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# Bamboo Goes Digital: An E-Commerce Adoption forHundred Islands E-Kawayan Factory in theCity of Alaminos, Philippines

**Dr. Carlo Genster P. Camposagrado[1], Dr. Thelma D. Palaoag[2]**

[1]Information Technology Department, Pangasinan State University, Pangasinan, Philippines
[2]Information Technology Department, University of the Cordilleras, Baguio City, Philippines

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**ABSTRACT**:

This paper presents the transformation of the bamboo business in the digital age, emphasizing the role of e-commerce as a catalyst for growth and innovation. As the demand for sustainable and eco-friendly products grows, the bamboo industry is at a crossroads, where implementing digital technology can dramatically improve market reach and operational efficiency. As the City of Alaminos adopts technology to make engineered kawayan items, the success of the transforming process is dependent on how it is introduced to everyone. As most consumers go online, the internet is a significant aspect that would be ideal as a marketplace in any organization. Development of e-commerce platform to sustain the bamboo industry in the city providing ways of buying bamboo products over the internet. This study employed a developmental and descriptive research approach to come up with working applications suitable for the factory. Understanding the current situation and analyzing the problems using SWOT analysis provides insights on how solutions be integrated into the e-commerce application for the factory. The usage of the Internet will be a significant component in the factory's marketing strategy, eliminating the barrier between the buyer and the manufacturer. The introduction of an online store enabled the manufacturing to compete in the business world.

**KEYWORDS**: engineered-kawayan, ecommerce, City of Alaminos, bamboo industry, online store

## 1) INTRODUCTION

The Philippines' bamboo sector is becoming more well-known for its promise as a resource that is both sustainable and adaptable. There is a growing recognition of bamboo as a valuable resource for economic development in the Philippines [1]. Bamboo is highlighted as an adaptable material that may be used for handicrafts, furniture, and buildings, offering substantial local and international market prospects. The Philippine government intends to spend more than PHP100 million to strengthen the skills of the local bamboo sector and promote Filipino ideas in bamboo construction [2]. The Philippine government emphasized the value of bamboo in the country's economy and in the agricultural sector [3]. Government authorities are promoting the growth of the bamboo industry, which is estimated to contribute USD3.5 billion to the Philippine economy [4]. With these initiatives, innovation on the marketing side of the product is essential to the business of bamboo grower and product manufacturer. Furniture, handicrafts, and engineered bamboo are the leading bamboo items with a strong potential for the domestic and international markets [5]. Other areas of the country, such as towns in Leyte province, are urged to get into bamboo cultivation to react to increased demand for its by-product [6]. The bamboo sector in Central Luzon created P9.12 million in investment, 28 new jobs, and P7.54 million in sales for 38 micro, small, and medium-sized companies (MSMEs) in December 2021 [7]. The country's bamboo sector is being pushed through convergence and collaboration with several government entities to help enhance employment and livelihoods in rural areas.

The Hundred Islands E-Kawayan (Engineered-Kawayan) is a sustainable development project in the City of Alaminos. The E-Kawayan factory converts bamboo into wood components that are used in a range of applications, ranging from furniture to souvenir goods. The factory also has its own souvenir shop where tourists can select from a wide range of unusual bamboo products. The products of the factory diversified from key chains to plaques, chairs, tables, wall clocks, sala sets, fruit trays, lampshades, podium, and table names depending on the needs of the customers. The Hundred Islands E-Kawayan Factory is currently part of the City of Alaminos' agritourism project, which is driving the development of a dynamic bamboo sector in the city and across the province, as well as providing livelihood options for bamboo producers and cooperative members. The profit goes to the factory for operation, improvement, and maintenance of the machines and as salary to the cooperative members who work in the factory. Selling the furniture, souvenirs, and other items would help the factory to promote the industry in the locality and nearby municipalities. The promotion of the bamboo industry can be achieved through selling these products to tourists coming from different places in the country visiting the Hundred Islands National Park. Innovation through digital store selling bamboo products in a wider market would further promote the bamboo industry in Alaminos.

