Designing an Inventory Management System for Convenience Store X Using Design Thinking Approach

Ann Kathryn T. Laping, Charmaine Anne R. Mendoza,
Keith Nathan L. Tiulentino,
And Ryan Mikael M. Villaraza
Department of Industrial Engineering,
University of Santo Tomas
España Boulevard, Sampaloc, Manila, 1008, Philippines
annkathryn.laping.eng@ust.edu.ph, charmaineanne.mendoza.eng@ust.edu.ph,
keithnathan.tiulentino.eng@ust.edu.ph, ryanmikael.villaraza.eng@ust.edu.ph

Gabriel C. Bucu and Joehanna K. Ngo
Department of Industrial Engineering,
University of Santo Tomas
España Boulevard, Sampaloc, Manila, 1008, Philippines
gcbucu@ust.edu.ph, jkngo@ust.edu.ph

Abstract

The total food waste constitutes a great portion of perishable goods and Kaya (2021) stated that inventory management has been proven to be more challenging for perishable goods since these deteriorate over time and become obsolete. This study will be significant for business owners in Convenience Store X in Marikina City and for future studies to have an effective inventory management. The objective of this study is to create user-focused inventory management system using a design thinking approach which is a five-stage process: Empathize, Define, Ideate, Prototype, Test. With that, the researchers gathered data and determined the users' pain points related to the inventory management system for perishable goods in Convenience Store X. Then, the researchers came up with criteria and solutions for the new inventory system with the use of Multi-Criteria Decision Analysis (MCDA), specifically Analytical Hierarchy Process (AHP) and integrated with software developers in designing the three (3) user interfaces of a Software-as-a-service (SaaS) inventory system namely: System X, System Y and System Z. Through the Pugh Selection and User Acceptance Test, the researchers collected ratings from the users and concluded that System X is the most preferred design based on the users' pain points and preferences.

Keywords

Inventory Management System, Design Thinking Approach, Perishable Goods, Convenience Store/s, Multi-Criteria Decision Analysis (MCDA)

1. Introduction

Perishable goods are a large component of retail sales, they represent up to 50% of all sales in the retail food industry. However, 70% of the total food waste constitutes a great portion of perishable food products (Gardas et al. 2018). In general, a problem is seen from perishable food spoilage and deterioration in the retail industry, wherein it results in significant losses of profitability. With that, Kumar (2020) highlighted that a system perspective is needed to analyze the complexities on the sustainability of perishable food supply chains.

With Convenience Store X located in Marikina City as the study site, the researchers gathered data recurring from August to December 2021 and found significant reports of bad merchandise, or also known as products that may be damaged, expired, or near their expiration dates. It was recorded that Convenience Store X had a significant financial loss in just 5 months. Furthermore, based on the users' experiences in the existing inventory management system of Convenience Store X in Marikina City, the researchers have concluded that the owner, managers, and employees of

Convenience Store X need to have an inventory system with real-time updates of sales and stocks, and to have an effective monitoring and tracking system for the inventory.

1.1 Objectives

This research aims to create a user-focused inventory management system for Convenience Store X located in Marikina City. It is expected at the end of the study that the researchers will be able to fulfill the following objectives:

1. To determine the significant factors and current challenges of users related to the inventory management system for perishable goods in Convenience Store X.
2. To translate the findings using a design thinking approach in designing a user- focused inventory management system for Convenience Store X.
3. To test the user acceptance of the new inventory management system in Convenience Store X located in Marikina City.

2. Literature Review

The Food Retail Industry has developed through time wherein food retailers used to be small corner stores in the urban areas and villages in the United States of America and Europe. These stores were supplied by wholesalers in general and were the foundation of food retailing until the mid-1800s. One of the biggest changes in the industry was the emergence of the concept of self-service in the early 1900s wherein consumers casually walked into the stores and chose the products that they would buy. Before this era, the clerks usually looked for the request of the consumers behind the counters and handed it to them. This is where the notion of branding started, in which the food processors had to make their products appealing for an increase in customer demand and sales. It was in the 1970s wherein revenue for the retailers gradually increased in the food retail industry as consumers continue to resort to food retail outlets. Progressing to the modernization era, technology has started to become a source of competitive advantage in the food retail industry wherein the channels of distribution and operating system in the businesses have been enhanced to more efficient and effective schemes (Stanton 2018).

