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Emotional Intelligence, Consumer-Perceived Values, and E-Shopping Satisfaction: A Mediation Analysis

Ellaine Joy G. Eusebio, Evaliza F. Moreno and Feve D. Faeldan

ABSTRACT

Filipinos' interest in online shopping is growing, and businesses should adapt to this new marketing landscape. To win, business managers should strategize how to compete to satisfy their online customers. This paper explored the effects of emotional intelligence (EI) on consumers' online shopping satisfaction (SS). Further, it studied the role of consumers' perceived values, namely utilitarian values (UV) and hedonic values (HV) on EI-SS relationship. The respondents were the regular faculty of the Romblon State University-main campus who have engaged in online shopping. The researchers used descriptive statistics (i.e., mean, standard deviation) and linear and mediated regression analysis. The results showed that EI affects HD, UV, and SS, while HD and UV affect SS. Moreover, the results revealed that UV fully mediates and HD partially mediates the relationship between EI and SS.

Keywords: *consumer satisfaction, emotional intelligence, hedonic values, online shopping, utilitarian values*

INTRODUCTION

Filipinos are becoming more involved in the internet. The Philippines ranked first in the world regarding social media usage and time spent online (Zialcita, 2019). Furthermore, from 2 million internet users in 2000 Q4, the country has 79 million internet users in 2020 Q1, representing a 3,950 percent increase in internet usage (Internet World Stats, 2019). Furthermore, as of 2019 Q3, 91 percent of internet users in the Philippines stated that they visited an online retail store, searched for, and purchased a product or service online (Internet World Stats, 2020). E-commerce has proliferated, and online shopping is now a standard method of purchasing goods (Yan et al., 2016).

As defined by Turban et al. (2018), e-commerce refers to buying and selling products and services and transporting and trading data over the internet and intranet. Online shopping has become a way of life. Businesses are capitalizing on this new norm, and e-commerce sites benefit significantly. To name a few, Amazon's online store segment alone increased 14 percent from the second quarter of 2018 to the second quarter of 2019 (Internet World Stats, 2019). Furthermore, Lazada Philippines, an online department store and marketplace for retailers to sell their products, reported 25 million visits to its e-commerce website in 2019 (Internet World Stats, 2020).

E-commerce has made a significant contribution to the economy of some countries. According to a joint study conducted by Google, Temasek, and Bain & Co, Southeast Asia's internet economy, primarily driven by e-commerce and ride-hailing, reached $100 billion in 2019, tripling in size over the previous four years (Saxena, 2020). Given these facts, it is clear that e-commerce offers numerous benefits to both businesses and the country's economy. Turban et al. (2018) classified e-commerce based on the nature of the transactions and the relationships between the participants as follows: business-to-business (B2B), business-to-consumer (B2C), consumer-to-business (C2B), business-to-employees (B2E), drop shipping, consumer-consumer (C2C), collaborative commerce (c-commerce), and e-government. The researcher concentrated on the B2C classification in this study.

Filipinos' interest in online shopping is growing, and businesses recognize the importance of adapting to this new marketing landscape. Companies must strategize on how to compete online to win. However, one of the biggest challenges for online shopping is providing and maintaining customer satisfaction (Rita et al., 2019). Electronic satisfaction (e-Satisfaction) is critical for online retailers to attract and retain online shoppers in the virtual environment (Ting et al., 2016). As a result, to survive in a fiercely competitive e-

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environment, businesses must understand how to satisfy online consumers. Customer satisfaction is the customer's overall assessment of a product or service after purchasing it (Choi et al., 2013, as cited by Pham & Ahammad, 2017).

Several studies have been conducted on the various factors that influence e-commerce satisfaction. Meanwhile, few studies focus on a person's psychological characteristics, specifically emotional intelligence, as a determinant. Mayer and Salovey (1997) define emotional intelligence (EI) as an individual's ability to process dynamic information: perceiving emotion, integrating emotion to facilitate thought, and understanding and regulating emotion to promote personal growth (as cited in Extremera et al., 2011). EI has been linked to higher levels of customer satisfaction (Rajput & Talan, 2017; Lim & Kim, 2020). Bhalerao and Sharma's (2018) research, on the other hand, found that EI has no direct impact on consumer satisfaction. Furthermore, Lim and Kim's (2020) study demonstrated that EI influences consumer value perceptions, divided into two categories: hedonic and utilitarian values. These two values have been highly relevant factors influencing customer satisfaction (Avcilar & Ozsoy, 2015; Lee & Kim, 2016; Kesari & Atulkar, 2016; Samudro et al., 2020). However, according to Vijay et al. (2019), hedonic shopping value has no significant impact on e-satisfaction. Given that emotional intelligence influences shopping satisfaction and that emotional intelligence influences consumer perceived values, which results in shopping satisfaction, the researchers investigated whether utilitarian and hedonic values mediate emotional intelligence and shopping satisfaction.

This research will assist e-commerce businesses in remaining competitive in the online environment. The findings of this study will assist them in conceptualizing marketing strategies related to emotions. The researchers investigated the effects of EI on consumer perceived values, shopping satisfaction, and e-shopping satisfaction. Further, they looked into the role of hedonic and utilitarian values in mediating the relationship between emotional intelligence and online shopping satisfaction.

METHODOLOGY

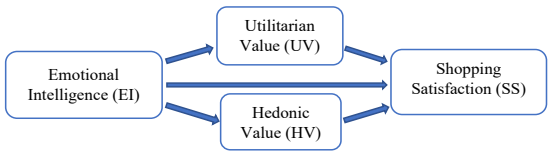

Figure 1. The Conceptual Framework

The researchers used the cognition-affection-conation framework to investigate the relationship between emotional Intelligence and E-shopping Satisfaction. Under this framework, Lim and Kim (2020) mention four characteristics: Cognition has two characteristics, namely psychological capital characteristics (e.g., emotional intelligence) and cognitive characteristics (e.g., utilitarian, hedonic values), Affection has emotional aspects (e.g., satisfaction), and Conation has an intentional element (e.g., intention, loyalty). In this study, three characteristics were considered: psychological characteristics, cognitive characteristics, and emotional characteristics (Figure 1).

Consumers have two types of perceptions of value. The first is the hedonic value (HV), which is more affective because it is associated with pleasure, entertainment, and interest. In contrast, the second is the utilitarian value (UV), which is more cognitive because it is associated with utility and usability (Kim & Eastin, 2011, as cited by Lim & Kim, 2020). Moreover, customers are satisfied based on how a product's performance meets their expectations (Kotler & Armstrong, 2012). Choi et al. (2013) defined *consumer satisfaction* as the overall evaluation of the products and services after purchase (Pham & Ahammad, 2017). Similarly, online shopping satisfaction fulfills a buyer's perceived value of a product after buying it.

Study Samples

The samples of the study were the 83 regular faculty members at the main campus of Romblon State University. Of these, 41% were men, 58% were women, and one percent were gay. Regarding the employment status, 77% were permanent, and 23% were temporary permanent faculty. A total of 23% had a Bachelor's degree, 64% had a Master's degree, and 13% had a Doctorate. Regarding academic positions, 71% were Instructors, 14.5% were Assistant Professors, and 14.5% were Associate Professors.

Data Gathering Method

The researchers gathered primary data by distributing a closed-ended questionnaire to the respondents who were engaged in online shopping. The questionnaire was adapted from Lim & Kim (2020). The researchers conducted a pre-test to ensure its reliability. Based on the Cronbach's Alpha values, all of the items qualified for inclusion in the questionnaire.

Data Analysis Method

Jamovi, a powerful statistical tool designed for academic researchers (Bunn & Korpela, 2019), was used to analyze the data. Descriptive statistics (i.e., mean and standard deviation) and linear and mediated regression analysis were also used.

RESULTS AND DISCUSSION

As to the e-commerce engagement of the respondents, findings show that 43% buy from Lazada, and 30% buy from Shopee, while the rest buy from other platforms. In addition, clothing and accessories (29.6%) and consumer technology and electronics (19.3%) are the top two products they buy online.

The following regression analyses were examined based on an alpha of 0.05. First, the regression with Emotional Intelligence predicting Shopping Satisfaction was conducted. The regression of Shopping Satisfaction on Emotional Intelligence was significant, $F(1,81)= 19.5$, $p <0.001$. The results showed that Emotional Intelligence was a significant predictor of Shopping Satisfaction, $B = 0.58$, indicating that the first criterion for mediation was satisfied. Second, the regression with Emotional Intelligence predicting Utilitarian Value was conducted. The regression of Utilitarian Value on Emotional Intelligence was significant, $F(1,81)=120$, $p <0.001$. The results showed that Emotional Intelligence was a significant predictor of Utilitarian Value, $B = 0.88$, indicating that the second criterion for mediation was satisfied. Third, the regression with Utilitarian Value predicting Shopping Satisfaction was conducted. The regression of Shopping Satisfaction on Utilitarian Value was significant, $F(1,81)=40.2$, $p <0.001$. The results showed that Utilitarian Value was a significant predictor of shopping Satisfaction, $B = 0.67$, indicating that the third criterion for mediation was satisfied. Next, the regression with Emotional Intelligence and Utilitarian Value predicting Shopping Satisfaction was conducted. The regression of Shopping Satisfaction on Emotional Intelligence and Utilitarian Value was significant, $F(2,80)=19.90$, $p <0.001$, suggesting that Emotional Intelligence and Utilitarian Value accounted for significant variance in Shopping Satisfaction. The individual predictors were examined further. The results showed that Utilitarian Value was a significant predictor of Shopping Satisfaction when Emotional Intelligence was included in the model, $B = 0.67$, indicating that the fourth criterion for mediation was satisfied. The results showed that Emotional Intelligence was not a significant predictor of Shopping Satisfaction when Utilitarian Value was included in the model, $B = -0.014$, indicating that the fifth criterion for mediation was satisfied. Full mediation is supported since items 1, 2, 3, 4, and 5 were met.

Furthermore, the regression with Emotional Intelligence predicting Shopping Satisfaction was conducted. The regression of Shopping Satisfaction on Emotional Intelligence was significant, $F(1,81) = 19.5$, $p <0.001$. The results showed that Emotional Intelligence was a significant predictor of Shopping Satisfaction, $B = 0.58$, indicating that the first criterion for mediation was satisfied. Second, the regression with Emotional Intelligence predicting Hedonic Value was conducted. The regression of Hedonic Value on Emotional Intelligence was significant, $F(1, 81)=122$, $p = 0.001$. The results showed that Emotional Intelligence was a significant predictor of Hedonic Value, $B = 0.48$, indicating that the second criterion for mediation was satisfied. Third, the regression with Hedonic Value predicting Shopping Satisfaction was conducted. The regression of Shopping Satisfaction on Hedonic Value was significant, $F(1,81) =52.1$, $p < 0.001$. The results showed that Hedonic Value was a significant predictor of Shopping Satisfaction, $B = 0.60$, indicating that the third criterion for mediation was satisfied. Next, the regression with Emotional Intelligence and Hedonic Value predicting Shopping Satisfaction was conducted. The regression of Shopping Satisfaction on Emotional Intelligence and Utilitarian Value was significant, $F(2,80)=32.4$, $p <0.001$, suggesting that Emotional Intelligence and Hedonic Value accounted for a significant amount of variance in Shopping Satisfaction. The individual predictors were examined further. The results showed that Hedonic Value was a significant predictor of Shopping Satisfaction when Emotional Intelligence was included in the model, $B = 0.51$, indicating that the fourth criterion for mediation was satisfied. The results showed that Emotional Intelligence was a significant predictor of Shopping Satisfaction when Hedonic Value was included in the model, $B =0.33$, indicating that the fifth criterion for mediation was not satisfied. Since items 1, 2, 3, and 4 were met, while item 5 was not, partial mediation is supported.

The study's findings support Lim and Kim's (2020) finding that emotional intelligence influences utilitarian value. It also supports H_1 that emotional intelligence is essential in explaining utilitarian value. The findings are consistent with Lim and Kim's (2020) findings that emotional intelligence influences hedonic value, rejecting H_2 that emotional intelligence is negatively related to hedonic value. Furthermore, emotional intelligence was a significant predictor of shopping satisfaction. The findings are consistent with previous research findings that emotional intelligence influences shopping satisfaction (Lim & Kim, 2020; Rajput & Talan, 2017). However, contrary to Bhalerao and Sharma (2018)'s findings, emotional intelligence has no direct impact on customer satisfaction.

Furthermore, the findings support H_3 that emotional intelligence positively influences shopping satisfaction. The study also found that utilitarian and hedonic values significantly predicted shopping satisfaction. These findings are consistent with previous research findings that hedonic and utilitarian values had a significant influence on customer satisfaction (Kim et al., 2012; Avcilar & Ozsoy, 2015; Hsu et al., 2015; Lee & Kim, 2016; Kesari & Atulkar, 2016; Atulkar & Kesari, 2017; Samudro et al., 2020). Furthermore, the findings support H_4 and H_5, stating that consumers' utilitarian and hedonic values significantly influence their shopping satisfaction. Moreover, the findings revealed that utilitarian value fully mediated the relationship between emotional intelligence and shopping satisfaction, whereas hedonic value only partially mediated the relationship. The findings support H_6 and H_7, which state that consumers' perceived, utilitarian, and hedonic

values mediate the relationship between emotional intelligence and shopping satisfaction.