E-commerce in the Philippines has seen tremendous growth in recent years, driven by rising internet coverage, a youthful, tech-savvy populace, and improvements in digital infrastructure. Firm size, computer and internet availability, and ICT integration into corporate operations are all important factors in boosting e-commerce adoption [8]. Younger business owners were more willing to adopt new technologies than older businesses [9]. The COVID-19 pandemic accelerated the shift towards online shopping, with consumers adopting e-commerce. The rising digital economy and increased internet connection in rural areas create new market opportunities. E-commerce is also integrated with some social media platforms where products are advertised, and links are posted to be connected to the websites or applications. Other e-commerce applications are now simple to use on handheld devices like mobile phones giving efficiency and ease of use to do transactions over the internet. These factors together with the rise of mobile technology and social media, have influenced the Philippines' expanding e-commerce adoption rate [10]. Consumer service is an important aspect of e-commerce since it directly affects consumer happiness, brand loyalty, and overall business performance. Components that influence a website's customer service experience include ease of navigation, security features (such as SSL encryption and privacy policies), and features that increase customer trust, such as the availability of secure payment options and clear communication about transaction policies [11]. Standard features of e-commerce websites includes navigation, home link, search functionality, shopping cart view, customer support options, account management, catalog and personalization [12]. Consistency and standards in web design are essential for increasing customer happiness and decreasing wasted sales chances.

With the fast development of internet access and mobile usage, especially in emerging economies, e-commerce is making it easier for bamboo industries to enter the global marketplace. These businesses can use online platforms or develop own application to exhibit their products to a varied customer base, overcome geographical barriers, and compete on a larger scale. As the bamboo industry embraces e-commerce, it not only stands to boost its economic potential but also contributes to the sustainable development goals by promoting eco-friendly materials. This paper presents the development of e-commerce platform of Hundred Islands E-Kawayan Factory that help to sustain the bamboo industry in the City of Alaminos.

## 2) METHODOLOGY

A descriptive developmental technique was employed to help the researcher perform the study. Descriptive research seeks to accurately explain a research problem. Developmental research in software development plays a vital role in advancing the field by creating practical, evidence-based solutions that address real-world challenges. A descriptive approach was used to understand the situation of the intended user of the e-commerce platform. The researcher used a developmental approach to design a business model and web architecture framework for a Business-to-Consumer (B2C) e-commerce platform for Hundred Island E-Kawayan Factory. The business model and web framework were implemented through the web application.

The researcher initially employed a human-centered innovation technique known as "design thinking" that

integrates people's desires, technological possibilities, and the environment required for effective organizational operations. The E-Kawayan e-commerce platform was built using an iterative software development approach that includes several phases: planning, requirements, analysis and design, implementation, testing and evaluation, and deployment.

Interviews and observation were the key data collection strategies used to understand the factory's business processes. The interview was mainly undertaken to identify the problems they encountered as well as how business operations are carried out in the facility. In addition, the researcher went to the factory to observe the current setting and collected different forms used by the factory in their business process. Moreover, customers were interviewed for their experiences and observations about purchasing bamboo products. Furthermore, forms utilized by the factory were collected and examined to help create the system's internal components. The researcher used diagrams from system analysis and development to create a quality system.

A review of relevant studies to determine the elements of web architecture and features of e-commerce platform was performed to meet the expected functionalities of the website. A SWOT analysis was carried out to discover the critical variables that should be included in the Hundred Islands E-Kawayan Factory e-commerce web application. Elements and features were reviewed, analyzed and mapped to the needs of the customers.

**3) RESULTS AND DISCUSSION**

A series of interviews and observations were conducted to determine the problems associated with selling the factory's bamboo products. The researcher interviewed the factory's administrator and customers. The factory's administrator personally greets visitors or customers, and some of them share their opinions about the location. Customers' observations are very significant to consider in this study because they are the buyers of bamboo products and would be the final users of the e-commerce platform. The researcher documents the difficulties and observations of two personas: the factory employee and the customers. Table 1 shows the problems and observations by the factory employee and Table 2 by the customers of the factory.