In the Philippines, food consumption has fueled expansion in the food and beverage retail sector. According to the United States Department of Agriculture (USDA), the Philippine food retail sector has risen by 25%, reaching almost $50 billion in 2019. The Philippines' food retail industry is dominated by three supermarket chains, however they only account for 20% of total sales because most purchases are still made through conventional retail outlets. The three leading retail stores, according to USDA, are SM Markets, followed by PureGold, and Robinsons. However, traditional retailers, such as convenience stores, saw the fastest rise in spending value per trip among Fast-Moving Consumer Goods (FMCG) channels in the first quarter of 2021 (Key et al. 2021).

Since Convenience Stores saw the fastest rise in spending value per trip among Fast-Moving Consumer Goods (FMCG) channels in the first quarter of 2021, the challenges in perishable food supply chains have also risen. According to a study of Joshi & Visvanathan in 2019, the lack of awareness that food waste reduction is considered as a problem in developing countries. It has been claimed that perishable food products represent 70% of the total food waste (Gardas et al. 2018) in which Jonkman et al. (2019) also stated that it is essential to integrate perishability in the design of food supply chains. Moreover, Deng et al. (2019) claimed that failure to include the food characteristics and quality in supply chain design and planning may pose a significant challenge to sustainability in perishable food supply chains. Thus, it can be observed that these challenges need to be addressed by understanding the factors to be considered and by implementing sustainable practices in perishable food supply chains.

Inventory management is one of the most significant processes in supply and distribution management. While inventory stock is an important asset for companies, specifically those in the manufacturing line. However, an out-of-stock situation is a problem that disrupts a company's business processes. That is why the task of having effective inventory management is to make sure that the quantities of inventories are sufficient to fill the demands of consumers without overstocking. Bautista et al. (2022) cited that creating a re-ordering system template as the main tool can be used to replenish the inventory, achieve the desired inventory level, and the truckload optimization.

In order to achieve a more optimized inventory management system, a new approach had to be used and one approach which could make this feasible is the Design Thinking Approach. The Design Thinking was born from the questions – “How is it that designers think?” and “How is design done?” (Baytas 2021). It is defined as an iterative process in

which creative thinkers try to understand the user, challenge assumptions, and reframe problems in order to find new tactics and solutions that are not immediately obvious based on normal level of understanding. It is centered on an ardent desire to learn more about the individuals for whom creative thinkers design products or services. Design Thinking improves the observation and development of empathy with its target users. This aids in the process of questioning: the problem, the assumptions, and the consequences. It is particularly beneficial when dealing with ill-defined or complex problems, by re-framing the problem in a human-centric manner, brainstorming several ideas, and prototyping & testing with a hands-on approach (Dam et al. 2021). This understanding isolates facts and methods to apply knowledge gained across domains and creates a linear solution. This framework can be said to be effective in fixing problems when applied, as solutions are typically within a known range. However, Traditional approaches to problem solving may not be applicable to all real-life problems as it creates research questions that defy simple explanations. The overall flow of design-thinking's framework consists of three major parts – 1) Understand. 2) Explore. 3) Materialize. Under the major parts are the six phases of Design Thinking, the process of the approach: empathize, define, ideate, prototype, test, and implement. A lot more industries have already shifted to the use of Design Thinking and have already benefited from it. Some of these industries are the Fashion Industry, Entertainment Industry, Banking Industry, Automotive Industry, and Tech Industry (Fabrica 2020). This explains the effectiveness of the Design Thinking approach as it can be flexible and can adapt to various fields.

3. Methods

3.1 Research Design

The research design has evaluated the factors affecting the performance of existing inventory management systems used for perishable goods. Based on the previous chapter, the literature review served as the basis to determine some of the variables included in this study. Specifically, the independent variables that were considered are consumer demand, product lifetime, control, operational cost, and user persona. The study used a design thinking approach to evaluate how these aforementioned independent variables affect the dependent variable which is the overall performance of the inventory management system. With that, the researchers underwent a comparative type of research utilizing the design thinking approach to compare a set of criteria and solutions to identify the optimal solution for the newly designed inventory management system. To bridge the gap between the wastage of perishable goods and the challenges of the existing inventory systems, the researchers' conceptual framework focused on redesigning an inventory management system that is user-focused through a design thinking approach.