The positive effect of EI on CS suggests that emotionally intelligent people are easily satisfied with the products and services they acquire online. The findings indicate that consumers with low emotional intelligence are harder to satisfy. As a result, businesses must go above and beyond their typical practices to fulfill and satisfy their customers' expectations. Furthermore, businesses should always solicit and consider customer feedback to ensure customer satisfaction. The significant effect of EI on consumer perceived values suggests that highly emotionally intelligent customers have greater perceived values for products and services. Furthermore, the positive link between Consumers' Perceived Values and Consumer Satisfaction means that as consumers' value perceptions increase, so does their satisfaction when their expectations are satisfied.

Finally, since Utilitarian Value fully mediates the relationship between Emotional Intelligence and Shopping Satisfaction, a consumer's emotional intelligence will only affect shopping satisfaction if it first affects utilitarian value. However, since hedonic value was only a partial mediator in the relationship between emotional intelligence and shopping satisfaction, it confirms Lim and Kim's (2020) claim. According to them, consumers with high levels of emotional intelligence seek utilitarian value rather than hedonic value, which influences e-commerce satisfaction more than hedonic value. Previous research also discovered that while utilitarian value influenced shopping satisfaction, hedonic value did not (Vijay et al., 2017; Vijay et al., 2019).

CONCLUSIONS AND RECOMMENDATIONS

The study looked into the role of emotional intelligence in predicting consumers' perceived values and shopping satisfaction. Previous research has demonstrated a relationship between the factors under investigation. Consumers' emotional intelligence influences their value perceptions. Furthermore, EI improves customer satisfaction. Moreover, consumers' perceived values improve their shopping satisfaction. As a result, this study investigated the indirect effect of EI on CS through consumers' perceived values, such as hedonic and utilitarian values. Although utilitarian value fully mediates the EI-CS relationship, hedonic value only partially mediates it.

The study's findings can be used as a guideline for online vendors, particularly those on the Lazada and Shopee platforms. Online business managers must ensure that their products are well-performing to meet the consumers' high-perceived value, mainly utilitarian value. Emotionally intelligent consumers make decisions based on emotion and logic. Thus, they must develop emotional strategies emphasizing the utility and usability of the products and services rather than highlighting entertainment, pleasure, and interests. For instance, they can promote their products and services to high-EI consumers by emphasizing their usability and utility. Furthermore, they must ensure that their products are constantly innovated, and their services continuously improve.

Moreover, the website should be visually appealing, interactive, and easy to navigate to meet customers' hedonic value pursuit. Promotional activities such as "one-day-only sale" or "year-end sale" will pique their interest and entice low-EI consumers to buy their products. E-commerce managers may also invest in aesthetics, digital marketing, user interface, and user experience. Likewise, the target market's emotional intelligence and consumer perceived values should be assessed before developing marketing management strategies. Different types of customers necessitate different customer-relationship management strategies.

The findings of this study will apply to the academic institution being studied. Future researchers may wish to replicate this study in other organizations or educational institutions to compare the results. Other contextual factors were not taken into account in this study. This pandemic, for example, may have an impact on people's emotional intelligence and shopping satisfaction. As a result, future studies may consider other factors influencing a person's emotional intelligence and shopping satisfaction.

Furthermore, because of the significant differences in employment status and educational attainment, the values for the hedonic value may be affected. Thus, the results for the hedonic value may be subject to further review. Future researchers may consider employment status and educational attainment factors influencing the pursuit of hedonic values. Moreover, the significant differences between academic ranks may affect the utilitarian values, so the results may be subject to further scrutiny. Future researchers may want to consider academic rank influencing utilitarian value pursuit.

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AUTHORS' CONTRIBUTION

All authors have contributed equally.

CONFLICTS OF INTEREST

The authors have no conflicts of interest concerning this study.

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Insecticidal and Antifeedant Activity of *Andrographis paniculata* as Rice Grain Protectant against Red Flour Beetle (*Tribolium castaneum* Herbst)

Marife S. Sayat

ABSTRACT

The red flour beetle (*Tribolium castaneum* Herbst) is the most common stored-product insect pest infesting rice, which acts as vector for several fungal post-harvest diseases. To eradicate such pest, fumigation with chemicals is often used. As a natural alternative, this study explored the potential of *Andrographis paniculata,* an indigenous herb in the Philippines, as an antifeedant agent against *T. castaneum*. Three treatment groups were prepared, consisting of 2kg infected rice with 50 starved unsexed adult red flour beetles. Two grams of *A. paniculata* crushed leaves were placed inside a teabag (5.5 cm x 7 cm). Different amounts of *A. paniculata* tea bags (2 g, 4 g, and 6 g) were used for each treatment to determine its toxicity and antifeedant effect. Gathered data were further analyzed by analysis of variance (ANOVA) to compare the significant differences among treatments. Results of the study showed that among the treatments, three teabags (6g) of *A. paniculata* crushed leaves exhibited the highest percent insect mortality (50%) and lowest percent weight loss (1.87%) of rice. Therefore, this study suggests that three teabags of *A. paniculata* powder may be used for the efficient management of *T. castaneum* infestation and reduce the weight loss of rice in storage.

Keywords: *Tribolium castaneum, stored grain, teabag, antifeedant activity, toxicity effect*

INTRODUCTION

The continuous expansion of human population and the rising demand for food grains and other agricultural-based products put pressure on managing losses due to the infestation of stored insect-pest. One of the major secondary pests that has been a big problem mostly in stored products are the red flour beetles (*Tribolium castaneum* Herbst) since both grub and adults reduce the quality and quantity of grain (Satshi & Patrigi, 2017). To minimize infestation, most farmers typically depend on the use of synthetic products as a method of grain protection against stored-product pests (Azad et al., 2013). Repeated application of this chemical to control stored-product pests leads to several adverse effects on humans, to the environment, and thorough misuse leads to the development of pest resistance (Belmain et al., 2013). Thus, the demand for safeguarding food security by finding a new source of natural and sustainable approaches are needed to be prioritized, hence the use of synthetic chemicals must be prohibited (Ayvaz et al., 2008). As a natural alernative, scientists are exploring various plants to discover potential natural products that can address the problem with *T. castaneum* infestation in rice. One such plant that is being studied is *Andrographis paniculata,* an indigenous herb commonly known in the Philippines as "serpentina" or "king of bitters" due to its extremely bitter taste in every part of the plant body. The aerial parts of this plant are proven to contain the different active phytochemical compounds such as diterpenoid lactone, which contains 2.39% andrographolide (Shahid, 2011). These plants are widely used in traditional medicine for prevention and treatments of malaria, dysentery, and digestive ailments but relatively limited studies were undertaken on its biological activities as bio-pesticides (Kanokwan & Nobuo, 2008).

Exploiting plant products with bioactive components that have similar efficacy as synthetic pesticides are safer and may impart different modes of action in their pesticidal activities (Dubey, 1999). The *A. paniculata* leaves were found to possess andrographolide, a bioactive compound that has insecticidal and antifeedant activity against *Helicoverpa armigera, Sitophilus oryzae*, *Spodoptera litura, Aedes aegypti* (Govindarajan et al., 2011), and *Nephotettix cincticeps* (Widiarta et al., 1997).

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Relatively limited studies made use of plant products as biopesticides in the Philippines, particularly in the province of Romblon where this control method using *A. paniculata* is still unpopular to farmers despite being abundantly available in the province. Thus, the present study aimed to determine the insecticidal and antifeedant activity of *A. paniculata* for the management of *T. castaneum* in stored rice grains under laboratory conditions.

METHODOLOGY

Collection and preparation of plant powders

Two-kilogram fresh leaves of *A. paniculata* were collected around the municipality of Odiongan, Romblon. The collected plant materials were authenticated by a plant expert from the University of Rizal System (URS). Following collection, the leaves were washed separately, shade-dried for 7 days to obtain constant weight. The dried leaves were blended using an electric blender and thereafter sieved into 25 mesh net to obtain a fine powder.

Collection and rearing of test insect

Adult red flour beetles were collected from the different rice storage facilities in Odiongan, Romblon. The collected insects were authenticated by an insect expert from the Cavite State University (CvSU). These insects were maintained at temperature range of 30-35°C in the College of Agriculture, Fisheries and Forestry, Laboratory for mass culture production. These were reared for 35 days in plastic containers with rice grains as a food source, covered with fine mesh cloth and secured with a rubber band for ventilation.

Pesticidal treatments

Different amounts of crushed *A. paniculata* (2 g = 1 teabag, 4 g = 2 teabag and 6 g = 3 teabag) were used as treatment in 2 kg rice. These were placed inside a teabag measuring 5.5 cm x 7 cm. Each tea bag contained 2 g powder.

Bioassay test

The teabags per treatments were placed inside a plastic container with 2 kg rice and were infested with 50 starved unsexed adult red flour beetles to determine their toxicity and antifeedant effect. Adults used in the experiment were aged 2 weeks, unsexed and starved for 24 h before testing. Toxicity effect were observed after 7, 14, 21, and 28 days after the treatments were employed. Percentage of insect mortality was calculated using Abbott's formula (1925), and weight loss (%) of rice after 28 days of observation using the formula by Parkin (1956).

$$\text{Pr} = \frac{Po - Pc}{100 - Pc}\ x\ 100$$

where, Pr= *Corrected % mortality*, Po = *Number of mortality*, Pc = *Total number of insects*

$$\%\ \text{WL} = \frac{WI - W}{WI}\ x\ 100$$

where, W_I = *wt. of rice grains before the experiment*, W = *wt. of rice grains after the experiment*

Data analysis

Data were analyszd and subjected to Analysis of Variance using a Statistical Package for the Social Sciences (SPSS) software with a completely randomized design. Means were compared using Tukey's Multiple Comparison Test at 0.05 probability level to check the significant differences among treatments.

RESULTS AND DISCUSSION

Toxicity

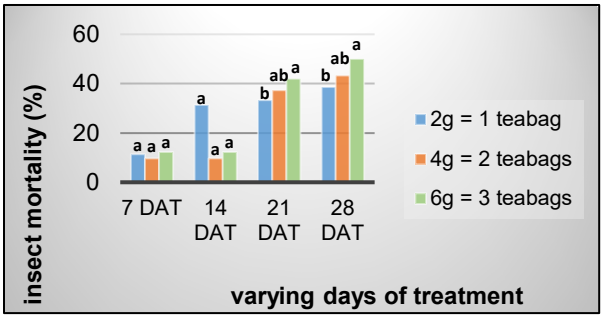

Figure 1. Percent mortality of *T. castaneum* as affected by *A. paniculata* powder at varying days after treatment. *Means followed by the same letters above bars indicate no significant difference (*$p < 0.05$*) in a Tukey's test.*

Earlier utilization of plant powders as stored grain protectant has been reported by Ogban et al., (2015). The effect of different plant products may depend on several factors which include its chemical composition and susceptibility of an insect pest (Isman & Akhtar, 2004). Based on the results, *A. paniculata* powders placed in teabags show significant toxic effect against *T. castaneum* adults. At 28 days after treatment (DAT) application, the highest mean percent mortality (50.00%) was observed using three teabags (6 g) of *A. paniculata* powders (6 g = 3 teabags) followed by 4 g = 2 teabags (43.33%) and 2 g = 1 teabag (38.67%).

At 7 DAT, 6 g = 3 teabags gave a highest mean percent mortality (12.33%) followed by 2 g = 1 teabags (11.33%) and 4 g = 2 teabags (9.67%). Still, at this time, 1 teabag performed better against *T. castaneum* than 2 teabags = 4 g with an average increase of 1.66%. At 14 DAT, still, 6 g = 3 teabags obtained the highest mean

percent mortality (37.33%) which is much higher than the untreated grains.

In addition, as the days of storage period prolonged a significant increase in mean percent mortality increases ranged from zero to an average of 50 percent among other treatments. This can be linked to the volatile compounds present in *A. paniculata,* which is responsible for its strong odor that once inhaled or taken in by the insect, could block its tracheal system that is used for respiration, leading to its death (Pugazhvendan et al., 2012). Most insects breathe through the trachea which usually leads to the opening of the spiracles. This simply implies that the effectiveness of the *A. paniculata* powder was dose and days dependent as its mortality increases with the increase in dose and days of exposure to *A. paniculata* powders.

Antifeedant

Insects inflict damage on stored products mainly by direct feeding. The *T. castaneum* mainly feeds on the nutritive tissues of rice grains causing weight loss and quality, while other species feed on the germ, resulting in poor seed development and seed viability. Thus, due to damage done by these insects, rice grains valued for selling, consumption, and for planting were lost. Figure 2 shows the percent mean values for weight loss of rice grains caused by *T. castaneum* observed after 28 DAT.

Figure 2. Percent weight loss of rice grains at 28 days after treatments (DAT). *Means followed by the same letters to the right of the bars indicate no significant difference ($p < 0.05$) in a Tukey's test.*

Results revealed that after 28-days of storage, all treatments were effective in limiting the percentage weight loss caused by *T. castaneum*. The treated rice grains had shown lower weight loss than untreated grains. The lowest percent weight loss was observed in grains treated with 6 g = 3 teabags of *A. paniculata* powder with 1.87 percent indicating its ability to act as an antifeedant. However, the mean weight loss of rice grains treated with 4 g = 2 teabags of *A. paniculata* powder (3.56 %) were lower compared to rice grains treated with 2 g = 1 teabags (5.73%).