Table 1 List of Problems/Observations by the Factory Employee

| | |
|---|---|
| Persona | Factory Employee |
| Role | Facilitate the purchase and job order of the customer for the items bought and customization. |
| Problems / Observations | |
| The factory is far from the city proper and tourism area. There is no stall for bamboo products at the Lucap Warf where most of the tourists come in.<br>Bamboo products of the factory are only showcased or displayed during city fiesta. | |

Table 2. List of Problems/Observations by the Customer

| | |
|---|---|
| Persona | Customer |
| Role | Client of the factory in purchasing bamboo products |
| Problems / Observations | |
| 1. There is no direct trip from any of the TODAs in the city. The tricycle will be hired for transportation which makes the fare high because of the location of the place.<br>2. The process for requesting an onsite tour takes time. The request shall be submitted to the factory and will wait a couple of days for approval. The requestor needs to call for updates on the request.<br>3. Just found out about the factory from a friend.<br>4. The needs to go there for number of times, for purchase and pick up of the items for customized products. | |

The problems listed above were analyzed by the researcher by giving the point of view of the two personas in

order to come up with a solution to address these concerns.

Table 3. Collated Matrix of Problems of the Factory

| Persona | POV's | HMW | Proposed Solutions |
|---|---|---|---|
| Factory | Low sales because of the location of the factory | How might we help the factory increase its sales? | A website application that can help the factory increase its sales. |
| | Limited avenue for selling bamboo products. | How might we help the factory sell and promote their products in a wider market? | A B2C e-commerce platform that can be accessed by the public reaching the market not limited to the city of Alaminos but to other municipalities and regions in the country. |

Table 4. Collated Matrix of Problems of the Customer

| Persona | POV's | HMW | Proposed Solutions |
|---|---|---|---|
| Customer | The cost of fare is high due to the location of the factory. | How might we help the customer save money for transportation? | An online store that can be accessed over the internet without going personally into the factory. |
| | Lack of mechanism for any updates of approval to onsite tour. | How might we help the customer to know of their request? | A mechanism that processes onsite requests and gives notification for the status. |
| | Unaware of the factory that produces bamboo products in the locality, have known only from friends. | How might we help the customer become familiarized with the bamboo industry in the city? | A website that displays all the bamboo products of the factory. |
| | Cost of fare is high because of going there twice to get customized products or own design. | How might we help the customer reduce the expenses of buying bamboo products? | A mechanism processes the order, payment, and delivery over the Internet. |

Table 3 and Table 4 were the collated problems and observations of the two personas based on the interviews conducted. Taking into consideration the solutions provided for the different problems and observations, and emerging technologies for businesses, this had become the basis of researcher in creating a web architecture framework for the e-commerce platform that would facilitate and promote innovation in the business processes that will address the concerns of the personas.

Implementing the architecture framework of an e-commerce platform through a web application for Hundred Islands E-Kawayan Factory would change the business process physical store to an online store. After problems were identified, and proposed solutions to each problem were recommended, a SWOT analysis was conducted to identify the necessary important factors to be included in the e-commerce platform. The strengths, weaknesses, threats, and opportunities based on the proposed solutions were mapped out. The SWOT analysis fills the knowledge gap in the strategic planning context and indicates meaningful implications for managers that could help improve their strategic decisions. Table 5 shows the SWOT analysis done by the researcher.

