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Coco-based Product Decision Support System: Basis for Marketing and Promotions

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Abstract: This newly developed system addresses the lack of system software in the marketing and promotions of coco-based products in the Philippines specifically at the Cagayan State University. In this study, there were 90 participants involved: 52 clients, 25 income generating projects implementers, and 13 information technology experts from the academe and industry. They were randomly selected from the 128 system-registered customers within the period August 2017 to December 2017. The developed system, in terms of the different software quality characteristics like functionality, reliability, usability and efficiency, was assessed. The results of a Chi-Square test p-value for the system characteristics were: functionality (776.28), reliability (345), usability (737), and efficiency (737). These p-values are more than 9.488 for an alpha level of 0.05, which means there is significant difference on the extent to which the system complies with the International Standardization Organization (ISO-9126). The developed system business intelligence feature is useful in generating data graphs, charts, and facilitates the preparation of timely reports primarily needed as basis for a better business decision making.
Keywords: Developed System, Income Generating Projects (IGPs), International Standardization Organization (ISO).

I. INTRODUCTION

It has been recorded that globally, the Philippines is on the second spot in the list of top five coconut producing countries namely India, Brazil, Sri Lanka and Indonesia (FAOSTAT data, 2016).

The coconut palm tree (Cocos Nucifera) is available throughout the tropics, where it is interwoven into the lives of the local people. It is particularly important in the low islands of the Pacific where, in the absence of land-based natural resources, it provides almost all the necessities of life: food, drink, oil, medicine, fiber, timber, thatch, mats, fuel, and domestic utensils (Chan, E., Elevitch, C., 2006).

The Association of Southeast Asian Nations (ASEAN) is moving toward a single economic community based on an ASEAN Economic Community (AEC) Blueprint which calls for a single market and production base. Its priority has a focus on integration and enhancement of trade among ASEAN member-countries and long-term competitiveness of food and agriculture products produced within ASEAN.

This approach includes harmonizing their standards of quality and by standardizing trade certifications. Through these initiatives, ASEAN agricultural products are expected to become more competitive in the global market (Briones, R., Israel, D., 2012).

In like manner, among the ten ASEAN countries, Philippines remains consistent in its excellent performance with regard to production of agricultural products. A survey was conducted from 2010 to 2014 to determine the strength of production for all Philippine agricultural products.

Table 1 shows that coconut industry in the Philippines is performing and providing the country excellent record in coconut production (Bersales, 2015).

Figure 1, Figure 2, Figure 3, Figure 4 and Figure 5 are line graphs to visually represent the performance of Philippine coconut industry per year within the period 2010-2014.

Table 1. Volume of Production of major crops, Philippines

Crop	2010	2011	2012 R/	2013 R/	2014
			(IN METRIC TON)		
All Major Crops	**71,855,888**	**83,749,720**	**84,396,455**	**82,133,051**	**83,462,550**
Palay	15,772,319	16,684,062	18,032,525	18,439,420	18,967,826
Corn	6,376,796	6,971,221	7,407,068	7,377,293	7,770,603
Abaca	66,512	68,613	68,510	64,952	68,053
Coconut	15,510,283	15,244,609	15,863,801	15,354,334	14,696,298
Coffee	94,536	88,526	88,943	78,634	75,454
Arabica	*19,421*	*19,002*	*18,783*	*18,594*	*18,028*
Excelsa	*6,354*	*5,916*	*5,737*	*4,917*	*4,725*
Liberica	*633*	*630*	*598*	*563*	*533*
Robusta	*67,933*	*62,978*	*63,825*	*54,560*	*52,168*
Rubber	395,237	425,705	442,998	444,818	453,052
Sugarcane	17,929,269	28,376,518	26,395,915	24,584,841	25,029,880
Tobacco	40,530	44,944	48,075	53,753	61,418
Native	*10,765*	*11,546*	*10,525*	*10,805*	*10,169*
Virginia	*18,839*	*21,447*	*23,644*	*28,245*	*31,321*
Banana	9,101,341	9,165,046	9,226,768	8,646,417	8,884,857
Cavendish	*4,600,617*	*4,685,997*	*4,694,655*	*4,230,089*	*4,448,460*
Lakatan	*921,602*	*926,719*	*942,938*	*930,032*	*954,856*
Saba	*2,632,692*	*2,616,842*	*2,645,893*	*2,557,109*	*2,567,495*
Calamansi	188,340	182,550	178,549	164,091	160,740
Mango	825,676	788,074	768,410	816,378	885,038
Carabao	*669,520*	*638,954*	*630,596*	*671,929*	*730,140*
Pineapple	2,169,233	2,246,806	2,397,745	2,458,528	2,507,098
Cabbage	128,964	125,309	126,381	127,463	127,986
Sweet Potato	541,265	516,338	516,907	528,250	519,855
Cassava	2,101,454	2,209,684	2,223,182	2,361,561	2,540,254
Eggplant	208,242	207,994	211,885	219,911	225,579
Garlic	9,563	9,057	8,808	8,986	8,993
Mungbean	27,055	32,960	32,366	32,422	32,144
Onion	135,377	128,387	124,890	134,239	203,651
Peanut	29,624	29,734	29,136	29,091	29,196
Tomato	204,272	203,582	203,593	207,668	214,573