3.2 Research Methodology

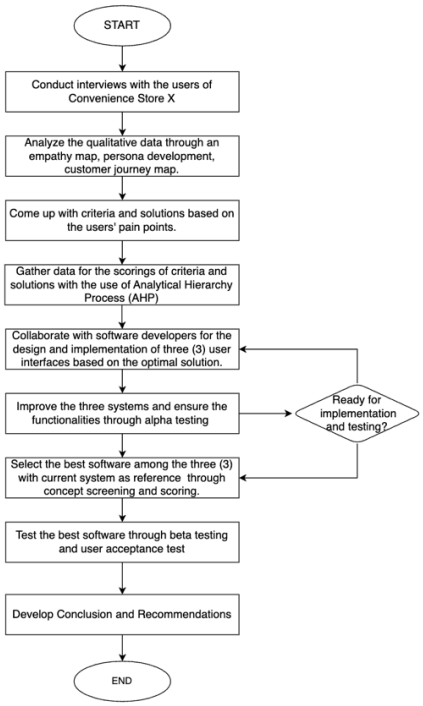

Figure 2. Design Thinking Flowchart

The researchers underwent a process based on the design thinking approach which is known for its five-stage process – Empathize, Define, Ideate, Prototype and Test. This is for the researchers to evaluate the problems related to the existing inventory system. Where observations were done for the researchers to familiarize themselves with the current inventory system that will allow them to acquire enough data and responses to create an optimal solution based on the users' pain points. A system would then be selected and tested to see if that system would be able to meet the requirements of the study and if it was able to address the concerns of the potential users which is shown in Figure 2.

4. Data Collection

Within the first two stages of the Design Thing Approach, Empathize and Define the Problem, the researchers evaluated the problems related to the existing inventory systems for perishable goods that were previously mentioned in the literature review. The researchers contacted the owners of the chosen convenience stores to ask for their permission to use their store to gather data regarding the breakdown of sales to identify the number and total cost of unsold items per month. Moreover, interviews have been conducted with the users of Convenience Store X regarding the problem with their inventory and inventory management system. Moreover, Observations have been done for the researchers to familiarize themselves with the current inventory management system of each store and identify the problem/s of each system. The researchers have also analyzed the qualitative data through an empathy map, persona development, and customer journey map.

5. Results and Discussion

5.1 Numerical Results

Table 1.1. Tabular Summary of the AHP Model (Level 1 – Potential Users)

CRITERIA	TOTAL AVERAGE	RANKING
Ease of Use	0.2438	3
Accuracy	0.2447	2
Cost Efficiency	0.1597	4
Forecasting Demand	0.0768	5
Data Storage Capacity	0.2750	1
SUM	1.00	

Based on the users' pain points regarding the existing inventory management system in Convenience Store X, the researchers considered five (5) criteria to determine the optimal solution which comprises the following: Ease of Use, Accuracy, Cost Efficiency, Forecasting Demand, and Data Storage Capacity. According to Tejesh et al. (2018), the accuracy of a system must be high within a precise scope since it illustrates an overall excellence and quality of the information. Moreover, Tejesh et al. (2018) mentioned that the system should be able to deliver a system that would be convenient and easy to navigate for users and that cost must always be considered when implementing a system by ensuring that it does not result in a higher cost. In addition to that, Kot et al. (2014) also stated that forecasting of demand in an inventory system starts with its purpose to reduce inventory levels and that a system should have the capacity to store enough data.

The potential users, namely the owner, manager, assistant manager, and an employee, performed the Analytical Hierarchy Process (AHP) to compare the weight or relevance of each criterion. The obtained results guided the researchers in identifying which among the criteria should be mostly taken into consideration when designing the inventory management system. Table 1.1 shows that among the five (5) criteria, the Data Storage Capacity ranked first with an average of 0.2750 or 27.50%.

Table 1.2. Tabular Summary of the AHP Model (Level 2 - Researchers)

SOLUTIONS	TOTAL AVERAGE	RANKING
RFID Tags and Software	0.1196	4
Barcoding System	0.2319	2
Software-as-a-Service (SaaS)	0.4379	1
Smart Shelves	0.2108	3
SUM	1.00	

To determine the optimal solution on the users' pain points based on the personas, the researchers proposed four (4) solutions in making an effective inventory management system, namely, Radio-frequency identification (RFID), Barcoding system, Software-as-a-Service (SaaS), Smart Shelves. During the ideation process, the researchers focused on the digital transformation with the industrial internet of things (IIOT) to come up with these solutions. The RFID Technology can be used for managing inventory and tracking it in real-time through its tags, readers, and software. The Barcoding system can be used for quick identification of certain products through barcode scanning for faster reordering, tracking of inventory, and monitoring of the expiration dates of the products. On the other hand, Software-as-a-Service (SaaS) is considered as a cloud computing software that can be used by several users to track the inventory stocks, is more flexible, and cost-efficient since its inventory tracking features can be used from different locations. Lastly, Smart Shelves are electronically connected shelves that are a combination of sensors, digital displays and RFID tags that can be used to track inventory and gather real-time data.