Table 5. SWOT Analysis of the Proposed Solutions

| Proposed Solutions | Strengths | Weaknesses | Opportunities | Threats |
|---|---|---|---|---|
| A website application that can help the factory increase its sales. | Can be accessed anytime and anywhere by its customer. | Loading of the website depends on the internet connectivity of the customers. | Development of mechanisms and policies to prevent attacks and fraud. | Prone to cyber attacks and identify fraud. |

| | | | | |
|---|---|---|---|---|
| A B2C e-commerce platform that can be accessed by the public reaching the market not limited to the city of Alaminos but to other municipalities and regions in the country. | Wider reach of market or target audience. | Innovation to compete and reach wider market is too late. | Can be used as a reference or model by Starp-up businesses | Competitions to different marketplaces that have been established already. |
| An online store that can be accessed over the internet without going personally into the factory. | Save time to purchase products. | No real-time assistance with on actual purchasing processes of the products. | Purchasing orders at the convenient time of the customers. | Understanding the business flow of implementing the e-commerce platform may be new to the customers of the factory |
| A mechanism that processes onsite requests and gives notification for the status. | Save time for an on-site tour request. | Can be intrusive if used too often | The growth of mobile devices and the Internet of Things (IoT) creates new opportunities for online notification systems. | The increasing amount of spam and fraudulent messages can make it difficult for users to identify legitimate notification |
| A website that displays all the bamboo products of the factory. | Wide selection and customer reviews | Trust due to lack of physical presence | Expansion into new markets | Changing consumer preferences |
| A mechanism processes the order, payment, and delivery over the internet. | Electronic means or transaction giving convenience to its customers | The system may experience technical problems, such as downtime or security breaches. | Businesses can expand into new markets by using this mechanism to reach customers around the world | Regulatory changes, such as data privacy laws, could impact the use of this mechanism. |

In general, a framework is a real or conceptual structure intended to serve as a support or guide for the building of something that expands the structure into something useful. An e-commerce framework is made of underlying architecture needed to develop and maintain a system for selling products online. The new generation of shoppers and entrepreneurs prefer online shopping and business platforms more than regular brick-and-mortar stores.

The researcher used the proposed solutions in Table 3 and Table 4 to identify the elements of each layer in a three-tier application. These serve as the basis for identifying modules in the development the e-commerce platform. Table 6 shows the mapping of elements in a three-tier application.

Table 6. Mapping of Proposed Solutions to Elements of Architecture

| Proposed Solutions | Presentation Tier | Application Tier | Data Tier |
|---|---|---|---|
| A website application that can help the factory increase its sales. | An interface that displays all bamboo products | A product module that manages the display of the website | An SQL instruction that manages the displays of the product module |

| | | | |
|---|---|---|---|
| A B2C e-commerce platform that can be accessed by the public reaching the market not limited to the city of Alaminos but to other municipalities and regions in the country. | | A product module that displays different items in the factory | |
| An online store that can be accessed over the internet without going personally into the factory. | | A product module that displays different items in the factory | |
| A mechanism that processes onsite requests and gives notification for the status. | An interface that displays the content and status of onsite tour request | An onsite tour module that caters to requests for visits. | An SQL instructions that manage the onsite tour module |
| A website that displays all the bamboo products of the factory. | An interface that displays all bamboo products | A product module that manages the customer orders | An SQL instruction that manages the displays of the product module |
| A mechanism processes the order, payment, and delivery over the internet. | An interface that displays the content of the website cart. | A cart module that handles customer multiple orders | An SQL instruction that manages the functions of cart module |
| | An interface that displays the progress of the payment transactions | A payment module that processes the customer payment transaction | An SQL instruction that manages the payment process of the website to a payment gateway |
| | An interface that displays the status of the shipping service. | A delivery module that processes the shipping process of the ordered product | An SQL instruction that manages the functions of the shipping process |

Based on the mapping of proposed solutions to the web architecture of the e-commerce platform, Figure 1 shows the Web Architecture Framework. Three-tier architecture is a well-established software application architecture that organizes applications into three logical and physical computing tiers: the presentation tier, or user interface; the application tier, where data is processed; and the data tier, where the data associated with the application is stored and managed.