R/ - Revised due to inclusion of Batanes data.

Source: Bersales, L (2015). Selected Statistics on Agriculture.

To help the country maintain excellent standing on coconut production, the Cagayan Valley region, thru the Philippine Coconut Authority, the government's agricultural arm in Cagayan, recently held training on coconut-based farming system. Its focus is to enhance the knowledge and skills of farmers whose participants were coconut growers in Sanchez Mira, Cagayan. Also, it was attended by other participants like agricultural extension workers, 4H and businessmen. In the training, the impact of climate change to agricultural production was discussed which gave the opportunity on the introduction of coco-based farming system (CBFS) and its advantages.

Different coconut intercropping practices were likewise discussed to include coconut-corn intercropping, coconut-cacao intercropping, coconut-coffee intercropping, and coconut-root crops intercropping. Farmers have the options of what to intercrop in their coconut plantation depending on their preference and capacity. It was also included in the program that promotion and production of coconut would surely help farmers in their livelihood. It was explained to the participants that coconut growers need to work hand in hand to organize an association to strengthen their ability and initiative to produce more coconuts and elevate the coconut industry (Alaska, C., 2014).

Sanchez Mira, the venue of the training on coconut- based farming system, is a 4th class municipality of 23,044 residents, located at the Northern tip of the Philippines. Its land area planted with various crops (e.g. palay, coconut, corn, vegetables and other fruit bearing trees). Its coastal part is rich in fishing activities where town folks are into it for their daily needs.

Within the Sanchez Mira commercial town center is where one of the Cagayan State University's eight campuses is situated. It is a campus of the University where most of the town folks and school-kids get educated and finish their tertiary education. Being an agricultural school as its beginnings (PD 1436, s. 1978), the government has provided Cagayan State University-Sanchez Mira campus with more than one hundred hectares of agricultural land. Most of its land area are planted with coconut and other tropical fruit bearing trees, with the coconut tree being the second national tree of the Philippines due to its versatility and value from root to leaves (Peralta, J., 2015).

Documents would show that Cagayan State University Sanchez Mira campus has been into processing and marketing of coco-based products since 2001. This campus undertaking was materialized through the persistent effort of the previous University administration, local government unit and support of the local coconut community. Because of its potential as local industry, it was decided by management to make it as Income Generating Project (IGP) of the University.