Overall results range from 1.87% to 6.41%, indicating low to high percent weight loss. The rice grains treated with 2 g of *A. paniculata* demonstrated the highest weight loss while 6 g *A. paniculata* showed the lowest grain weight loss. This demonstrates a significant decrease in weight loss as dosages of *A. paniculata* powder increase and further indicates that as exposure and storage period prolonged the antifeedant activity of the botanical powder becomes more effective.

CONCLUSION AND RECOMMENDATION

This study demonstrates the bioefficacy of *A. paniculata* powder against *T. castaneum* adults. These findings suggest that there may be different constituents in the powder possessing different bioactivities but their identities are yet to be determined. The isolation and identification of the bioactive compounds in the plant powder are of utmost importance so that their potential application in controlling stored-product pests can be fully exploited. However, the present findings could be used to control insects in stored products to minimize pest infestation.

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CONFLICT OF INTEREST

The author declares no conflict of interest.

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Acceptability of Paper Folding-Based Instructional Material in Geometry

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ABSTRACT

The study focused on the acceptability of a developed supplementary learning material (SLM) in geometry in terms of adequacy, clarity, contents, objectives, suitability and usefulness. It was subjected to the scrutiny of competent DepEd Mathematics teachers and professors in mathematics at two universities, Romblon State University and De La Salle University. The study concludes that the developed SLM titled "Paper Folding in Geometry" is highly acceptable in terms of adequacy, clarity, content, objectives, suitability, and usefulness. It was also revealed that there is no significant difference between the level of acceptability between the teacher-evaluators from CHED and those from DepED. The development of the SLM is on its initial stage yet as it has to be pilot tested with grade six elementary pupils as participants.

Keywords: *supplementary learning material, paper folding, acceptability, content validity*

INTRODUCTION

Geometry is an area in mathematics that has the widest and most visible application in real life. Various shapes and sizes can be observed in this sphere's rocks, plants, sea creatures, birds, animals, and heavenly body formations. An in-depth knowledge of geometric figures, their properties, and measurements is essential in understanding other fields like engineering, architecture, science and arts, and even technology education. The study of geometry trains learners to think, analyze, critique, and argue. In short in geometry, learners are trained to reason logically. It teaches them to be more coherent in expressing their ideas, be sequentially and systematically organized in thoughts, and become explorative and creative thus able to meet the demands of the rapid changes in science and technology in a world that struggles to win a fight against the Covid-19 pandemic. In a situation like this, the Commission on Higher Education (CHED) together with the Department of Education (DepEd) work together to switch from face-to-face teaching to distance learning with the use of modular and e-learning approaches. The difficulty now lies on how to enable students to develop logical or geometric reasoning.

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While geometric concepts are introduced in the primary grades, it is in junior high school that students are taught the basics of geometric reasoning. In grades 9 and 10, they are introduced to the use of deductive reasoning in proving theorems. It is certain that the task to teach geometric reasoning to learners during this pandemic is challenging. In this regard, this research focused on the acceptability of a supplementary learning material (SLM) in geometry which uses paper folding as a manipulative. This learning material shows the step-by-step process of folding lines, angles, triangles, circles, and selected polygons and their parts allowing the learner to be self-directed. In this rapidly changing society, individuals must learn how to direct themselves in acquiring information and knowledge to be able to survive and compete with others (Torrefranca, 2017).

Several studies had shown that visual aids and manipulatives are very useful in understanding mathematics and in the retention of mathematical concepts. Spatial abilities are enhanced through the infusion of origami in mathematics lessons as revealed in the research done by Cornelius and Tubis (2003). In the study conducted by Galicha and Lazaro (2019) they concluded that infusion of paper folding in the teaching of Geometry is an effective method of enhancing geometric reasoning skills.

During the pandemic, young learners can benefit from manipulatives or hands-on activities at home especially with their parents' supervision. Together, parents and children can have fun exploring and understanding math concepts. This family activity will help enhance children's math skills as well as develop

positive math attitudes. Learners' math anxiety will be lessened as they will enjoy working on their math activities with the use of manipulatives like paper folding. There is no doubt that most parents find their children's math home works very challenging hence, a supplementary learning material which introduces the use of math manipulatives is an advantage. Eventually, algebra or calculus problems will involve geometric figures, so it is important to make sure children are properly prepared by using quality geometry resources both in the classroom and at home. This study is corollary to previous research with title "Contextualization of Geometric Concepts through Paper Folding: Basis for Development of Instructional Materials in Geometry" which was also conducted by these researchers. Hence, the design of the developed supplementary learning material is focused on the enhancement of the geometric reasoning skills of the learners.

Supplementary Learning Material (SLM) Development

With the rise of COVID-19 infection students have to be home-schooled and parents have no other alternative but to assist their children in understanding the contents of their learning module. Thus, there is an undeniable need for supplementary learning materials. Kapur (2019) asserted that in educational institutions, the development of teaching-learning materials is regarded as one of the major aspects that would promote student learning and help in the achievement of academic goals and objectives. Books are effective methods of imparting basic knowledge to students in terms of concepts. It is obvious that there's a lack of these materials as indicated in Llego's (2018) article, 'A Call for Submission for Evaluation of Supplementary Learning Resources (SLR) for Public School Libraries', where he stated that these materials have to be made available and accessible to teachers and learners in order to develop positive reading and study habits and develop the ability to use these resources efficiently and effectively as tools of learning and teaching. He added that SLRs found in libraries must contain information and knowledge that will lead towards the achievement of curricular goals.

Engaging students to do their learning tasks poses a challenge to teachers especially in their absence. Only a few students are self-driven and therefore learning materials must contain that element which will activate the student's natural urge to learn. As cited by Dewi and Haharap (2016), Wijaya and Rohmadi (2009) stated that the success of a teaching-learning process is not solely determined by a reliable teacher, good input, and teaching facilities such as school buildings, teaching tools, or libraries but also by the selection of appropriate and quality teaching materials. Salcedo (2016) points out that teachers should be encouraged to develop instructional materials like a module, particularly on subjects/topics where most students encounter difficulty. Instructional materials play an important role in the foundation of learning in the classroom according to Pangesti (2012) as cited also by Dewi and Haharap (2016). To address this need, the design and development of an instructional material in mathematics should then be called forth.

After the development of the SLM, its acceptability among the teachers and the learners must be ascertained. In his paper, Molano (2020) concluded that his proposed innovative learning material in statistics and probability is found to be very acceptable in terms of its objectives, contents and clarity. Results of the study conducted by Rogayan and Dollete (2019) revealed that their developed workbook in physical science evaluated based on criteria that include adequacy, coherence, appropriateness, and usefulness is very much acceptable. Espinar and Ballado (2016) argued that since learning materials significantly increase students' achievements then validating and identifying the level of acceptability of a developed worktext is just fitting. This will allow the students to learn the materials in the easier way because the lessons are presented in the language suited to the students' level.

In their study on the development and validation of project-based module for biology, Cruz and Rivera (2022) stated that they selected validators of their study those teachers that have specialization in biology, and seasoned teachers that are teaching biology for five years or more. They involved those that are well-versed in curriculum design and instruction, as well as those that are in a similar area in the teaching field that are considered as experts and consultants in the said endeavor.

As to studies regarding variations in the perception on the level of acceptability of a learning material by the evaluators from different categories, Auditor and Naval (2014) disclosed that they found no statistically significant difference between the evaluation of the students, peers, and experts on their physics modules' acceptability.

This study evaluated and determined the level of acceptability of a developed learning material in geometry. The researchers also determined the significant difference between the evaluation of teachers teaching mathematics in college (CHED) and those teaching the subject in high school (DepED).

METHODOLOGY

Method

This study used developmental research that employed the ADDIE model. It is an instructional

design, which serves as guide in creating effective educational courses and materials (Instructional Design, 2015). The model consists of five (5) phases, namely: (1) analysis, (2) design, (3) development, (4) implementation, and (5) evaluation. This present study however, temporarily excluded the fifth phase (evaluation) in the research process as it requires student participation which is difficult because of the existing pandemic and the restricting policies for the young people. Hence, the current research only went through the four (4) phases illustrated in Figure 1.

In the implementation phase, the developed SLM was assessed based on six criteria: adequacy, clarity, content, objectives, suitability, and usefulness. The mean and standard deviation of each criterion indicator were computed and interpreted. To determine the significant difference between the evaluation of teachers from DepED and those from CHED, the *t*-test for independent samples was utilized.

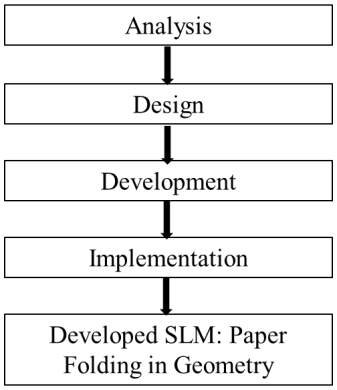

Figure 1. The Development Chart of the SLM

Phase 1: Analysis

This developed SLM in Geometry is based on a previously conducted research that involved paper folding to contextualize geometric concepts. Hence, the analysis phase of this current research was already carried out during the conduct of the previous study. It utilized the quasi-experimental pretest/posttest design to determine whether the use of paper folding is effective in enhancing the geometric reasoning skills of students. The results of the analysis phase served as basis for the choice of topics and exercises that were included in the SLM.

Phase 2: Design

It is in this stage when the researchers decided on the coverage of the SLM. It is divided into four chapters: Chapter 1 covers points, lines and planes; Chapter 2 focuses on angles; Chapter 3 deals with triangles and quadrilaterals; and Chapter 4 includes circles and some polygons. Every chapter contains an introductory statement, a learning outcome, learning objectives, content discussion and paper folding exercises.

Phase 3: Development

This is the phase in which the researchers started writing the entire material. The contents were written with grade six students as target audience in consonance with the fact that the researchers deemed it necessary for the learners' reasoning ability to be developed at an early age.

Phase 4: Implementation

The evaluators of the SLM were three DepEd Math teachers from three districts of Romblon and three Math professors from Romblon State University and the De La Salle University, Manila. They were selected using non-probability purposive sampling technique. Two of these evaluators are authors of published books in algebra and calculus and thus can be considered as experts in instructional material development. Another evaluator is the main proponent of a developmental research that introduced the use of a modified set of cards to be used as teaching tools in probability. The rest of the evaluators were selected by the researchers based on their mathematics performance when they were undergraduate and graduate students. Their number of years of experience as a DepEd math teacher which is five (5) years or more was also considered. They evaluated the SLM's content validity based on adequacy, clarity, content, objectives, suitability, and usefulness using an evaluation tool for instructional materials adopted with some modifications from the College of Education (CED) of the university. The instrument was already validated by the CED committee of educators who each represent the different programs of the College.

RESULTS AND DISCUSSION

Content Validity of the Developed SLM

Table 1 presents the results of evaluation of the SLM by math experts. As seen from the table, the SLM obtained a very good rating as to adequacy (*M = 4.74; SD =0.32*). The evaluators indicated that they strongly agree with each of the indicators, implying that the SLM is acceptable in quality. One evaluator's comment was that the activities can be tried as diagnostic test for students entering college and those intending to take architecture or engineering courses. The researchers took note of one evaluator's suggestion that learning tasks should not just be limited to paper folding activities but should also include real-life applications.

The SLM also got a very good rating in terms of clarity (*M = 4.71; SD = 0.32*). The evaluators strongly agreed with all the indicators but for one: the provision

Table 1. Expert's Validation of the SLM in Geometry

Criteria	Mean ± SD	Verbal Description
Adequacy		
1. Tasks and other activities can tap the creativeness of the learners.	4.86±0.18	SA
2. Tasks and other activities can tap the resourcefulness of the learners.	4.86±0.18	SA
3. Manipulative activities are carefully designed to suit the level of the learners.	4.86±0.18	SA
4. Activities are adequate to measure learner's performance.	4.87±0.60	SA
5. Activities include a miniature of the outside world which are evident in local setting.	4.87±0.60	SA
Grand Mean	4.74±0.32	SA
Clarity		
1. Thought- provoking questions are stated in a way that can easily be understood by the learner.	4.43±0.69	A
2. Activities are well-designed to develop creativity among the learners.	4.86±0.18	SA
3. Activities are well-planned for greater participation among learners.	4.86±0.18	SA
4. Directions are clearly stated resulting to better perception of the varied activities presented.	4.71±0.51	SA
5. Graphics and illustrations used support concepts and thought processes.	4.71±0.51	SA
Grand Mean	4.71±0.32	SA
Content		
1. It reveals the learners' intellectual abilities.	4.71±0.38	SA
2. It supports the instructional objectives.	4.86±0.18	SA
3. It enhances the learners' critical thinking skills.	4.86±0.18	SA
4. It develops the learners' ability to understand the topic of discussion.	4.86±0.18	SA
5. It encourages independent learning.	4.86±0.18	SA
Grand Mean	4.83±0.22	SA
Objectives		
1. They are specific/comprehensive.	4.86±0.49	SA
2. They are stated in behavioral terms.	5.00±0.00	SA
3. They are sufficient to satisfy learner's needs.	4.86±0.18	SA
4. The projected learning activities are achievable.	5.00±0.00	SA
5. They are meant to measure the learning ability of the learner.	4.86±0.18	SA
Grand Mean	4.91±0.12	SA
Suitability		
1. Activities are adapted to the level of the learners.	5.00±0.00	SA
2. Activities are diverse with respect to level of difficulty.	4.43±0.69	A
3. Lessons are presented in the correct sequence.	4.46±0.18	A
4. Careful planning, selecting and designing of activities that develop critical thinking skills and creativity among learners are evident.	4.86±0.18	SA
5. Activities are relevant to the descriptions and specification of the course objectives.	5.00±0.00	SA
Grand Mean	4.83±0.18	SA
Usefulness		
The Supplementary Learning Material		
1. serves as motivation to the learners.	4.86±0.18	SA
2. promotes independent learning.	4.86±0.18	SA
3. develops and enhances critical thinking among learners.	4.86±0.18	SA
4. encourages minimal supervision on the part of the facilitator.	5.00±0.00	SA
5. provides opportunity for discipline and interaction among learners.	4.57±0.60	SA
Grand Mean	4.83±0.20	SA

Legend: Strongly Agree (4.50–5.00), Agree (3.50–4.49), Fairly Agree (2.50-3.49), Disagree (1.50–2.49), Strongly Disagree (1.00–1.49).
SD: Standard deviation

of thought-provoking questions because there are sections in the SLM in which the activities are procedural in nature. However, since the rest of the indicators achieved high ratings then it means that the activities are well-planned and well-designed to develop learner's creativity. Additionally, printed images and figures used are of excellent quality. One evaluator's suggestion was to add activities that will provide balance between the quality of activities and questions.