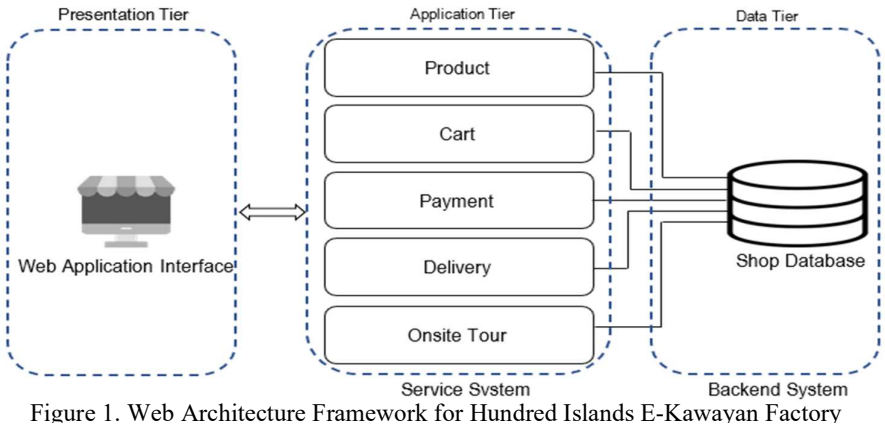


Figure 1. Web Architecture Framework for Hundred Islands E-Kawayan Factory

The e-commerce platform attributes were carefully studied in light of the factory's and target customers' needs. The researcher sketched out the features based on the two personas' points of view and ISO-IEC 9126. Figure 2 shows the mapping of features to the POVs. Based on the mapped features to ISO-IEC 9126, the functionality of the website focuses on the purpose of the e-commerce platform on the aspects of the product, the managing products, search products, add to carts and checkout process, payment and delivery, and customer review.

The website's reliability is more dependent on the processing of payment orders and the delivery of

merchandise. This feature on the website is a huge worry because it affects the factory's revenue. The usability of the website includes all of the elements that have been built. This applies not only to the user interface, but also to how the user interacts with the system's various functional uses. The website's efficiency focuses on the aspects that most customers conduct on an e-commerce platform, such as product search, add to basket and checkout procedure, payment and delivery. The website's functions that needed to be maintained included the search product, add to basket and checkout process, and payment and delivery.These are the most commonly used functions, and they must be able to repair problems if they occur. The integration of new technology is the focus of the portability category. According to the numbers, when the website adds new payment and delivery options, the feature should be able to support new modules and technologies.

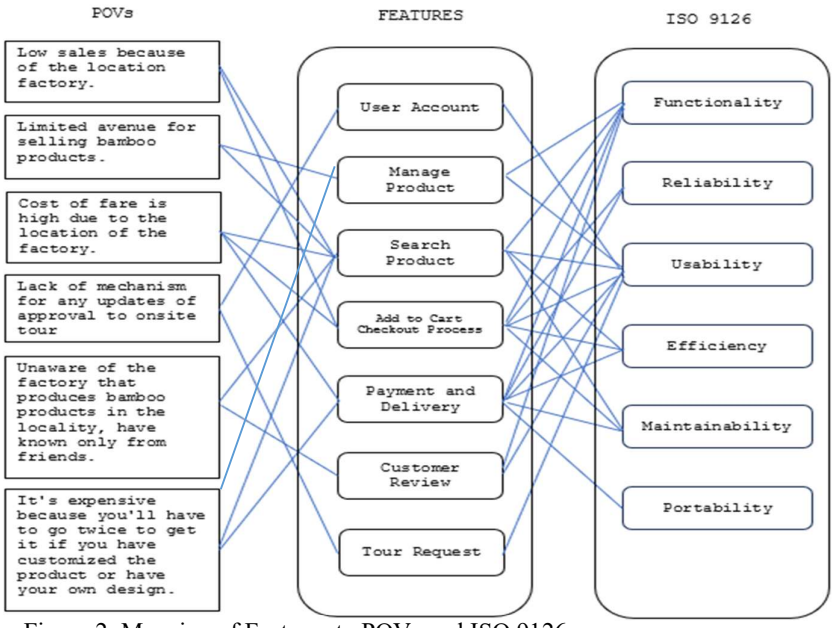

Figure 2. Mapping of Features to POVs and ISO 9126

*User Account*. The customer must create an account with a valid email address. The email will be used to provide account verification to consumers so they may purchase bamboo products, personalize products, and arrange an on-site tour. The customer's user account can view the contents of their carts as well as the status of their orders. To provide protection against fraudulent transactions, unverified accounts are unable to perform any transactions on the e-commerce platform. Figure 3 shows the verification requirement page for user account.