As shown in Figure 1, CSU-Sanchez Mira campus coconut product processing section is manned by select University officials and group of IGP Staff and Laborers with coco-product processing skills to meet the demand of the coconut dependent community (e.g. customers, raw materials suppliers, and IGP employees). Recently, local construction companies and the Department of Public Works

and Highways (DPWH) Region 02 and Apayao province became regular buyers of coconut by-products like coco-logs or biolog, geotextiles and coco-nets. According to them, these products are useful in controlling soil erosion and other land-based applications.
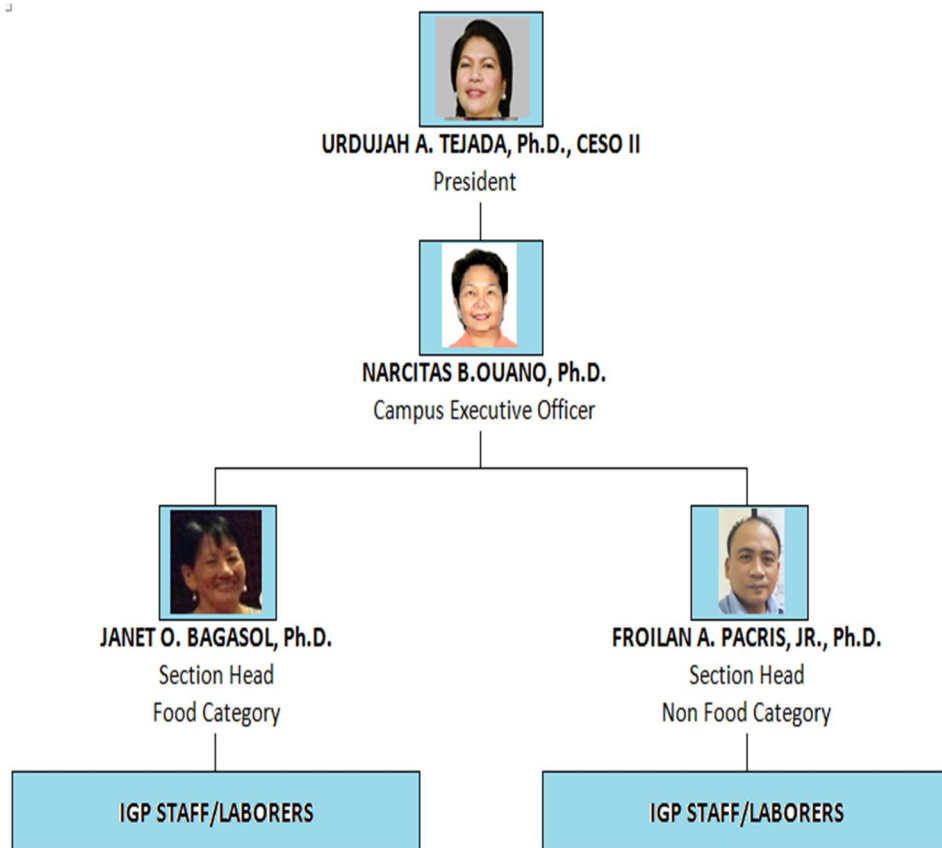

Figure 1. CSU-SM IGP Organizational Chart

In like manner, the Philippine Coconut Authority (PCA) Cagayan Valley and Cagayan State University – Sanchez Mira campus have been in a partnership to establish a coconut nursery which will produce coconut seedlings for farmers (e.g. varieties on ornamental and native coconut). This PCA project is in response to the high demand in coconut seedlings, especially native coconut variety (Baccay, O., 2011).

To date, Cagayan State University coco-based products marketing network is limited to Sanchez Mira and its nearby towns based on the discussion made between the researcher and the Dean of the College of Agriculture and former Research, Development and Extension Coordinator of the campus. Aside from the existing contract the University has with local companies and PCA, other coco-based product customers are students, visitors and people within the campus vicinity. Presently, the University strategy on coco-based product marketing and promotion is more on traditional view or approach (e.g. attracting customers and closing deals). The present system requires coconut based products customers to visit the University business center for them to be educated on the importance of the product and to encourage them to try the product. Personal appearance is a requirement by the campus business center when buying something from the displayed array of coconut based products. In short, individual appearance is necessary. It is a business marketing strategy that ends up into limited market network thus, coco-based products level of consumption does not have any difference.