Based on the result from Table 1.1, the researchers performed Analytical Hierarchy Process (AHP) to compare which among the proposed solutions satisfies the criteria most. The results are presented in Table 1.2 wherein Software-as-a-Service (SaaS) ranked first, having an average of 0.4379 or 43.79%.

Concept Screening

A criteria-based decision matrix commonly known as *Pugh Concept Selection*, which was developed by the Scottish scientist, Dr. Stuart Pugh, was used in this study to select the best solution that meets the set of criteria. The Pugh Concept Selection is a selection tool that is usually used in a decision-making process to determine which of the alternative solutions should be selected (Pugh 1980). Based on the four criterions namely, ease of use, accuracy, cost efficiency, forecasting demand, and data storage capacity, the researchers asked the users to compare the three (3) developed user interface designs based on their chosen solution – Software-as-a Service system, to the current inventory system of Convenience store X. With all the reference criteria being marked as 0, concepts or solutions that meet the criteria are marked as + with a value of positive whereas if not, they are marked as - with a value of negative 1 (–1). The ranking of the solutions and knowing if they will proceed to the Concept Scoring will be determined by adding up these values.

Table 2. Concept Screening

SUMMARY				
Concept Screening				
Selection Criteria	Reference	Concepts		
	Current System	System X	System Y	System Z
Ease of Use	0	+	+	-
Accuracy	0	+	+	-
Cost Efficiency	0	+	+	+
Forecasting Demand	0	+	+	+
Data Storage Capacity	0	+	-	-
Sum +'s	0	5	4	2
Sum 0's	5	0	0	0
Sum -'s	0	0	1	3
Net Score	**0**	**5**	**3**	**-1**
Rank	**0**	**1**	**2**	**3**
Continue?	**Yes**	**Yes**	**Yes**	**No**

The researchers conducted a focus group discussion with the same end-user group to discuss the three (3) developed Software-as-a-Service (SaaS) user interface designs. This will allow the researchers to determine which among the

designs is most desirable for the users based on the set criteria. The chosen design(s) will be the one(s) developed and improved by the software developers.

Table 2 shows the summary of results from the concept screening conducted by the researchers. Results show that System Z acquired the lowest net score of negative one (–1) therefore, it will not be included in concept scoring, and will not be continued for further testing.

Concept Scoring

The researchers used the relative performance rating (See Table 3) for the end users to rate the current system and the three (3) Software-as-a-Service (SaaS) user interfaces that were designed and further discussed in detail in section 4.6.2. The ratings from the users of Convenience Store X were multiplied by the corresponding weights of each criterion, which were calculated in section 4.6.1 using the Analytical Hierarchy Process (AHP).

Table 3. Relative Performance Rating

Relative Performance Rating	Rating
Very Unsatisfied	1
Unsatisfied	2
Neutral	3
Satisfied	4
Very Satisfied	5

Table 4 presents the tabular summary of results from concept scoring. This was conducted through a focus group interview with the same users, asking them to score the current inventory management system of Convenience Store X and the proposed Software-as-a-Service (SaaS) user interface designs in relation to the five (5) criteria provided.

Table 4. Concept Scoring

SUMMARY							
Concept Scoring (SaaS Systems)							
		Reference		Concepts			
Selection Criteria	Weight	Current System	Weighted Score	System X	Weighted Score	System Y	Weighted Score
Ease of Use	24.38%	3.5	0.85	4.75	1.16	3.75	0.91
Accuracy	24.47%	3.75	0.92	4.5	1.10	4.75	1.16
Cost Efficiency	15.97%	3	0.48	5	0.80	5	0.80
Forecasting Demand	7.68%	1	0.08	3.5	0.27	3.25	0.25
Data Storage Capacity	27.50%	4.25	1.17	5	1.38	2.25	0.62
Total Score		3.50		4.70		3.74	
Rank		3		1		2	
Continue?		No		Yes		No	

The researchers computed the mean scores for each criterion and system to summarize the users' scores. The table shows that among the three, System X acquired the highest total score of 4.70, and is the best design for the proposed Software-as-a-Service (SaaS) solution.