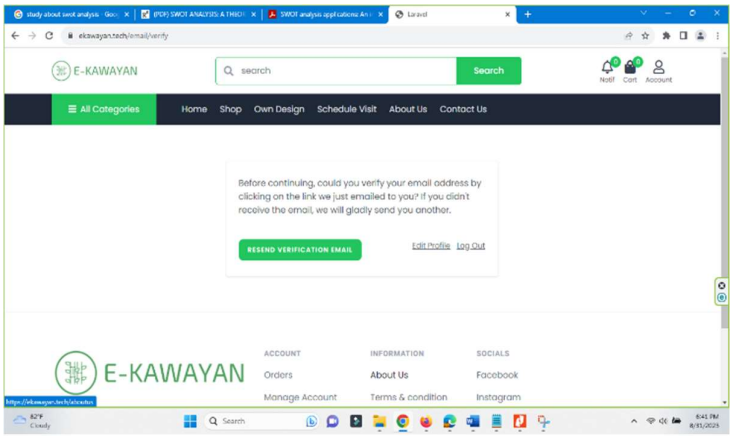

Figure 3. Verification Requirements for Account

*Manage Product*. The management of website content must be dynamic; the employee is in charge of capabilities that manage website content and customer orders. The Bamboo-hayan is simple to maintain, allowing the employee who controls the website's content to utilize and navigate it easily. This feature allows customers access to a diverse range of products. The customer manages the product by adding personalization, such as engraved text and graphics. This feature allows the consumer to add personalized text and images to the ordered product. Furthermore, there is a function that allows customers to design their own products in terms of size and

appearance. Figure 4 shows the Manage Product Page of the website by the administrator.

*Search Product*. The user utilizes the website's search bar to enter keywords for the things they wish to purchase. Furthermore, customers can select display products depending on the categories or prices of bamboo products. Figure 5 demonstrates the Product Page, which includes the website's search bar and filtering capabilities to assist customers in conveniently finding things.

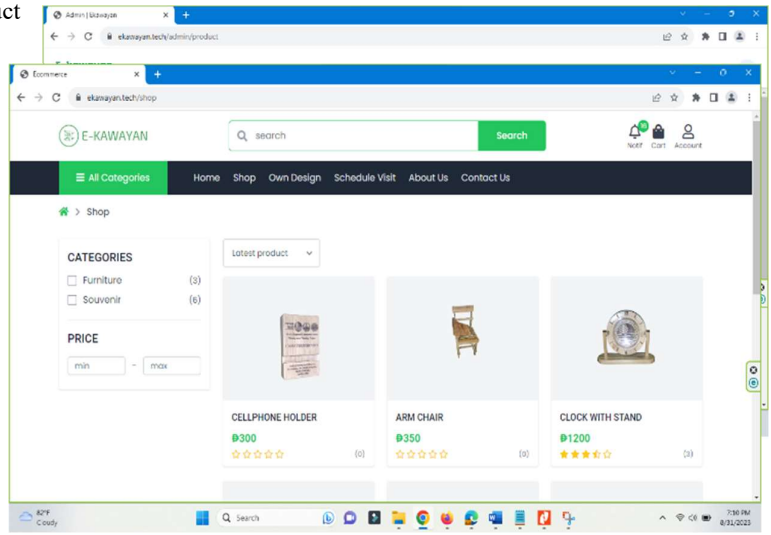


Figure 5. Product Page

Add to Cart and Check Out Process. The customer may add different items in their cart. The cart serve as temporary storage for different products the customer wants to buy. After looking and adding items in the cart, the customer checkout all the items to be purchased. The customer needs to fill data such as the contact number, and shipping address. The customer needs to place the order, for the employee can process the product ordered. Figure 6 shows the Shopping Cart Page of the website that display items inside the cart and the total order summary.