As of this writing, the Cagayan State University has come up with a tool for product marketing and promotion but utilized to a minimal extent. It also includes overcoming major gaps that separate goods and services from people who would like to use them (i.e. time, place, possession). It is a kind of coco-based product distribution channel that enables the increase of business transactions and direct contacts to would-be coco-based product customers. This internet technology based approach on product marketing and promotion may establish customer's good buying relationship to the University making them become loyal repeat customers. These efforts could also be extended to coconut raw materials suppliers and IGP-employees as well. These changes in product marketing and promotion strategies are driven by fast pace change on customer's product buying preferences which is a widely known fact. As per

International Telecommunication Union (2009), the use of internet keeps on growing day by day and record shows that since year 2010, two billion people were found having an activity online. Many business operators and business agents are applying online technologies to reach more customers; however, using more high-tech technologies means more budget needs and highly-skilled human resource, etc. Advancement in technology has placed a vital role in the unexpected transformation in business strategy (Kotable & Helsen 2000).

As the researcher is affiliated with the Cagayan State University – Sanchez Mira campus, he has selected it as the primary locale of the study. His vision is to help the campus in reaching out to more people nationwide through Information Technology. Since the campus is leading on coconut-based product production university-wide, the result of this study could easily later be utilized by other campuses offering agricultural discipline.

With the previously mentioned situation in mind, the researcher proposed the coco-based products decision support system, a tool to expedite the processes of coco-based product marketing and promotion. Extended functionality is included to enable selling of coco-based products online using the internet. Likewise, it includes business intelligence as its other important feature which may greatly be needed by the University business IGP section heads for decision making and future coco-based product market planning.

Nogue's, A., et al (2017) added that doing business requires intelligence. This principle is effective to any business especially when doing it correctly because profitable business cannot be better without intelligence. The www.dictionary.com definition of Business Intelligence is this: "It uses methods and technologies that gather, store, report, and analyze business data to help people make business decisions". Business Intelligence is, thus, a system software acting as front-end tool as well as back-end tool, a solution to be in place to adopt some theories and applies methodologies derived from the business architecture designed to provide businesses the appropriate return of investment.

As mentioned by Hallar (2017) in his study titled "Enhancing Quality Assurance Mechanism through Data Analysis Approach", once the new system is proven working, it may become highly conceivable that it could be adopted by other state educational or agricultural institutions in the region or even the nation as well.

The possibility of maximizing the importance of ICT-based technology could be a contributor to a more robust Philippine coconut industry and the ASEAN countries. This inspired the researcher to conduct this study. This ICT-based tool may accelerate and improve decision making; optimize internal business processes; increases operational efficiency; drive new revenues; and gain competitive advantages.

Hence, this study may bring various opportunities to the University on coco-based product marketing and promotion. Many industries in other field had already adopted e-business to enhance their marketing and promotion processes and to better facilitate potential customers anywhere, anytime.

The researcher's prime focus is to gather baseline data and information by assessing the status of the present processes on coco-based product marketing and promotion.

The main objectives of this study are the following:

1) to develop decision support system, a basis for coco-based product marketing and promotion;

2) to enable coco-based product marketing and promotion for a wider market access;

3) to help the University and coconut farmers earn more as they are the primary sources of coconut product raw materials; and

4) To help revitalize the coconut industry in Northwestern Cagayan.