The evaluators also gave favorable ratings to the content of the SLM (*M = 4.83; SD = 0.22*), indicating that they strongly agree with all the indicators. This could be due to the inclusion of a number of paper-folding illustrations and activities that enhances the creativity, critical thinking and analytical thinking skills of the learners. The evaluators noted that with the method used in presenting the lessons in the SLM, learners can discover their hidden spatial abilities.

They have also observed that the approach suits the learners in the absence of teacher's supervision. Its development is timely especially that the students must be home-schooled during the pandemic.

The evaluators strongly agreed on the formulation of the objectives (*M=4.91; SD=0.12*). They gave excellent ratings on the indicators which specify that the objectives are stated in behavioral terms and that the projected learning activities are achievable. In other words, the learning activities are just within the capacity and interest of the learner. This also means that the evaluators found the objectives of the SLM to be within the acceptable standard in setting the instructional goals.

The SLM also got very good ratings in terms of suitability (*M=4.83; SD=0.18*) and usefulness (*M=4.83;SD=0.20*). Since two indicators for suitability received agree remarks: the provision of diverse activities with regards to level of difficulty and the presentation of lessons in the right sequence, these items will be taken into consideration during the SLM's revision. With two of its indicators, adaptability of the SLM to the level of the learners and relevance of its activities to the course objectives, getting excellent ratings, the material is still acceptable in terms of suitability. A suggestion from the evaluator that the targeted K-12 learning competencies be stated in every activity will also be considered in editing the SLM.

Finally, looking at the evaluators' responses on the usefulness of the SLM, they all strongly agreed that the developed material will require minimal supervision from the facilitator, serve as tool for motivation, promote independent learning, develop and enhance critical thinking skills and provide opportunity for discipline and interaction among the learners. It was noted that since the SLM is textual in nature then learner-learner interaction is not possible. However, the learner-content interaction may take place as the learner navigates and explores the various activities in the SLM. The overall rating of the validators shows validity of the developed SLM as to its usefulness.

Table 2. Summary of Experts' Validation

Criteria	Mean±SD	Verbal Description	Rank
Adequacy	4.74±0.32	SA	5
Clarity	4.71±0.32	SA	6
Content	4.83±0.22	SA	3
Objectives	4.91±0.12	SA	1
Suitability	4.83±0.29	SA	3
Usefulness	4.83±0.20	SA	3
Overall	4.81±0.06	A	

Legend: Strongly Agree (4.50–5.00), Agree (3.50–4.49), Fairly Agree (2.50-3.49), Disagree (1.50–2.49), Strongly Disagree (1.00–1.49). SD: Standard deviation

Table 2 presents the summary of experts' validation of the developed SLM. As shown in the table, the SLM received an excellent rating from the experts (*M = 4.81; SD = 0.06*) which implied that the validators strongly agreed with all the aspects of the learning material. Objectives (*M = 4.91*) ranked first, followed by content, suitability, and usefulness (*M = 4.83*), adequacy (*M = 4.74*), and content (*M = 4.71*). It is anticipated that since the activities are in visual form then students who fear math will find learning the concepts in this material more fun and in a concrete way. This agrees with the research findings of several studies (Evangelista et al., 2014; Ocampo, 2015; Pastor et al., 2015, as cited by Rogayan and Dollete, 2019). Tomlinson (1998) commented that the impact of instructional materials is achieved when materials have a noticeable effect on learners, that is, when the learners' curiosity, interest, and attention are aroused.

CONCLUSION

The study sought to determine the level of acceptability of a research-based supplementary learning material in geometry intended for grade six pupils. The developed SLM was found to be an excellent learning aid based on the evaluation of the experts. The evaluators are all in agreement that the instructional material possesses adequacy, clarity, suitability and usefulness. Moreover, they also gave very good ratings for its contents and objectives. The development of the SLM is timely as the country in the midst of the pandemic. It utilizes paper folding in its teaching of geometric concepts and thus promotes independent learning. In addition, the study did not find any significant difference between the perception of the evaluators as to the SLM's adequacy, clarity, content, objectives, suitability, and usefulness.

To heed DepEd's call for submission for evaluation of supplementary learning resources to support the implementation of the K- 12 Program, the following are recommended: (a) the developed "Paper Folding in Geometry" be evaluated based on students' perception on its format and content; (b) test the effectiveness of the SLM by conducting quasi-experimental research with grade six pupils as participants; and (c) modification of the said SLM based on the comments/suggestions/recommendations of the expert validators before forwarding it to DepEd for evaluation.

AUTHORS' CONTRIBUTION

S.F.G. wrote the entire paper as well as the developed learning material while M.G.L. did the statistical treatment and interpretation.

CONFLICTS OF INTEREST

No known conflict of interest.

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Design and Development of Romblon State University Romblon Campus Accreditation Data Warehouse

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ABSTRACT

Accreditation is conducted to assess and upgrade the educational quality of higher education institutions and programs, which requires complete documents for the precise information specification before the expert's review. Therefore, the documents and records of an institution must be effectively preserved to facilitate compliance with accreditation requirements. However, the data generally comes from different sources of various types, unstructured and distributed. This study designed a data warehouse to incorporate all the documents in preparation for college accreditation. The data warehouse was developed in a five-step process, considering the accreditation assessment with an emphasis on academics. Systems Development Life Cycle model was used in the development of the system. The ISO/IEC 25010:2011 standard was used to evaluate the system's acceptability using the eight characteristics. However, only applicable sub-characteristics such as suitability, efficiency, compatibility, usability, reliability, security, and maintainability were applied to evaluate the system. This standard ensures that the system meets the user's preference with the system being satisfied, and the essential features like uploading, viewing, and system maintenance by the administrator, are at their most excellent functional operation. The parameters which were created by the system can be used by other satellite campuses of Romblon State University, as well as other universities applying for accreditation of the Accrediting Agency of Chartered Colleges and Universities in the Philippines (AACCUP).

Keywords: *accreditation, data warehouse system, system development, system quality model, data security*

INTRODUCTION

Every accreditation, the faculty in-charge seeks for documents to be prepared. They ask where these documents can be obtained and file them to the accreditation folders. Sometimes, however, the faculty has a hard time searching for the specific documents needed, especially if the person in-charge of the document is absent, on leave or resigned already, some of them might not be readily available. This will lead to delays in the accreditation process. In addition, the source of data is circulated using the manual system of photocopying and scanning of the printed documents. During pandemic, the accreditors could not visit the school personally and the documents need to be saved in digital file format (.docx) or (.pdf), and shared via Google drive. This circumstance makes gathering data a problem. For this reason, the researchers designed a system that will help the faculty and staff of RSU-Romblon Campus in accreditation.

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The accreditation of a program is one of the important parameters needed to determine the standards of universities. It is measured through supported evidence and assessment associated with the standards of the accreditor's judgment or consideration. In the Philippines, the accreditation in chartered higher education is done by an accreditation council called Accrediting Agency of Chartered Colleges and Universities in the Philippines (AACCUP). The university prepares the complete data in a template provided by the AACCUP. This data consists of compliance report, program performance profile, and benchmark statements/parameters for every area as follows: I - Vision, Mission, Goals and Objectives; II – Faculty; III - Curriculum and Instruction; IV - Support to Students; V – Research; VI - Extension and Community Involvement; VII – Library; VIII - Physical Plant and Facilities; IX – Laboratories; and X – Administration.

Access to reliable and accurate information is essential for the management of educational institutions. For this reason, administrative staff should have the access to current and older version of information to perform their administrative duties.

Table 1. A Conceptual Framework for Building an Accreditation Data Warehouse System

Steps	Description
1. Investigation	Understand the problem and recognize the opportunities that can be appreciated with the implementation of system.
2. Analysis	Detailed specification of functional requirements of the system. Determine the cost-benefit ratio of its creation and maintenance.
3. Design	Design the system to satisfy the requirements based on analysis.
4. Implementation	Launch the implementation of the system.
5. Maintenance and Revision	Evaluate the ease of use and understanding of the users (faculty/staff) regarding the system. Evaluate the quality of information stored in Data Warehouse. Evaluate the impact of the implementation of the system in managing the relationship with internal/external users.

System development is a multifaceted process, mainly because of the issue of aligning the system's characteristics with the requirements of an organization, but also because controlling both time and costs of development is difficult (Stair & Reynolds, 2008). The organization must realize and recognize the activities of the development of systems so that it can grow on a program of implementation of a data warehouse system in a mindful and reflected manner. Thus, in systems development, involving either the design of a new system or the modification of an existing one, it must meet the five main steps: (1) Investigation – to gain a clear understanding of the matter to be solved or opportunities to be addressed, the researcher must understand the problem; (2) Analysis – understand solutions, to clearly define the matter and also the expected opportunities; (3) Design – select and plan the best solution, to determine how the new system will work to satisfy the organization needs to be defined during analysis; (4) Implementation – place solution into effect, to create or acquire the system components defined within the design, assembling them, and putting the new system into operation; and (5) Maintenance and Revision – evaluate results of solution, to monitor and evaluate system performance, and resolve on the need for possible changes to improve (Stair & Reynolds, 2008).

Developing a system for a specific organization could be done through research gathering techniques. Different techniques exist for gathering data, such as observations through direct and participants, interviews, questionnaires, and other relevant documents (Shanks & Bekmamedova, 2018). Table 1 shows the conceptual framework adopted from (Simões, 2010) that guides the researcher in developing the data warehouse. However, only the applicable description was applied.

This study aimed to design and develop a data warehouse for Romblon State University - Romblon Campus accreditation. Specifically, the following objectives were addressed: (1) to design an online platform for the RSU Romblon Campus Accreditation Data Warehouse. (2) to design and implement databases for the areas needed in the accreditation process, and (3) to evaluate the system using ISO 25010:2011 standard.

METHODOLOGY

Design and Methodology

Descriptive and developmental research was applied in this study. The descriptive method was used to gather documents as inputs to the system's design, whereas the developmental research was done to produce an online system that could benefit the faculty and staff of Romblon State University-Romblon Campus.

Software Development

The software development life cycle (SDLC), which deals with online programs or computer software, was used in this study.

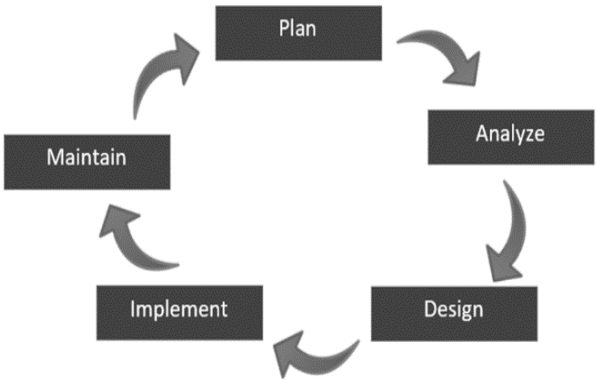

Figure 1. Systems Development Life Cycle Model

Different designs were created to cater to individual developers' needs with other skills, demands, or business environments. The data and process modeling analyzed and defined the data requirements within the scope of the organization's information systems. Data modeling was focused on the documentation of complex system design of software to quickly understand the design and the diagram while applying symbols and texts to illustrate the flow (Vaughan, n.d.). Figure 1 demonstrates that five stages in designing new systems or modifying existing ones.

- *Planning.* Understand the problem and recognize the opportunities that can be appreciated with the implementation of the system.
- *Analysis.* Detailed specification of functional requirements of the system and determine the cost-benefit ratio of its creation and maintenance.
- *Design.* Design the system to satisfy the requirements based on analysis.
- *Implementation.* Launch the implementation of the system.
- *Maintenance.* Evaluate the ease of use and understanding of the users (faculty/staff) regarding the system. Evaluate the quality of information stored in Data Warehouse and its impact with internal and external users.