5.2 Graphical Results

Empathy Map

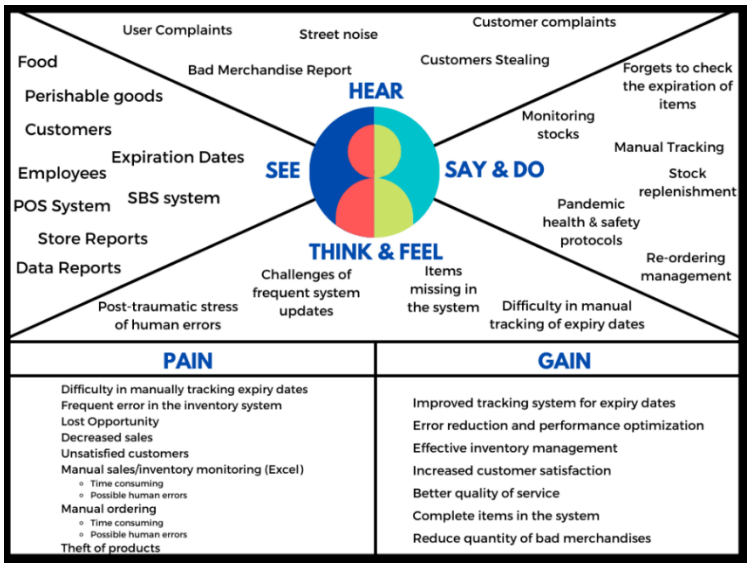

Figure 3. Empathy Map

Based on the interview conducted by the researchers, an empathy map was constructed as shown in Figure 3. This will provide researchers with deeper insights on the needs of the end users and be able to determine the users' attitudes and behaviors. The empathy map illustrated above is mainly focused on the pains and gains of the 5 interviewees (owner, managers, and employees). Moreover, it includes the four elements particularly, see, hear, think & feel, and say & do that would be interconnected to the persona development and customer journey map.

Persona Development

Table 5 shows the persona development of different characters regarding their characteristics and user story. Upon analyzing and breaking down the information, one can clearly see that these users often encounter issues with reordering stocks, tracking, replenishing, and automatic updates before the expiry dates of inventory. Difficulties in the area of reordering and tracking are a prominent issue since there is no forecasting feature that could suggest this. Replenishing and automatic updates before the expiry date are some of the dilemmas that users also face due to the lack of features that the current system can offer. These factors would lead to not only the wastage of products but could also majorly impact the sales of the said business.

Table 5. Persona Development

Name	Characteristics	User-story
Blair	Knowledgeable and Detail-oriented; Female Store Owner in her 40s	She is mainly concerned about the performance of the inventory management system of Site X. She hopes for a more accurate inventory system that will serve as a guide in reordering stocks and in tracking inventory.
Felix	Punctual and Technology Illiterate; Male Manager in his 30s	The errors that he experiences from the system have been consuming his precious time which is why he feels that there is a need for improvement in the current process for replenishing inventory. He wishes that there is a feature in the system that double checks the fast-moving items and effectively monitors stocks, especially the possible expired products.
Tiana	Humble and Diligent; Female Employee in her 20s	Tiana does her best to provide excellent customer service. She fears forgetting to manually check the inventory for expiring products that could eventually be sold to customers. This keeps her stressed out since she would not want to face customers with complaints regarding this situation, which is why she wishes for a system that keeps her updated with the products to be removed from the shelves before their expiration.

Customer Journey Map

Table 6. Customer Journey Map

Name	Scenario	Goals & Expectations	Opportunities & Ideas to Improve	Existing Inventory Management System							
				Forecasting	Ordering	Delivery	Receiving & Checking	Sorting & Storing	Monitoring	Arranging	Low Stock levels trigger purchasing
Blair	40-year-old female store owner who is knowledgeable and detail-oriented;	More accurate system for inventory tracking and reordering stocks Increase Site X's sales and generate More profit	Improve inventory system Make the inventory system easier to understand, use, and maintain	✓	✓	✓	✓	✓	✓	✓	✓
Felix	Male tech-savvy and punctual store manager in his 30s;	Inventory replenishment system with added features: Checks for fast-moving items and monitors expiry dates of stocks	Make inventory system easy to use and understand Input monitoring features		✓	✓	✓	✓	✓		
Tiana	20-year-old female employee who is humble and diligent;	Provide the best customer service Keep stocks fresh and remove nearly expired items from the store Expiration dates should be monitored digitally	Digital inventory tracker Provide better customer experience		✓			✓	✓	✓	