A. *Theoretical/ Conceptual Framework*

The study system design requirements were patterned from "Interaction Design Model". The IDM figure was modified to suit the objectives of the study. The modified version is presented in Figure 2. It is a user-centered paradigm model procedure of system development that involves four (4) stages. This model reminds system developer to conduct consultation to users anytime, when needed, since they are considered as the center in program design and development. This model approach to system development allowed all stages to an open communication thereby permits the designer to collect and evaluate important information primarily needed to address what users want and preferences.
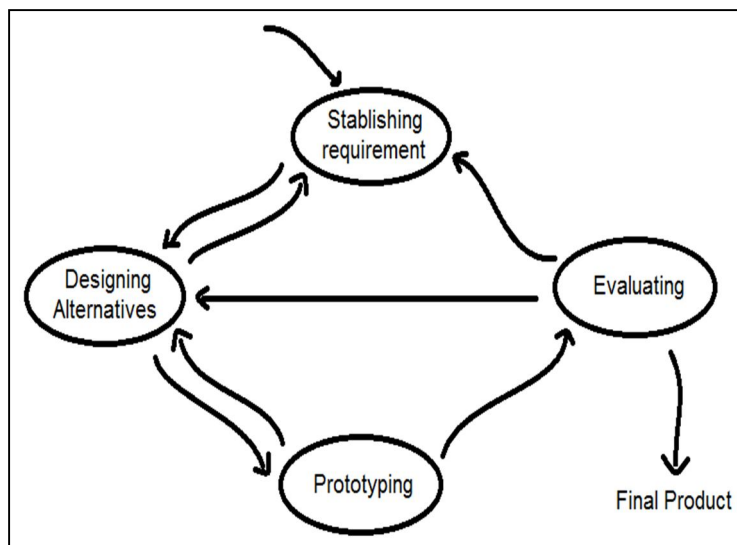
Figure 2. Interaction Design Model (Roger, et al., 2011)

The four stages of the interaction design model are elaborated below.

1) Establishing Requirements. The researcher of this study gathers pieces of ideas from different sources for the purpose of knowing what things need to be done. Most of the time, would-be system user's involvement into this activity is highly required.

2) Designing Alternatives. Presentation of ideas into a number of designed outputs during system's development. This core activity makes system development more precise in order to meet what user's expectation.

3) Prototyping. It allows system designer to further understand user's preferences. Interaction to system prototypes provides an easy way of what users really want.

4) Evaluation. Its goal is to uncover and fix possible problems arises during the entire stage of system testing. Although after thorough system evaluation has been done and clearance to use the system for its intended users has been given, system evaluation must not stop to sustain its expected level of performance and output quality.

The conceptual framework applied in this study is the usual Input-Process-Output model. This model includes all the materials and information required for the process (www.businessdictionary.com). In this study, the IPO model is presented as a series of boxes (processing elements) connected by inputs and outputs. This model provides the general structure and guide for the direction of the study. It has three stages.

The input stage is represented by the necessary information and gathered data for the study. Likewise, serve to guide the study process as it includes ISO-9126 suggested characteristics for functionality, reliability, usability and efficiency.

The process stage is represented by how input information are analyzed, processed and evaluated. In this stage, important phases of Software Development Life Cycle (SDLC) have to be observed as it serve as guide during the entire period of program development.

The output stage is represented by the developed coco-based product decision support system with features on selling coco-based products and reporting like producing of graphs, charts and records management.

