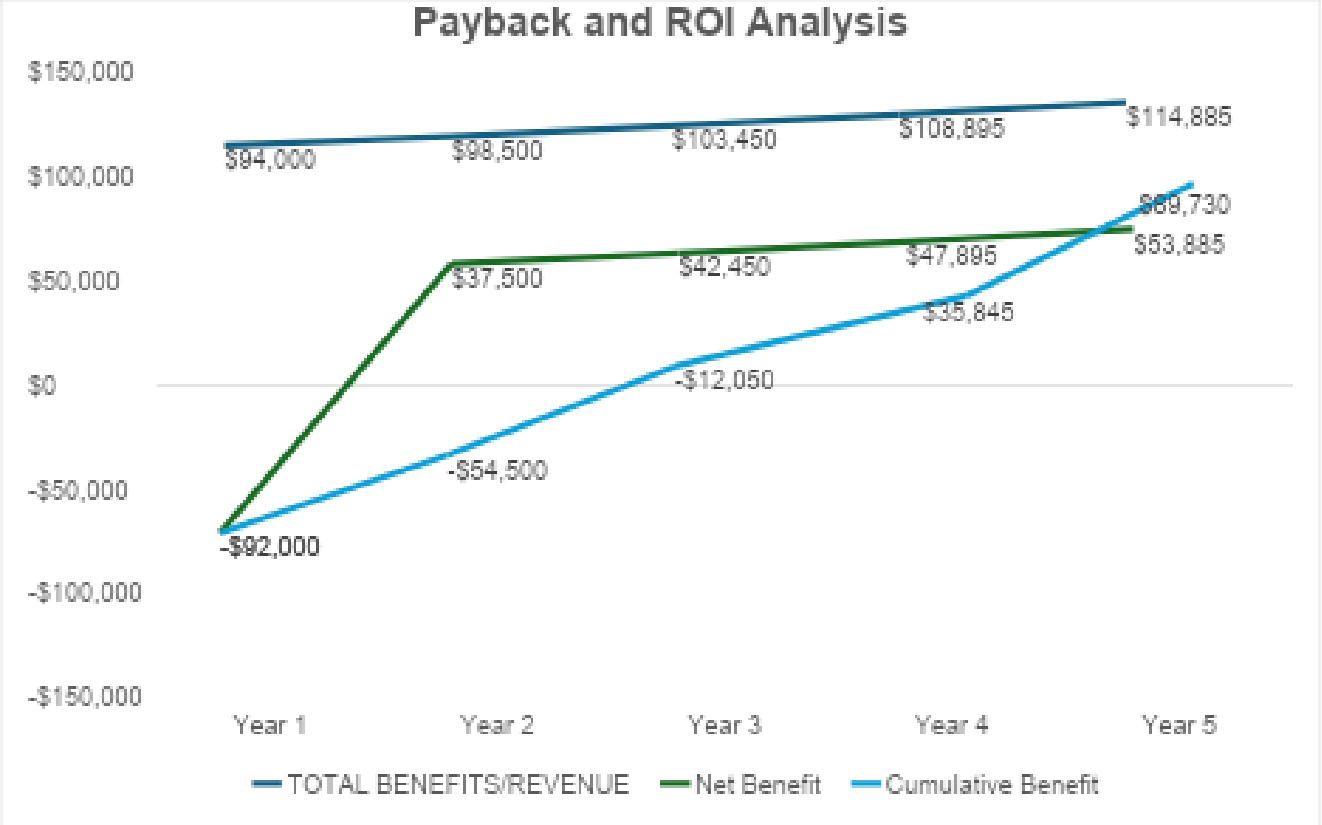
2. BENEFIT ANALYSIS

Benefit/revenue analysis						
	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Increased Revenue	$45,000	$49,500	$54,450	$59,895	$65,885	$274,730
Reduction in manual errors	$10,000	$10,000	$10,000	$10,000	$10,000	$50,000
Proactive maintenance savings	$8,000	$8,000	$8,000	$8,000	$8,000	$40,000
Inventory management savings	$5,000	$5,000	$5,000	$5,000	$5,000	$25,000
Employee Productivity Gains	$5,000	$5,000	$5,000	$5,000	$5,000	$25,000
Quality Control Cost Reduction (f	$7,000	$7,000	$7,000	$7,000	$7,000	$35,000
Cloud Service Efficiency Gains	$6,000	$6,000	$6,000	$6,000	$6,000	$30,000
Customer Retention Improveme	$8,000	$8,000	$8,000	$8,000	$8,000	$40,000
TOTAL BENEFITS/REVENUE	$94,000	$98,500	$103,450	$108,895	$114,885	$519,730