Table 6 shows the users' experience in the existing inventory management system of Convenience Store X located in Marikina City. This also includes the goals, expectations, opportunities, and ideas to improve one of each user persona. Upon analyzation of the Customer Journey Map, it is observed that the three personas, Blair, Felix, and Tiana, experience troubles and difficulties in Ordering, Sorting & Storing, and Monitoring with the existing inventory management system used by Convenience Store X. Difficulties in ordering were experienced because of the inventory management system lacks a forecasting system which could assist the users and prevent over/under stocking of goods. For sorting and storing, users often get trouble tracking merchandise on shelves since the existing system does not have this feature. This may lead to missed sales opportunities. Lastly is monitoring, users encounter difficulties in monitoring of sales, stocks, and bad merchandises since the existing inventory management system does not record these data in real time which results to manual checking of products and manual encoding of store data.

Analytical Hierarchy Process (AHP)

Analytical Hierarchy Process (AHP) is a structured technique for dealing with complex decisions that are high stakes, that involves human perceptions and judgments, and resolutions that have long-term repercussions. It provides a rational framework for a needed decision by quantifying its criteria and alternative options while relating those elements to the overall goal. Rather than suggesting a correct decision, this technique helps users to find the best decision that will suit their values and understanding of the problem at hand. According to Dewi et al. (2021), "the AHP algorithm is used to decide the best decision based on predetermined variables, in the presence of the determined variables, the maximum results will be obtained, and the decisions taken from the AHP algorithm will produce something that is helpful to its users." That is why the Analytical Hierarch Process is typically used in government, business, industry, healthcare, and education as it is a mathematical synthesis of numerous judgments that makes use of weights and priorities.

Table 7. Intensity Scale for Criteria of Pairwise Comprison

Intensity of Importance	Definition	Explanation
1	Equal importance	Two elements contribute equally to the objective
3	Moderate importance	Experience and judgment slightly favor one element over another
5	Strong importance	Experience and judgment strongly favor one element over another
7	Very strong importance	One element is favored very strongly over another; its dominance is demonstrated in practice
9	Extreme importance	The evidence favoring one element over another is of the highest possible order of affirmation
Intensities of 2, 4, 6, and 8 can be used to express intermediate values. Intensities 1.1, 1.2, 1.3, etc. can be used for elements that are very close in importance.		

Table 7 shows the degree of importance (intensity) of each criterion. Potential users and researchers were asked to certify the impact of each criterion on the other criteria, with respect to criterion 1, criterion 2, criterion 3, etc., in order to determine the relative relevance of criteria and sub criteria. Additionally, each sub criterion's relative weight in relation to each other sub criterion is supplied in order. Basic Saaty's scale with verbal terms of 1–9 was used to assess the degree of preference between two elements, where extreme importance of one element (row cluster in the matrix) compared to the other (column cluster in the matrix) is indicated by a score of 9 and equal importance between two elements is represented by a score of 1.