Software Development Tools

The study was designed to meet the desired needs to satisfy the requirements based on analysis. The development tools used to design an online platform for the RSU Romblon Campus Data Warehouse is shown in Table 2.

Table 2. Software development tools

Development tools	
Software:	Visual Studio Code
Operating system:	Windows 10
Web/Mobile platform:	Deluxe Linux Hosting with cPanel
Database:	Phpmyadmin, MySQL
Subscriptions:	Deluxe Linux Hosting
Programming Languages:	HTML, PHP, JavaScript, CSS

The coding was written, and configuration was done to interlink the software via the network. The designed system was deployed on the server for a series of actual tests of the users. Testing of functionalities was done, and training of the users was conducted to ensure that they knew how to navigate the system. In this phase, the researcher worked on the actual function of the website. Although it is already an eye candy for the users, it is essentially a shell with limited features. Constant development, review of function, and constant revision were accomplished.

Sampling Procedure

The population of this study included faculty members and staff of Romblon State University – Romblon Campus. Purposive sampling was utilized to test the acceptability of the system. The evaluation was done by the 10 accreditation chairpersons, two team members in every area, and two internal Accreditors, with a total of 32 respondents.

Acceptability Test

To test the acceptability of the software, the researcher used the ISO/IEC 25010:2011 standard applying these eight characteristics: suitability, efficiency, compatibility, usability, reliability, security, maintainability, and portability, as shown in Figure 2 (Garcés & Nakagawa, 2017). Table 3 summarizes the questions used to evaluate the acceptability of the system while Table 4 shows the numerical rating and descriptive scale used to evaluate the result.

Table 4. Likert Scale

Scale	Verbal Interpretation
4.50 – 5.00	Strongly Agree (SA)
2.50 – 4.49	Agree (A)
2.50 – 3.49	Neutral (N)
1.50 – 2.49	Disagree (D)
0.50 – 1.49	Strongly Disagree (SD)

Statistical Tool

The statistical tool that was used in the interpretation of data is the arithmetic mean. Some items refer to the number of respondents who evaluated the system. In this study, the arithmetic mean was used to get the result of the sub-characteristics. Taking the mean will evaluate if each sub-characteristic obtains the level of acceptance of the system considering the Likert Scale.

Table 4 shows the numerical rating and descriptive scale used to measure the result evaluation. This is the tool used to interpret the output of the ISO/IEC 25010:2011 evaluation and has a scale of 4.50 to 5 being the highest and 0.50-1.49 as the lowest.

Each characteristic arithmetic mean and the general arithmetic mean of all sub-characteristics was used to obtain the final result. The result of taking the individual characteristic arithmetic mean is called Composite Mean. It is the partial arithmetic mean of the general weighted arithmetic mean.

After taking the composite mean of each characteristic, the average of the composite mean or the general weighted mean was calculated to get the final value that identifies the system's acceptability.

RESULTS AND DISCUSSION

The system was designed to have convenient uploading, browsing, viewing, and retrieving of files needed for the accreditation process. The evaluation focuses on the system's objective as a developed platform for Romblon State University – Romblon Campus Accreditation Datawarehouse.

Shown in Figure 3 are the parameters in the Level 3 accreditation of Bachelor of Science in Secondary Education (BSED).

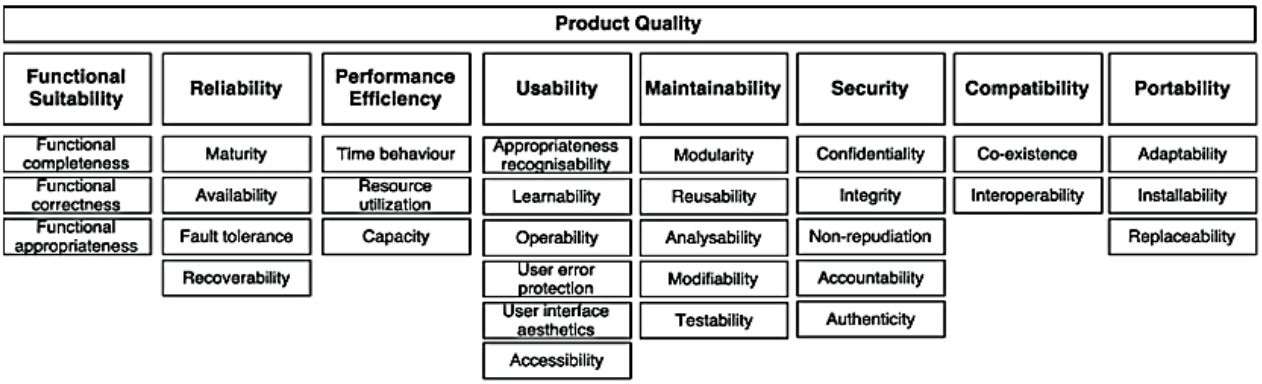

Figure 2. Eight Characteristics of Software Product Quality Model and System Quality in Use Model (Garcés & Nakagawa, 2017)

Table 3. ISO Characteristics and Sub-Characteristics Adopted in the Study

Characteristics	**Sub-characteristics**	**Questions**
Functional Suitability	Functional Completeness	Can software perform the task required?
	Functional Correctness	Is the result as expected?
Performance Efficiency	Time behavior	Does the system quickly respond?
	Resource utilization	Does the system utilize resources efficiently?
	Capacity	Does the system parameter meet the system's requirements?
Compatibility	Coexistence	Can the system perform the functions efficiently in sharing the resources?
	Interoperability	Can the software capable of exchanging information and using the information that has been exchanged?
Usability	Appropriateness/ recognizability	Does the system appropriate to your need(s)?
	Learnability	Can the user learn to use the system easily?
	Operability	Can the user use the system without much effort?
	User error protection	Does the system protect users against making errors?
	User interface aesthetics	Does the system interface look good?
	Accessibility	Can the system be used with the widest range of characteristics and capabilities?
Reliability	Availability	Can the software capable of providing necessary data or information all the time?
	Fault tolerance	Is the software capable of handling errors?
	Recoverability	Can the software resume working and restore lost data after failure?
Security	Confidentiality	Does the system have access level and can be use by authorized user?
	Integrity	Does the system prevent people from unauthorized access?
	Non-repudiation	Can the system provide assurance that someone cannot deny validity and authenticity of user's signature?
	Accountability	Can the system can audit and trace the events done by the users?
	Authenticity	Can the software preserve its original form without any falsification or tampering?
Maintainability	Modularity	Can the system be modified or changed without major impact to the entire system?
	Reusability	Can the system be enhanced?
	Analyzability	Can faults be easily diagnosed?
	Modifiability	Can the software be easily modified?
	Testability	Can the software be tested easily?

Adapted to ISO/IEC 25010:2011 - Systems and software engineering -- Systems and software Quality Requirements and Evaluation (SQuaRE) -- System and software quality models (2017).

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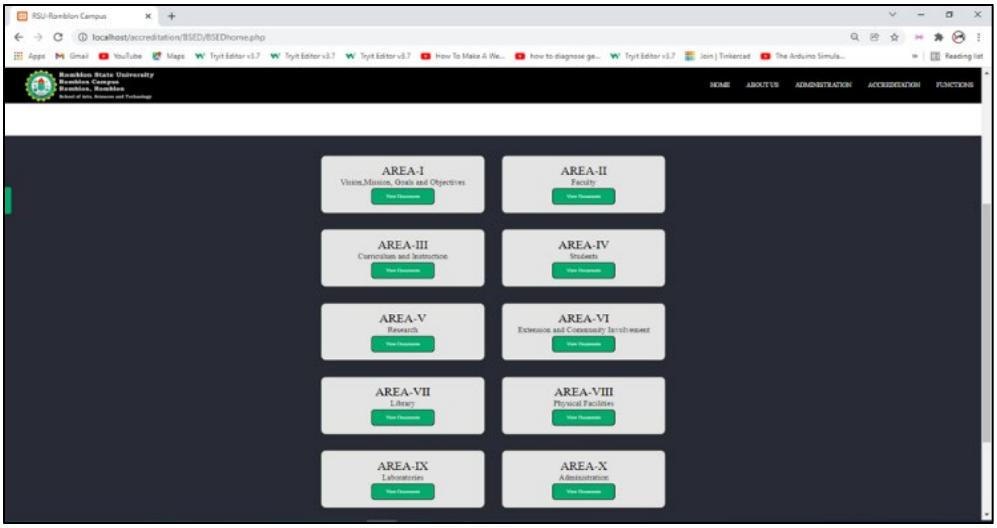