*Payment and Delivery*. The checkout procedure places the customer's order for payment processing and delivery. The consumer inspects the things that will be purchased. After entering the shipping address for delivery, the buyer selects the payment option for the purchased items. Figure 6 illustrates the website's Checkout Page.

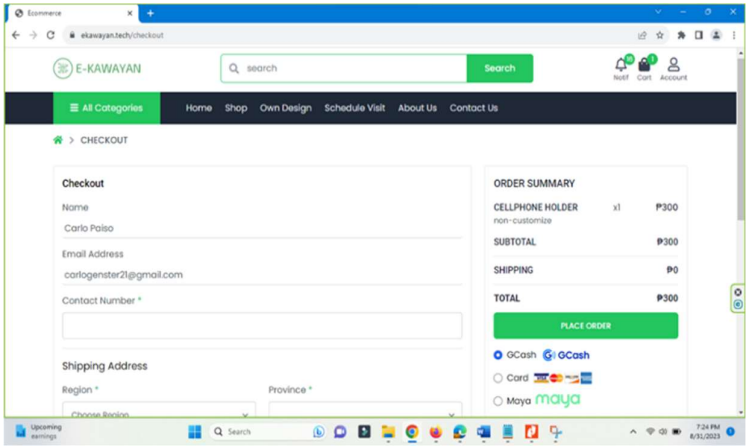


Figure 6. Check Out Page

*Customer Review*. Products are shipped out and delivered to customers. The customer waits for a set number of days, which varies depending on the region. Once the product has been delivered to the customer, the purchase status is complete. The consumer evaluates the product quality or the factory's services for the acquired product.

The consumer includes reviews of the item they purchased as shown in Figure 7.

*Tour Request*. As shown in Figure 8, the customer enters the necessary information for the request for an on-site tour, including name, contact number, name of association, client type, and date and time of visit. Once the customer sends the request, the factory will review it for approval. The data required in the forms was based on an existing form used by the factory for their request visit.

The features of e-commerce drive the behavior of the customer in purchasing items on their platform. With the mapped features based on the POVs of the two personas, the web architecture framework was suited in the needs of the Hundred Islands E-Kawayan Factory e-commerce platform.

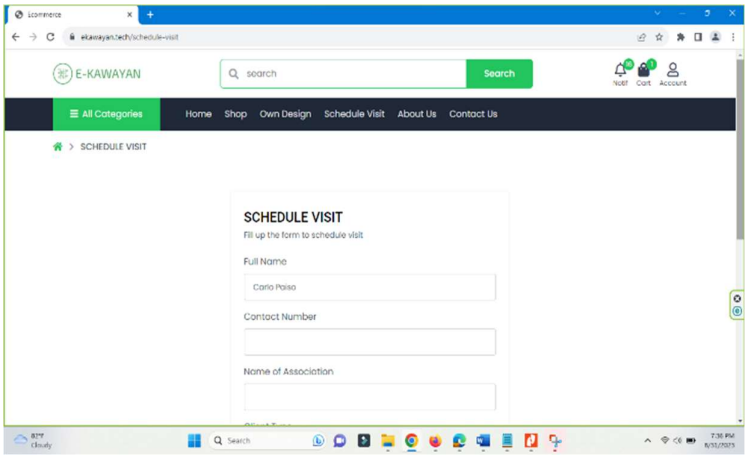


Figure 7. Schedule Visit Page

**4) CONCLUSION**

The development of an e-commerce platform for Hundred Islands E-Kawayan Factory must consider the interests of both the customer and factory personnel. The Hundred Islands E-Kawayan Factory, which is part of the City of Alaminos' agritourism initiative, used an e-commerce platform to bring the city's bamboo sector closer to tourists. The developed features assisted the manufacturer in developing a mechanism that provides a convenient and easy approach to purchasing bamboo items. With the adoption of e-commerce into the bamboo industry, the created platform would undoubtedly stimulate economic growth in the country's bamboo market.

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