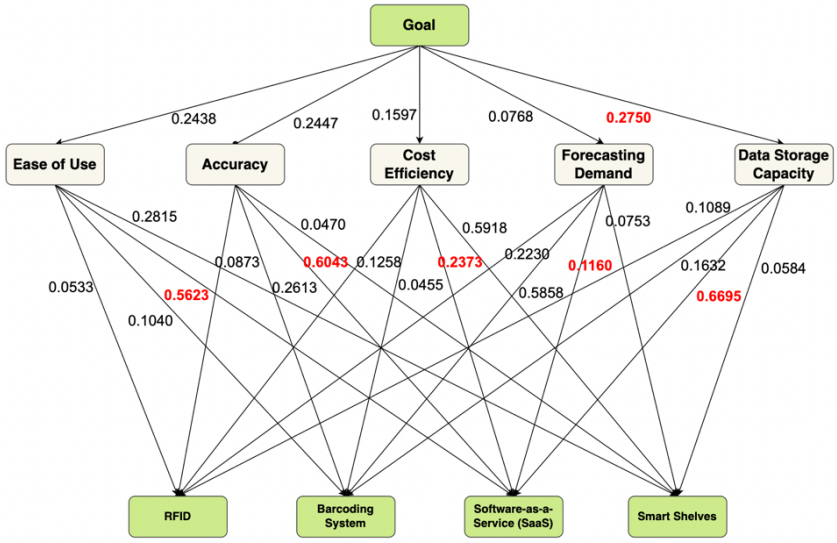

Figure 4. Block Diagram of the AHP Model

Figure 4 shows the block diagram of the AHP Model in choosing the optimal solution for the inventory management system. The block diagram consists of 3 levels, the goal, criteria, and solutions. The criteria include Ease of use, Accuracy, Cost Efficiency, Forecasting Demand, and Data Storage Capacity. While the solutions include RFID, Barcoding System, Software-as-a-Service, and Smart Shelves. As seen in Figure 4, the block diagram illustrates the pairwise comparison of the goal to each criterion along with its weight or the relative relevance of the criteria and solutions. By getting the overall weight and its total average, the block diagram shows that Data Storage Capacity had the biggest weight among the criteria, having a total average of 0.2750 or 27.5%. In addition, the pairwise comparison of each criterion to each sub criterion along with each solution's weight is also illustrated in the block diagram. With the same process done, the overall weight and total average of the solutions led to Software-as-a-Service being the most relevant solution, having a total average of 0.4379 or 43.79%.

5.3 Proposed Improvements

This study recommends future researchers to implement and further test the inventory management software to the actual system of convenience stores for a certain period of time. This will provide more data to see if there is a significant difference in the store's bad merchandise record when using new inventory management software. Further research regarding perishable demand and supply forecasting is necessary to enhance the effectiveness of the proposed model and method. Possible further areas to study by future researchers would be the forecasting tool that will include a mathematical model form as this will improve the system in foreseeing demands by consumers. Lastly, this study recommends organizations (in this case, convenience stores) to have sufficient budget on upgrading their technology infrastructures (e.g., hardware, software, and internet resources) that promote good management of data. This will aid in the optimization of the workforce and more efficient management of stocks.

5.4 Validation

The User Acceptance Test (UAT) is the final stage of a software testing process that determines whether a product or software system is appropriate for the intended use of the company, organization, and end-users (Tai 2020). The UAT ensures that the system has the capability of reaching the requirements for real-world tasks and scenarios. The results of the UAT determine whether a system is ready to be released in the market.

Table 8. User Acceptance Testing

SUMMARY						
USER ACCEPTANCE TEST FOR SYSTEM X						
Item	Frequency					
	1	2	3	4	5	6
	Strongly Disagree	Somewhat Disagree	Disagree	Agree	Somewhat Agree	Strongly Agree
Content						
The application is easy to use						✓
The application is accurate					✓	
The application is cost efficient						✓
The application can forecast demands				✓		
The application has large data storage capacity						✓

Table 8 presents the tabular summary of results from user acceptance testing. This was conducted by distributing the test to the owner, manager, and employees who were the potential users of the said application. This table shows that most users strongly agreed that System X is easy to use and cost-efficient while users somewhat agreed that System X is accurate and has a large data storage capacity and users only agreed that System X can forecast demand.

6. Conclusion

Going back to the objectives of the study, the researchers were able to determine the significant factors and current challenges of users related to the inventory management system for perishable goods in Convenience Store X. Moreover, the researchers were able to translate the findings using a design thinking approach and the effectiveness of the new inventory management system was tested by the users of Convenience Store X located in Marikina City.
The researchers came up with the problem statement that the owner, managers, and employees of Convenience Store X located in Marikina City need to have an inventory system with real-time updates of sales and stocks based on the users' pain points. To have an effective inventory management system, the researchers came up with four (4) solutions: RFID, Barcoding System, Software-as-a-service and Smart shelves. Moreover, the researchers decided to consider five (5) criterions based on the users' pain points to determine the optimal solution: Ease of use, Accuracy, Cost Efficiency, Forecasting Demand and Data Storage Capacity. These criterions were gauged based on the Multi-Criteria Decision Making specifically, the Analytical Hierarchy Process to see the importance of each criterion. With the use of their respective priority weights, Software-as-a-service (SaaS) turned out to be the most preferred solution among the four (4) digital technologies. Furthermore, the researchers integrated with software developers to create three (3) user interfaces of a Software-as-a-Service inventory management system: System X, System Y and System Z. After that, the software developers tested each system to ensure that there are no bugs when using these systems. The researchers proceeded to concept screening and concept scoring to determine which among the three (3) prototype designs is the most desirable for the end user. Based on the results of concept screening and scoring, the users

considered System X as the most preferred design. With that, to further test System X, beta testing was conducted to provide trial use to potential users. User acceptance testing was also provided to the users to guide the researchers. As a result, from all the tests that were conducted, the researchers were able to conclude that system X can tend to the needs of the users.