Figure 3. Accreditation Areas

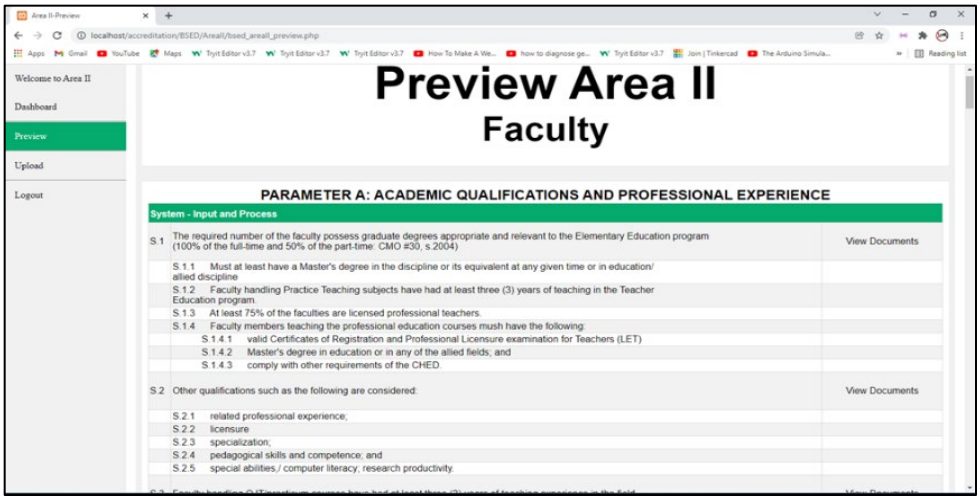

Figure 4. Area Chairman Dashboard

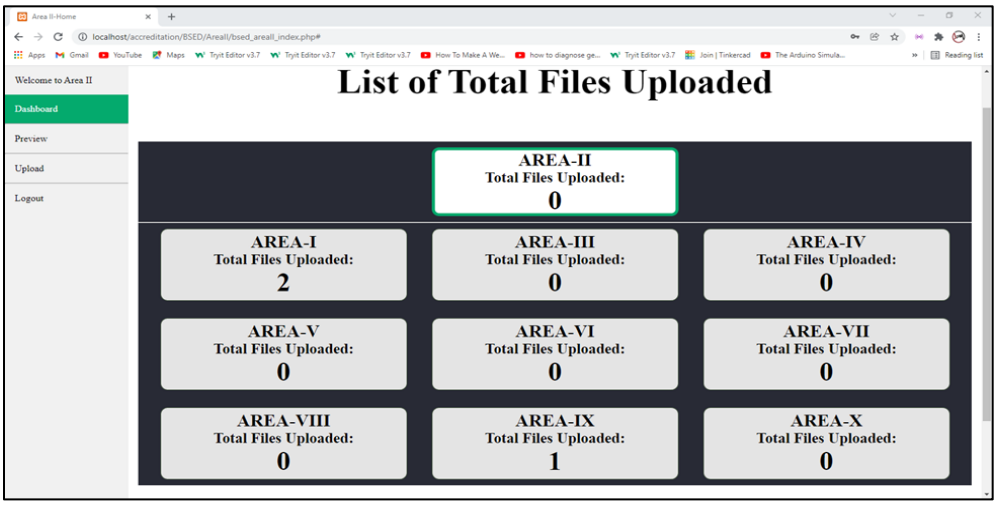

Figure 5. Area Chairman Upload Function

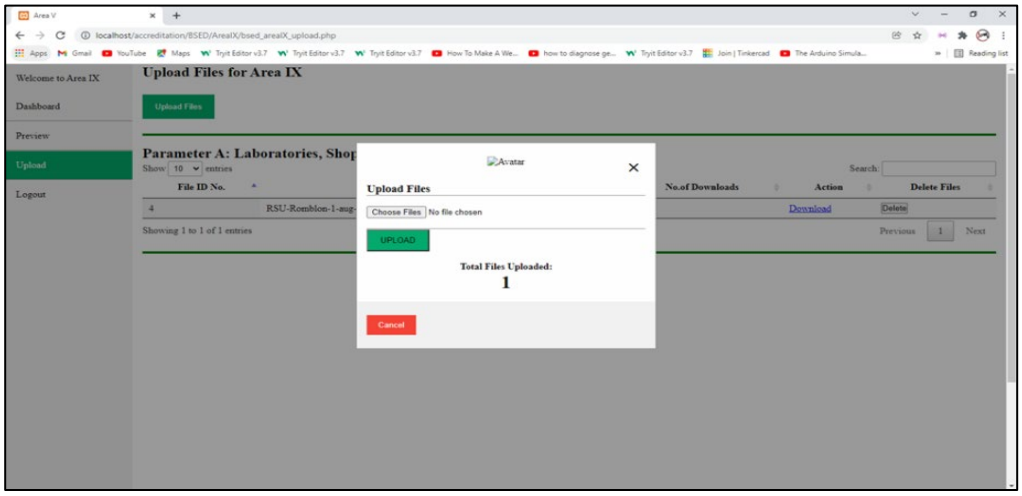

Figure 6. Area Chairman Preview Area

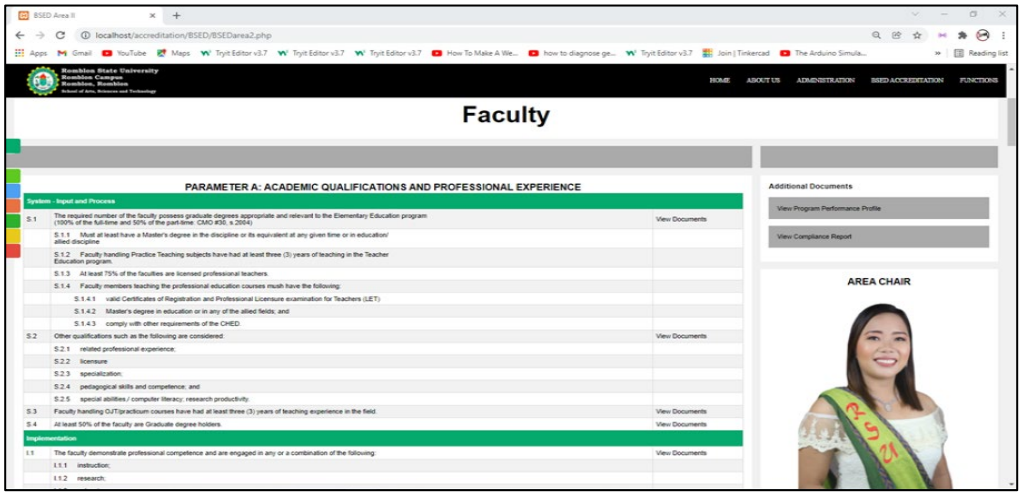

Figure 7. Internal/External Accreditors View

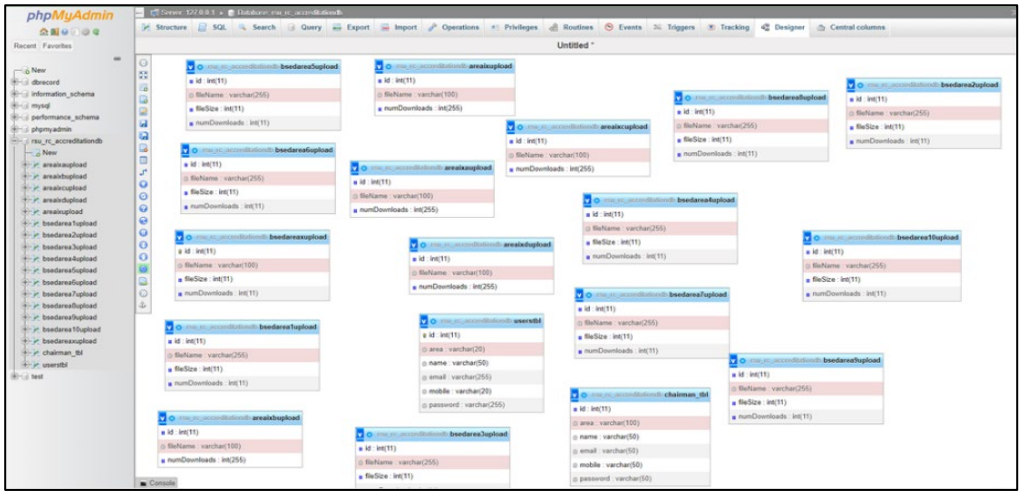

Figure 8. Database Design

Table 5. Result on the Software Evaluation for the Acceptability of the System using ISO/IEC 25010:2011

Characteristics		**Mean**	**Verbal Interpretation**
Functional Suitability	Functional Completeness	4.44	Agree (Very Satisfactory)
	Functional Correctness	4.41	Agree (Very Satisfactory)
Performance Efficiency	Time behavior	4.16	Agree (Very Satisfactory)
	Resource utilization	4.25	Agree (Very Satisfactory)
	Capacity	4.84	Strongly Agree (Outstanding)
Compatibility	Coexistence	4.50	Strongly Agree (Outstanding)
	Interoperability	4.53	Strongly Agree (Outstanding)
Usability	Appropriateness/ recognizability	4.88	Strongly Agree (Outstanding)
	Learnability	4.56	Strongly Agree (Outstanding)
	Operability	4.63	Strongly Agree (Outstanding)
	User error protection	4.47	Agree (Very Satisfactory)
	User interface aesthetics	4.69	Strongly Agree (Outstanding)
	Accessibility	4.78	Strongly Agree (Outstanding)
Reliability	Availability	4.41	Agree (Very Satisfactory)
	Fault tolerance	4.16	Agree (Very Satisfactory)
	Recoverability	4.22	Agree (Very Satisfactory)
Security	Confidentiality	4.31	Agree (Very Satisfactory)
	Integrity	4.34	Agree (Very Satisfactory)
	Non-repudiation	4.38	Agree (Very Satisfactory)
	Accountability	4.38	Agree (Very Satisfactory)
	Authenticity	4.34	Agree (Very Satisfactory)
Maintainability	Modularity	4.41	Strongly Agree (Outstanding)
	Reusability	4.53	Agree (Very Satisfactory)
	Analyzability	4.47	Agree (Very Satisfactory)
	Modifiability	4.47	Agree (Very Satisfactory)
	Testability	4.47	Strongly Agree (Outstanding)
	Overall Mean	**4.4**	**Agree (Very Satisfactory)**

Shown in Figure 4 is the list of total uploaded files by the members and chairman of each area. Figure 5 shows the upload function, in which the member or chairman of each area can upload a document related to the parameters. Figure 6 shows the preview window, in which they can view, edit, download and print the uploaded document. Figure 7 is the window in which an internal/external accreditor can view. Figure 8 shows the design of the databases for the areas in the accreditation. The database name is rsu_rc_accreditationdb, which composed 18 tables, one (1) table for users, one (1) table for Academic Chairpersons, while the remaining tables is intended for uploading of documents in each area.

As presented in Table 5, most respondents agreed that the entire system was acceptable and ready to use for the level 3 accreditation of the Bachelor of Science in Secondary Education (BSED) (M = 4.4).

Figure 9 shows the overall system evaluation using ISO/IEC 25010:2011 (International Organization for Standardization, 2011). Based on the results, the system is usable because it enables the user to perform

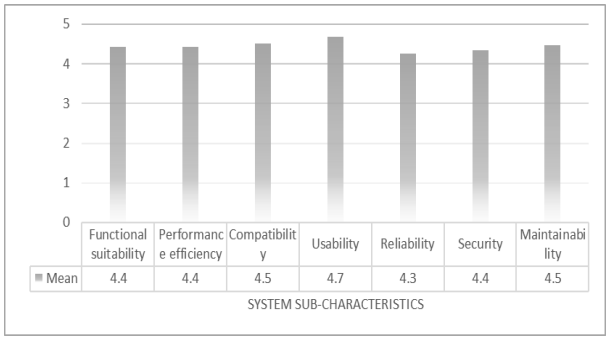

Figure 9. Overall System Evaluation - ISO/IEC 25010:2011

their task effectively, efficiently, and satisfactorily in the specified context of use (M = 4.7). On the other hand, the reliability of the system must be given an attention. Although the result got "very satisfactory" (M = 4.3) score, the users revealed that reliability is important factor that the developed system should possess. Security makes a unique contribution to the reliability of the system. A trusted system is one that is reliable and

has been tested to the end-user's laptop and desktop devices. Furthermore, based on the result of the overall system evaluation using ISO/IEC 25010:2011, the developed system ensures that the end-user needs security. All components must be consistent for the system to be reliable, that is, clear and secure. Overall, the respondents are very satisfied with the developed system (M = 4.4).

CONCLUSION

This paper presents the design and development of a data warehouse system for accreditation purposes using a conceptual framework which serves as a matrix when building a data warehouse system. The logical design focuses on the accuracy and integrity of the desired data warehouse so that the accreditation requirements and user environment can be accurately mapped. The physical design must take into account cost, data security, data relationships, naming standards for data types, tables, indexes, and so on. The proponents have successfully developed and tested the system to the end-user's laptop and desktop devices. Furthermore, based on the result of the overall system evaluation using ISO/IEC 25010:2011, the developed system ensures that the end-user needs were met and the system maintenance was successfully done by the system by the administrator.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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RMS: E-Commerce Platform for Marble Industry in Romblon

Lynie M. Mariño

ABSTRACT

Innovative marketing strategies had made a lot of improvements in different business industries. Utilization of the internet through various social media platforms and development of software applications have brought ease in promoting and selling products all over the world. However, not all merchants are able to conduct similar practice on due to technological and knowledge gaps. In the province of Romblon, where marble is famous, only few merchants use technology to market since few have resources and knowledge to manage such advancement. To address this, the study aimed to develop an online platform based on the Business-to-Consumers (B2C) hybrid market. Through this, marble marketers could advertise, sell, offer services, and earn profit using basic technological resources, in addition to the earnings in their physical shop. The online market features performance efficiency, functional feasibility, reliability, compatibility, usability, and portability of the system that ensure excellent functional operation and hassle-free services for the users. The system was launched and tested using the ISO/IEC 25010 that the overall result gives a satisfactory rating. Romblon Marble Shopping (RMS) system has been accepted and recommended to be of use by the municipal business marble industry sector as a step through in marble marketing for the province of Romblon.

Keywords: *B2C, E-Commerce, Marble, Online Shopping, RMS*

INTRODUCTION

The Internet is an excellent medium for products or services exhibitions. In today's generation, many users go online either for leisure or for serious business (Bismo, 2019). By using digital marketing tools, companies have easy access to promote their product and build relationship with customers, suppress the expenditure, and increase sales volume. In terms of marketing, technology serves as an excellent opportunity for users to become more productive and competitive in the business field. Shifting to online marketing means that it could be accessed anytime and anywhere without tremendous difficulty.

For its effective convenience and utilization, the e-commerce concept delivered an exceptional growth over the digital platform. Fast internet connectivity has encouraged buyers to buy online. According to ACNielsen report, far more than 627 million consumers have shopped digitally in global scale. Germans and Britons are the world's leading online shoppers. The most common goods they bought on the Web are reading materials (printed and digital format), airplane ticket reservations, garments (shoes and clothes), movies, electronic games and other electronic devices (AcNielsen, 2005).

Of the seven Asia Pacific countries surveyed for cross-border sales using a smartphone, the Philippines is the third highest. Among the Filipino participants in the study, 58 percent used an application or website to participate in online shopping in the Philippines, while 13 percent did so outside the country through an application or website (De Leon, 2018). In 2017, a total of Php92.5 billion pesos was spent by Filipinos in online shopping alone and is expected to grow further to more than Php185 billion pesos in 2020 (De Leon, 2018).

Marble industry is one of the industries that is going online. The municipality of Romblon, Romblon is known for marble, the industry being established since late 19th century (MIMAROPA-NEDA; Guia, 2012). Marble deposits abound in the northern section of Romblon island, as well as on the Alad and Cobrador Islands, in a variety of hues and forms. Marble is carved and fashioned into a wide range of things. A booming industry produces novelty items like little souvenir eggs and animals, chess sets, nameplates, mortars and pestles, and religious icons. Marble slabs and blocks are also

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shipped to other parts of the Philippines for construction, monuments, and gravestones.

Considering this, the researchers designed and developed an online system e-commerce platform for marble industry in Romblon. This study emphasized the benefits of having a user-friendly open system, simple yet systematize, that could offer a practical approach for online business shopping. This e-commerce platform is a great way to expand the marble business and eventually increase profits.

METHODOLOGY

The system was developed using the Agile Model, as shown in Figure 1 which serves as a guide to ensure all requirements integration.

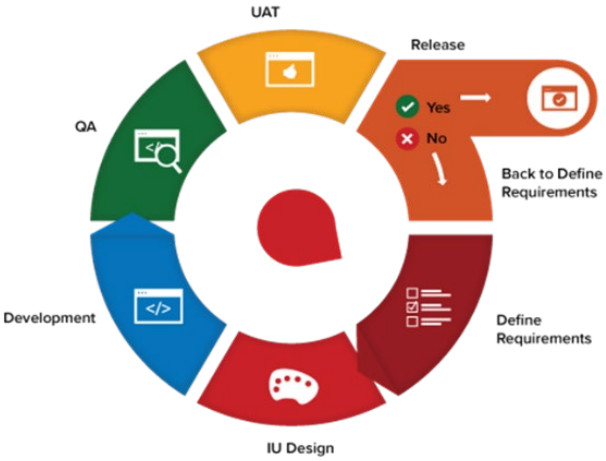

Figure 1. Design Process of the Proposed System

Figure 2. Flowchart of the Proposed System

The iterative process dominates the Agile software development life cycle. The next piece of the software creation puzzle results with each step before the finished output is completed and satisfied. With a purely fixed completion period, each iteration can typically take two to four weeks. It has a time-bound existence, thereby generating a mechanism of methodical repetition. As the allocated period permits, each iteration scope was specific.

During the Agile product development life cycle, multiple implementations have taken place, and each follows the workflow. The consumers and customers must have guidance during revisions to ensure that the requirements fulfill their needs. Business stakeholders must provide feedback to ensure that the features meet their needs.