Figure 15: Proposed System's Benefits Analysis

The net benefit of such implementation is enormous in terms of revenue increase and operational efficiency. Using improved customer service and operational efficiency, revenue is forecasted to grow to $45,000 in Year 1, then to $65,885 in Year 5. Based on the operational savings, we subtract $10,000 saved annually through automated quality control and computer vision verification (Akhtar and Martha, 2024). Proactive maintenance enabled by IoT saves money through real-time monitoring to $ 8,000 annually. In terms of benefits, quality control will experience cost reduction ($7,000), increased cloud service efficiency gain ($6,000), and customer retention improvement ($8,000) due to better monitoring and proactive service (Alshami et al. 2024). These improvements, together with $5,000 a year in inventory savings and employee productivity, gain total cumulative benefits of $519,730 over five years, that is $84,940 in Year 1, increasing to $114,885 in Year 5.

3. PAYBACK PERIOD AND RETURN-ON-INVESTMENT (ROI) ANALYSIS



Year	Net Cash Flow	Cumulative Co	Cumulative B	ROI
Year 1	-$92,000	$186,000	$94,000	-49.5%
Year 2	-$54,500	$247,000	$192,500	-22.1%
Year 3	-$12,050	$308,000	$295,950	-3.9%
Year 4	$35,845	$369,000	$404,845	9.7%
Year 5	$89,730	$430,000	$519,730	20.9%
ROI Total	20.87%			

Figure 16: Payback and Proposed System's ROI

Investment analysis shows that from an initial negative cash flow of $92,000 in Year 1, the implementation proceeds to a positive net cash flow of $89,730 in Year 5. This project shows improving ROI every year, starting at a -49.5% ROI in Year 1 and continually improving such that by Year 5, ROI reaches 20.9%, for a total ROI of 20.87% over the 5 years. Return on investment (3.25 years) is relatively quick (Martinez et al. 2020). However, this demonstrates that the investment progresses in building value and cumulative benefits grow from $94,000 in Year 1 to $519,730 by Year 5. The negative returns associated with the initial years due to the upfront investments are consistent with the positive returns in the long run associated with successful digital transformation projects in the water treatment industry (Wijesinghe et al. 2024).

4. FINANCIAL IMPLICATIONS

It is shown that embedding Oracle Net Suite with AWS IoT and Nyckel computer vision is a financially viable investment strategy for APEC Water. The long-term value proposition of this digital transformation is validated by the positive total ROI of 20.87% over five years (Alprol et al. 2024). The progression from negative to positive ROI in Year 5 shows strong potential for future value creation beyond the period considered in the initial analysis. With steadily improved financial metrics, higher operational efficiency (Martinez et al. 2020), simplified supply chain (Abed 2020) processes, and improved real-time monitoring, APEC Water has become a firm for future sustainable growth in an increasingly digital world. This investment, in addition to meeting our current operational challenges, creates a solid foundation for future scalability and competitive advantage in the water treatment market.

V. CONCLUSION

In conclusion, through the implementation of Oracle NetSuite ERP, AWS IoT, and Nyckel AI's computer vision capabilities, APEC Water can leverage a centralized control system that optimizes operational efficiency, enhances quality control and compliance, and improves customer experience. The proposed solution addresses the core issues identified through the Rich Picture, BPMN diagrams, and Fishbone analysis, such as ineffective communication between stakeholders, manual performance tracking, shipping errors, and delays in problem resolution. By automating processes, enabling real-time monitoring, and facilitating seamless information flow, the recommended system offers a holistic approach to streamlining APEC Water's operations.

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