Based on the results of the study, it shows the relevance of having a user-focused design of an inventory system as it aims to meet the needs and preferences of the users and it promotes an effective interaction between the user and the system. With a user-focused inventory management system, it allows users to track the products/items easily and efficiently throughout the supply chain of an organization. Hence, it is revealed from this study that organizations, particularly convenience stores, should focus on implementing a user-centered design of an inventory management system.

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Biographies

Ann Kathryn T. Laping is a fourth-year college student taking up Bachelor of Science in Industrial Engineering at the University of Santo Tomas. She took her primary and secondary education at Diliman Preparatory School, where she was a consistent honor student and received multiple academic excellence awards. Her interests in the field of Industrial Engineering include service engineering, supply chain management, and lean manufacturing. She was formerly an executive associate of the Community Development Team of the University of Santo Tomas Industrial Engineering Circle (2021-2022). She took up an internship in the operations department of Bewell Nutraceuticals Corporation, a licensed and accredited manufacturer and distributor of pharmaceuticals and herbal supplements by the Philippine Food and Drug Authority.

Charmaine Anne R. Mendoza is a fourth-year Bachelor of Science in Engineering student at the University of Santo Tomas. She was a former Executive Associate for Creative Media and Design at UST Industrial Engineering Circle and a former member at the UST - UNESCO Club and UST Hiraya. Currently, she is a member of the UST Industrial Engineering Circle and Operations Research Society of the Philippines - UST Chapter (ORSP-UST). Her interests in the Industrial Engineering field involve Supply Chain Management, Smart Manufacturing, and Production Engineering. She took up an internship in the architecture field at the Hercar Builders Inc., and an internship at the Philippine Seven Corporation in the office of the president under the data analytics team.

Keith Nathan L. Tiulentino is a fourth-year Bachelor of Science in Industrial Engineering student at the University of Santo Tomas. He was formerly part of the Finance and Sponsorship team of the UST Industrial Engineering Circle and Operations Research Society of the Philippines - UST Chapter (ORSP-UST). His interest in the field of Industrial Engineering would involve Supply Chain Management, Production Engineering, and Smart Manufacturing. He took up his internship at MotoItalia Philippines Inc. as part of the data analytics team that manages Vespa motorcycles, considered as one of the most popular licensed Vespa dealers in the Philippines.

Ryan Mikael M. Villaraza is a fourth-year Bachelor of Science in Industrial Engineering student at the University of Santo Tomas. He took his primary and secondary education in Marist School, which is found in Marikina City, where he has taken multiple extracurricular activities mainly in sports and music. His interest in the Industrial Engineering field involves Supply Chain Management, Smart Inventory Management, and Service Engineering. He took up his internship at Philippine Seven Corporation as part of the data analytics team which managed trends of multiple variables of stores across the country.

Gabriel C. Bucu is a graduate of Bachelor of Science in Industrial Engineering at the University of Santo Tomas (UST) and a graduate of Master of Science in Industrial Engineering at De La Salle University-Manila. He served as the Department Head and Supervisor from 2019-2022 of the Industrial Engineering Program and currently, he is an Instructor at the UST Department of Industrial Engineering and is specializing in Service Engineering and Management. He is a Certified Industrial Engineer (CIE) awarded by the Philippine Institute of Industrial Engineers (PIIE) and an Associate Engineer (AAE) awarded by the ASEAN Federation of Engineering Organizations (AFEO). He has presented in several conferences both locally and overseas, in countries including Indonesia, Taiwan, Japan and South Korea. His research interests include Optimization and Simulation, Design Thinking, and Supply Chain Engineering and Management.

Joehanna K. Ngo is an ASEAN Engineer, Professional Industrial Engineer (PIE), founding member of the Philippine Institute of Industrial Engineers, associate professor, practitioner, and a former administrator. She received her Master's degree in Industrial engineering from the University of the Philippines – Diliman and Ph.D. in

Commerce at the University of Santo Tomas. She currently heads the Industrial Engineering Department of the Faculty of Engineering of the University of Santo Tomas. It was during her term as the department chair that the Commission for Higher Education & Development (CHED) accorded recognition to the department as a Center for Development (COD) as well as earned for the Industrial Engineering Department an international accreditation by the Accreditation Board for Engineering and Technology (ABET).