The technology today made it possible for a faster and easier exchange of information. Every website has its unique designs that attract more visitors that make it possible to exchange information worldwide making online shopping nowadays, as one of the most popular online activities. The proposed system E-Commerce Platform gives a big help to the Marble Industry in Romblon in developing and improving the Municipality.

The diagram in Figure 2 explains the proposed system flowchart for RMS: E-Commerce Platform. It shows the graphical representation of the system's flow in the system and represents its work process.

Software Requirements

Programming Language

The developer used JavaScript in the implementation process, which has three main technologies: World Wide Web, HTML, and CSS. It requires websites to be interactive, thereby making it an integral part of web applications. Two JavaScript front-end frameworks Vue.js and React, are popular in the developers' world, and both tools have a productive approach in building various Web products. Both have the best usage cases of their own and respond to diverse market needs. PHP language was originally used for mobile application websites. It is used for command-line scripting and code applications in making websites, Android apps, and iOS apps since the system is viewable on a smartphone. It is used to create e-commerce websites, creating PDFs, and for building content management systems.

Database Management Software

The developer used MySQL, which enables relational databases to be managed, for its framework. It is an open-source, Oracle-supported application that can operate on several UNIX, Debian, Windows, and similar platforms. The researcher focuses on a software tool to

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develop a web-based application that is viewable on smartphones.

The researcher focuses on a software tool to be utilized in developing a web-based application that is viewable on smartphones. The researcher considers some programming languages and script languages to achieve and produce the desired features and functionalities. The proposed system be implemented using the minimum hardware requirements in Table 1.

Table 1. Hardware Requirements

Hardware Requirements (Minimum)		
Hardware	**Category**	**Specification**
Management Computer For system management (Customer, consumer, and Admin	Hardware	(*Admin*) Intel i3, 4gb RAM, 500gb HDD (*Customer, Consumer*) Non-specific
	OS	Windows 7
	Connectivity	Stable Internet Access
	Application	Google Chrome Browser, Microsoft Edge, Mozilla Firefox
Mobile (Customer, consumer)	Hardware	Non-specific
	Connectivity	Network Access
	Application	Google Chrome Browser, Microsoft Edge, Mozilla Firefox

System Design

Shown in Figure 3 is the system architecture of the proposed system for RMS. The proposed system has three primary users to have access to the system. The system is designed user-friendly and straightforward to address the variety of ages and literacy of the users. Users can access the system using a smartphone, laptop, or desktop. A user can be register, shop, and purchase orders anytime, anywhere in the Philippines.

Figure 3. System Architecture

Business owners need to register first online and validate their business store to have access to the system. They can add new products, edit and update the details, and manage the stocks' availability. The admin would validate this process before the business owner can post. They can make all inquiries regarding consumers' questions. Suggestions are entertained to have a good relationship with them.

The developer created a user-friendly home page for the consumers' convenience while browsing or making an online order and asking something about the company, products, and services that the marble store offered. Consumers are also required to fill-out personal data. After the registration, the consumers can now shop online marble products based on their desire, anytime, anywhere, using their mobile phones or laptop. The system requires the necessary consumers' information to validate delivery details.

The proposed system must have an administrator to manage and monitor the Romblon Marble Shopping, which the Municipal Business office manages. The admin is the one who validates the registration of businesses, manages and monitors the posting of a product by business owners.

System Development

In developing the website, the researcher focused on a software tool utilized as a web-based application that is viewable on smartphones. The developer considered some programming languages and script languages to achieve and produce the desired features and functionalities.

The PHP was initially used for creating websites for mobile app development, Android apps, and iOS apps since the system is viewable on a smartphone. It was used to create e-commerce websites and PDFs for creating content management systems.

To build the system, JavaScript was also used since it has three main technologies: the World Wide Web, HTML and CSS. It makes websites that are interactive, which is an integral aspect of web applications. It has the overwhelming majority of domains to use and a dedicated JavaScript engine is required for all major web browsers to operate.

For a database management system, MySQL helps relational databases to be managed. It is Oracle-backed open-source software that can operate on several UNIX, Debian, Windows, and similar platforms.

Test

Similar to how Agile approaches development, most of the best-known usability practitioners encouraged testing early and often. Thus, an iterative approach to testing was recommended (Coughlan, 2016).

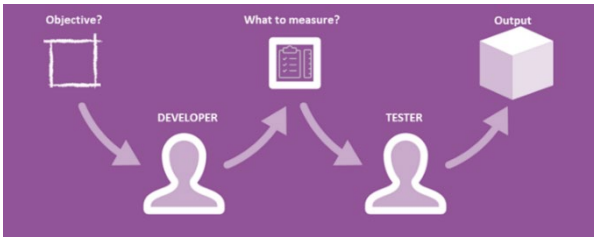

Figure 4. Iterative Test Model

As defined in Figure 4, the researcher needs to do some to conduct the usability test, as follows: (a) defining objective; (b) identifying the measurement needed; (c) creating tasks and questions which is best achieved when based on ISO/IEC 25010; and (d) recruiting testers.

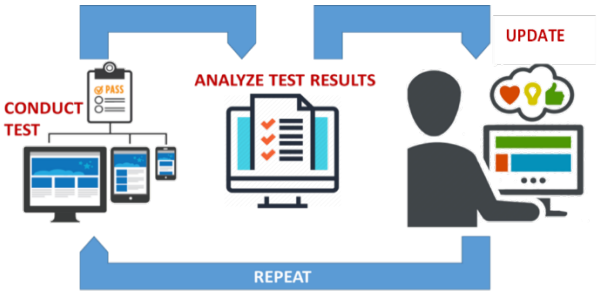

Figure 5. Iterative Test Cycle

The developer deploys the framework online to validate the website and to see how the system achieves the functionality of the system if the platform provides functions that when used under defined circumstances, fulfill mentioned and implied needs. It will share details and execute the required functions while testing the efficiency and compatibility of the device, thus sharing the same hardware and software environment. It will achieve the defined objectives with user-friendliness performance, efficacy, and satisfaction in order to verify the responsiveness of the process. Also, it will also check the reliability of the given rules set by the system. Considering the planning steps shown in Figure 5, the tested module before evaluation and user acceptance is shown in Table 2.

System Implementation and Evaluation

Implementation

The Municipality of Romblon, Romblon, and varied consumers, are the target users of the research project. The researcher requested to conduct a focus group orientation regarding the use of the online website and mobile application version. The target population sampling was randomly selected and for those who have marble business in Romblon, Romblon.

Evaluation

To determine system quality, the researcher used ISO/IEC 25010 standard. The quality of a system is linked to the degree to which the system satisfies the specified and implied demand for and from its interested parties, thereby providing value. The specifications of certain stakeholders (functionality, efficiency, protection, maintenance, and other related) are specifically represented by the quality model, categorizing product quality into features and sub-characteristics.

RESULTS AND DISCUSSION

The researcher provides a web-based ordering platform for the marble business owners to help their consumers who do not have access to their physical store (Tables 2, 3 & 4). The website lured consumers to visually observe the products before purchasing. In this way, the consumers can easily browse various displayed marble products with just a few clicks. Consumers may begin to buy conveniently from their internet-connected personal computers, tablets, and cell phones from shopping websites. Consumers will start waiting to collect their orders within a few days at the closest courier establishments within their neighborhood after paying their purchased items.

This system can help every consumer of every business store to have easy access to its management. They can have their inquiries online and have management feedback. All the information that the consumers want to know about the store is almost on

Table 2. Admin Test Procedure

Features	Test Objective	Test Procedure	Test Platform	Test Result
Log-in	The admin should be able to manage their account.	• Input username and password. • Change username and password.	Laptop or Desktop Computer Smart Phone	Successfully log-in and manage the username and password.
Manage Merchants	Able to validate the merchant's registration and verification.	• Test the validation of registration and verification.	Laptop or Desktop Computer Smart Phone	Successfully validate the merchant's registration and verification.
Manage Product Category and Validate	Set product categories and validate it.	• Set the product category. • Validate product.	Laptop or Desktop Computer	Successfully add, delete and validate product category.

Table 3. Merchant's Test Procedure

Features	Test Objective	Test Procedure	Test Platform	Test Result
Registration	• To register online using a different device and received SMS notification.	• Fill-up necessary information. • Set username and password. • Receive SMS notification (after the verification of the admin).	Laptop or Desktop Computer Smart Phone	• Successfully register and manage personal account. • Successfully received SMS notification.
Log-in	• To log-in with the registered username and password. • To be able to manage their account/s.	• Input username and password • Change username and password • Edit and update personal information	Laptop or Desktop Computer Smart Phone	• Successfully log-in using username and password. • Successfully edit and update information.
Manage Products	• To add, edit, and update products. • To monitor the products and stock	• Add products • Edit and update products details • Upload products design • Display the availability of the product and stock.	Laptop or Desktop Computer Smart Phone	• Successfully add, edit and update products. • Successfully monitor the products and stock.
Manage Purchased Order	• To monitor the product ordered by the customer. • To set the status of delivery and pick-up details of orders. • To monitor the payment transaction of the consumers.	• View customers order. • Set the status of ordered products. • Verify the consumer's information for the delivery and pick-up details. • Set the delivery and pick-up details of orders. • Verify the payment transaction made by the consumers.	Laptop or Desktop Computer	• Successfully monitor the product order. • Successfully set the status of delivery and pick-up details. • Successfully monitor payment transaction thru system notification.

Table 4. Consumers' Test Procedure

Features	Test Objective	Test Procedure	Test Platform	Test Result
Registration	To register online using different devices.	• Fill-up the required information • Edit and update personal information	Laptop or Desktop Computer Smart Phone	• Successfully register online. • Successfully edit and update information.
Log-in	The consumer should be able to log-in and manage their account.	• Input username and password. • Change username and password.	Laptop or Desktop Computer Smart Phone	• Successfully log-in in the website and easily manage account.
Shopping	• To be able to shop online and browse the desired products. • To be able to upload personalized design.	• Search and select products. • Show product and store details. • Add the product in the cart. • Remove or change product order in a cart. • Set the product order quantity. • Request personalized products. • View total purchase. • View the status of orders.	Laptop or Desktop Computer Smart Phone	• Successfully shop online and browse products. • Successfully upload image for personalized design. • Successfully edit and update order and view total purchase. • Successfully view the status of orders.
Online Payment	To be able to process online payment.	• Process online payment transaction.	Laptop or Desktop Computer Smart Phone	• Successfully process online payment using credit card.

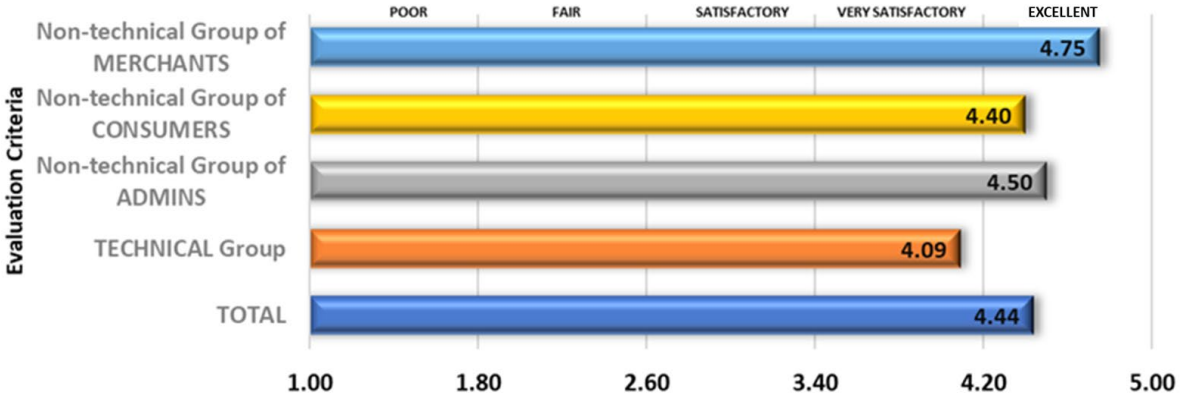

Figure 6. Overall System Evaluation Result

the products that they desire, add to their cart, and the system automatically computes the total amount purchased.

The prospect consumers can inquire online through the system. They can view the offered products, details, amounts purchased, and other services. The system also has a feature that enables consumers to view the availability of each product. The consumers can also request a personalized marble product from the business owner. The business process and procedures improvement could maximize the business income, facilitate and monitor all marble products and sales online. This website would give benefits to the marble business owners of Romblon, Romblon and consumers nationwide.

The research conducted to test the established framework came from four groups to ensured that the standards of the stakeholders were focused on the ISO/IEC 25010 specification to assess the consistency of the system. They are the non-technical admin, merchant, consumers, and the technical groups.

Shown in Figure 6 are the overall results of the system as evaluated by the admin group had a grand mean of 4.50 (excellent), the merchant's group was 4.75 (excellent) and the consumer's group was 4.40 (excellent). The system evaluation's overall mean for the technicality was 4.09 (very satisfactory).

The technical group shows the evaluated results means that the system was very satisfactory to meet the expected objective/output. In contrast, the admin group means that it did excellently meet its stakeholder's needs. The community of merchants and customers, on the other side, indicates that the measured outcomes indicate that the scheme meets the specified and implied needs of its different stakeholders excellently.

CONCLUSION

In general, the key objective of the study is to establish an E-Commerce Network for Marble Industry online platform in Romblon, which is excellently accomplished and fulfilled on the basis of the analysis and testing performed by the researcher.

It was shown that the developed system can check the legitimacy of the business. It is also viewable on a smartphone. It can provide feedback, confirmations, validations and status updates of online orders. It has a platform where customers can provide personalized design options for their orders, and it provides a convenient way of payment for consumers. Respondents benefit from knowledge in E-commerce from the system as it serves as an alternative expansion of the business. The evaluation and analysis of the data gathered proved that the majority favored and accepted the online shopping for the marble industry.

The study can help the industry keep and increase their patronage and transact untapped and new consumers. It provides much faster and better consumer services prompting the marble merchants to keep pace to remain competitive. The long-range approach would ensure the marble advertisement in the World Wide Web. The researcher concluded that as the users pilot tested the evaluated system, it helped them in the decision-making process.

CONFLICT OF INTEREST

The author declares that the project poses no conflict of interest in the process conceptualizing, designing, creating, testing, maintaining and publishing of this project from its software to hardware and unto this manuscript.

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Perceptions Towards No Single-Use Plastic Policy: The Case of Casual Dining Restaurants

Khrisna F. Vicente, Ruth F. Vicente, Gina V. Mapalad, Janine M. Faminial, Sisa F. Formento, Irene I. Fadera and Olga G. Eledia

ABSTRACT

Environmental challenges are becoming a never-ending source of study. Many nations are currently focusing on environmentally friendly policies. In the Philippines, Republic Act No. 9003 established an ecological solid waste management program. In 2020, the municipality of Odiongan, Romblon enforced the "no single-use plastics" ordinance in all businesses, including restaurants. The goal of this research was to discover local green rules that apply to casual dining restaurant businesses. It also sought to establish how participants felt about the local government's green programs and identified the numerous green efforts and practices of selected restaurants as well as the impact of green policies on their operations as viewed by the owners/managers. The descriptive-qualitative approach using interview as a data collection method was used. Results show that the town of Odiongan is facing several challenges in properly implementing its green initiatives such as the availability and durability of low-cost alternative packaging materials. The policy on "no single-use plastics" needs to be understood more by casual dining restaurant owners and the general public.

Keywords: *green policies, green practices, operations, performance, casual dining restaurants*

INTRODUCTION

Several businesses began to distinguish themselves by embracing green practices and developing unique green products to ensure continuous consumer happiness. However, some of these businesses saw these practices, which assure the long-term viability of social life, as a burden and a liability (Azmi et al., 2017). Even though services are naturally ethereal, service operations frequently necessitate numerous tangible features of service goods that have an environmental impact. One of the least sustainable economic sectors has been identified as the restaurant industry (Wang et al., 2013). As a result, the restaurant industry bears a more significant share of the blame for environmental damage.

Environmental concerns have pushed practitioners to implement numerous environmental efforts in recent years. This development has prompted a significant study on the link between green efforts, green performance, and business performance (Seroka-Stolka, 2016). According to Flammer (2013), the bouyant stock market reaction declines as more eco-friendly initiatives are implemented, implying decreasing marginal returns from environmental activities. Flammer conducted a follow-up study in 2015, which found a more significant marginal benefit for firms in industrial areas with higher corporate social responsibility (CSR) efforts. Recently, Tuppura et al. (2016) used sample data from US enterprises across four industry sectors to investigate the relationship between CSR and corporate financial performance. They discovered a bi-directional link between these two variables in the garment sector, energy, food, and forestry, when they looked at causality's influence. Given the rapidly expanding number of restaurants and the widespread habit of eating out, which has an increasingly negative influence on the environment, business establishments need to participate in green practices immediately. Firms may obtain economic benefits, improve environmental performance, and improve their corporate image by participating in the green practices' movement (Chen Tan et al., 2019).

In 2020, the municipality of Odiongan, Romblon mandated all establishments to refrain from the consumption of single-use plastics in support of Republic Act No. 9003, an act providing for an ecological solid waste management program, creating the necessary institutional mechanisms and incentives,

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declaring certain acts prohibited and providing penalties, appropriating funds, therefore, and for other purposes. Section 2-(f) provides greater private sector participation in solid waste management. This disrupted the operations of all existing businesses as they looked for alternative packaging materials for their products. It became one of the municipality's major priorities in prohibiting the use of plastics.

One of the challenges of the private sector, including restaurants in the town, is using paper instead of plastics unless the latter is recyclable. Wastes must be segregated and single-use plastics must be banned. Using plastic spoons and forks is prohibited, even plastic straws. Take-out orders require an additional fee for paper boxes or microwaveable containers. Some green practices to cope with these are purchasing spoons and forks made of corn starch.

These green practices that relate to banning plastic use are one of the green policies of Odiongan. However, it poses a challenge to the private sector as they will look for an alternative supplier that will maintain their operations and revenue.

This study aimed to determine the local government's green policies related to restaurant operations and the perceptions of selected owners/managers about the green policies mandated by the local government and their effect on their operations. Likewise, the various green initiatives and practices of selected casual restaurants in Odiongan, Romblon were determined.

On Plastic Use

The continuous dependence of people on plastics increases their consumption leading to a higher global environmental problem. Only two million tons per year were produced in 1950. Annual output has roughly doubled hitting 381 million tons in 2015 (Ritchie & Roser, 2018).

In 2002, Bangladesh became the first country to prohibit thinner plastic bags, followed by Morocco in 2016. In 2011, Australia became the first country to outlaw plastic bags. All merchants were subject to the prohibition on single-use, lightweight polyethylene polymer plastic bags with a thickness of less than 35 microns (these are the thin plastic bags with handles that were commonly provided at supermarket check-outs) (Policarpio, 2017).

In the Philippines, plastic straws and stirrers (66%), plastic *labo* bags (65%), styrofoam or polystyrene food containers (64%), sachets (60%), tetra packs for juices (59%), plastic drinking cups (56%), cutlery such as plastic spoons and forks (54%), plastic bottles for juice (49 %), and plastic bottles for water (41%) are the most commonly used plastics (Alegado, 2020). Nine provinces, 11 cities, and 101 municipalities have approved resolutions requesting the National Solid Waste Management Commission (NSWMC) to release the long-awaited list of non-environmentally acceptable goods and packaging (NEAPP), which includes single-use plastics (Oceana, 2021). The province of Romblon was not included in the list. Davao Oriental Province has signed a petition calling for a statewide ban on single-use plastics, joining 30 other coastal provinces and local government units around the country (Palicte, 2020). Because much plastic debris ended up in the ocean, Davao enacted a resolution.

In addition, seven municipalities in Metro Manila passed their city ordinance about banning single-use plastics. Ordinance No. 10-109 of Muntinlupa City restricts plastic bags on dry products, regulates their use on wet items, and outlaws the use of styrofoam. Plastic bags, styrofoam/stylophone as packaging materials, and containers for dry items and food products are forbidden in commercial places.

Pasig's City Ordinance No. 9 Series of 2010 was implemented in July 2011. Plastics are banned from dry products and their usage is regulated for wet items. The use of styrofoam and similar materials in food, vegetables, and other items is likewise prohibited under this regulation. Styrofoam food containers and straws are included. Cutlery, plastic eating goods, and plastic kitchen wares are not covered.

With City Ordinance No. 1036-11, Las Piñas City initiated its ban on single-use plastic in January 2012. Individuals and businesses are prohibited from distributing thin-film, single-use, carry-out, plastic bags and polystyrene foam (styrofoam/stylophone) under the municipal code.

Plastic bags are not allowed in Pasay City, according to City Ordinance No. 4647. The usage of recyclable paper carry-out bags and reusable bags is also encouraged by this law.

In Makati, a Plastic Regulation Order requires businesses to supply free or for a fee paper bags, cloth bags, basket/woven bags, or equivalents. Business owners must also report plastic, styrofoam, and other non-biodegradable materials to the Plastic Monitoring Task Force under the legislation.

Following Ordinance SP-2876, Quezon City imposed a single-use plastic ban in February 2020. This regulation prohibits the distribution and use of single-use plastics in the city. For dine-in guests, single-use and throwaway products such as plastic spoons, forks, knives, plastic/paper cups, plates, straws, stirrers, and styrofoam are prohibited. Personal hygiene products such as bar and liquid soap, shampoo and conditioner, and other single-use containers are also forbidden in hotels.

In 2020, Paranaque City passed City Ordinance No.18-40, which prohibited using single-use plastic in all dry products. Plastic bags, straws, spoons & forks, glasses, and stirrers are prohibited.

METHODOLOGY

This study used the descriptive qualitative method. Two owners and two managers of casual dining restaurants in the municipality of Odiongan were interviewed about their perceptions of the effect of the "no single-use plastic policy" on their operations. A representative from the municipal mayor's office answered questions about the existing local green policies related to the food industry. The interviews were recorded with the participant's consent, transcribed and analyzed.

RESULTS AND DISCUSSION

The local government unit of Odiongan has many regulations regarding green policies, especially in solid waste management. There is an ordinance that aims to reduce plastic consumption. Odiongan wants to be known as a green municipality by promoting "Go Green Odiongan". Though there were many projects and programs the town wants to pursue, funding is the biggest problem.

As to the participants' perceptions regarding the "No-Single Use Plastic" policy, they are willing to follow the green policy by the LGU and are willing to be part of the save the earth movement; however, it was apparently becoming a burden for them as well. The LGU extended no suggestion for alternative or possible materials. Interestingly, one of the participants has been using biodegradable plastic bags provided by the Department of Science and Technology. Annoyance on the part of the customers was also a concern the establishment identified.

According to a countrywide poll conducted by Global Alliance for Incinerator Alternatives (GAIA) and Social Weather Stations, 6 out of 10 people are eager to buy food condiments in recyclable or refillable containers rather than sachets, and 4 out of 10 believed that enterprises should look for alternatives to plastic (Alegado, 2020).

The participants believed that the green policy affected the operations of their establishment. The habit of using disposable plastic materials has been an issue of concern. The customers kept asking for disposable plastic spoons, forks, cups, and bags. The participants received complaints about their products' taste, especially with their drinks when the customers used paper instead of plastic straw. The taste of the drink was affected. Participants also reported that the price of the paper materials they used was much higher than the plastic ones. For example, customers would ask for another when the paper straw got soaked and softened. For take-outs, microwaveable containers became the alternatives with an additional fee to be shouldered by the customers. They also received complaints about the durability of the paper bag; thus, paper bags for take-outs are usually doubled.

Not only the participants but also the customers were experiencing challenges following the green policy implemented by the municipality of Odiongan. Furthermore, the participants claimed that their operations and revenue had been affected. The cost of alternative materials was twice as much. The higher cost of materials badly hurt their revenue. Some kept their menu price the same despite this situation. On the other hand, some establishments asked for additional payment only for take-out containers.

The owners/managers of casual dining restaurants are proactive in complying with the green policy of the municipality despite the difficulty of looking for alternative solutions to the "single-use plastic". This affected both their operation and financial performance. As much as they want to shift back to plastics because it is more convenient and less cheap, the ordinance prevented them from doing so.

To fully support the "no-single use plastic" policy of the LGU, the following green practices by the were enumerated by the participants: (a) use of paper cups and glasses instead of plastic cups; (b) use of paper straw/ metal straw as an alternative for plastic straw; (c) use of paper box, microwaveable container, paper bags and paper handles for take-outs; and (d) encouraging customers to bring containers for take-outs to avoid extra charges.

CONCLUSION AND RECOMMENDATIONS

The green policies of the local government of Odiongan, especially in the ban on single-use plastics, are well-implemented in the town. Participants show initiative to comply with the ordinance despite the apparently limited orientation about this environmental program. One of the problems faced by casual dining restaurants is getting support and accurate information about single-use plastics. Participants experienced challenges in looking for suppliers of alternatives for single-use plastics. Using paper materials as alternatives has been a challenge for restaurants because of customer complaints and higher cost which eventually affects revenues.

Collaboration among government agencies is encouraged to provide alternatives for plastics that may focus on reducing, reusing, and recycling. Further research may be done such as the relationship between green policies and price increase, implementation of no single-plastic use and financial performance and waste characterization study in restaurants comparing the volume of plastic and paper wastes generated.

ACKNOWLEDGMENT

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AUTHORS' CONTRIBUTIONS

Conceptualization and design: K.V., G.M.; data collection: K.V., J.F., I.F., O.E.; analysis and interpretation of results: K.V., R.V., S.F.; draft manuscript preparation and revision: K.V., G.M.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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ABOUT THE COVER

THE HIDDEN PARADISE OF COBRADOR ISLAND: A SNORKELER AND DIVER'S DREAM DESTINATION IN ROMBLON, PHILIPPINES. Cobrador Island is a small island located in Romblon, Philippines. It is known for its crystal-clear waters and white sandy beaches, making it a popular destination for snorkeling and diving. The island's coral reefs are home to a diverse array of marine life, including colorful fish and sea turtles. Visitors can also explore the island's lush jungle and hike to the summit for panoramic views of the surrounding islands. Cobrador Island is the perfect place for those looking for a secluded and tranquil getaway. Home to about 250 households, Cobrador Island is one of the recipients of Romblon State University's UNI-CESS Program or the University Community Empowerment through Sustainable Services which aims to uplift the vulnerable and marginalized communities through holistic and collaborative engagement.

Jerry Jay Fornal/RSU Media, Office of Media and Public Affairs

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