B. Input-Process-Output (IPO) Framework

As shown in Figure 3, the Input-Process-Output Framework illustrates a diagram presentation which serves as basis in the software development process. It is a framework used in order to come up with the final output or product (i.e. developed coco-based decision support system).
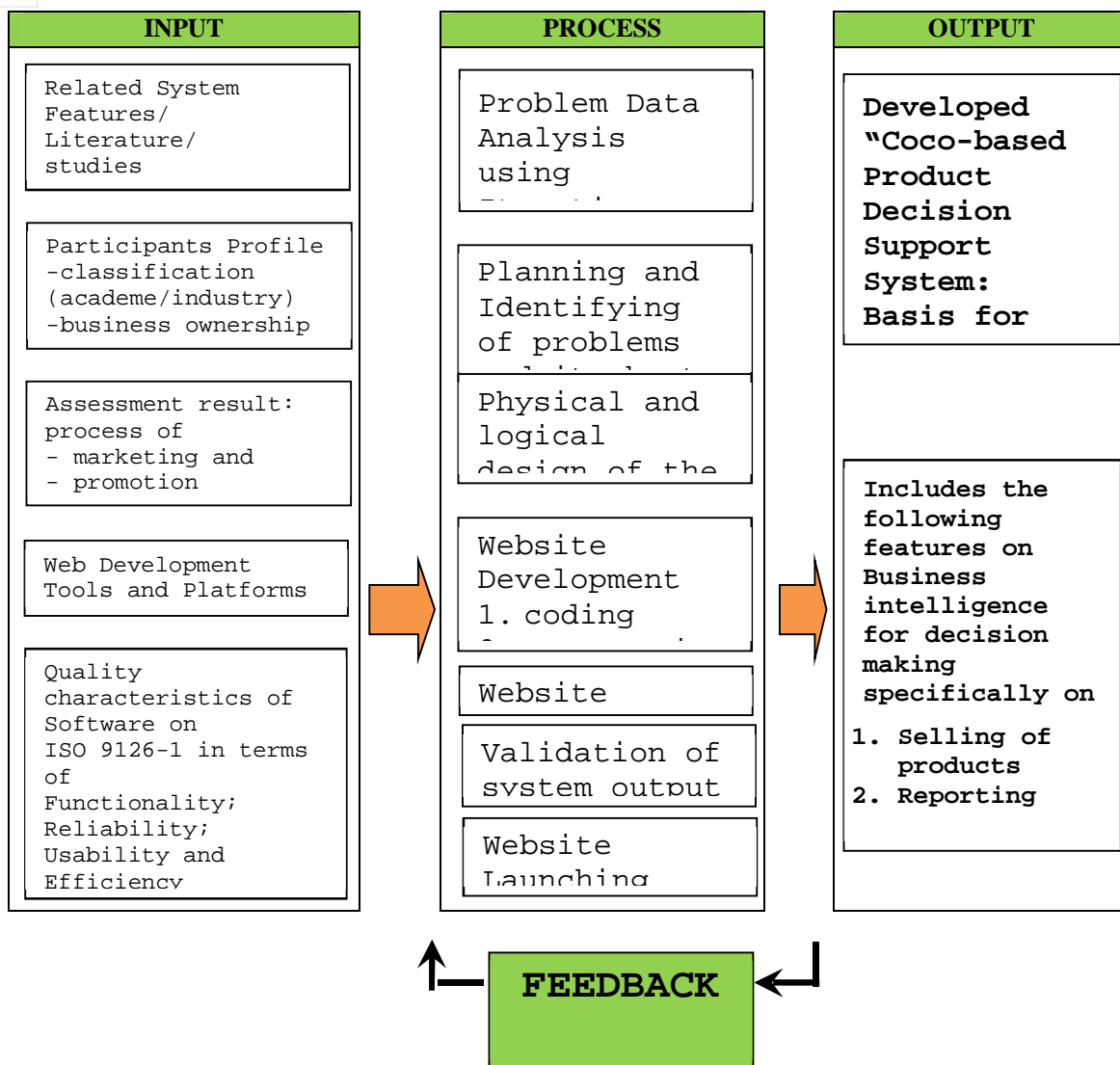
INPUT	PROCESS	OUTPUT
Related System Features/ Literature/ studies	Problem Data Analysis using	Developed "Coco-based Product Decision Support System: Basis for
Participants Profile -classification (academe/industry) -business ownership	Planning and Identifying of problems	
Assessment result: process of - marketing and - promotion	Physical and logical design of the	
Web Development Tools and Platforms	Website Development 1. coding	Includes the following features on Business intelligence for decision making specifically on
Quality characteristics of Software on ISO 9126-1 in terms of Functionality; Reliability; Usability and Efficiency	Website	1. Selling of products 2. Reporting
	Validation of system output	
	Website Launching	

FEEDBACK

Figure 3. Paradigm of the Study

The concept used for the development part of the study is based from the research paradigm (Figure 3) and its components which are presented as follows

1) *The Input:* It includes the following: 1) Ideas from those mentioned related literature/studies; 2) Participants profile in terms of classification of business and forms of business ownership; 3) Assessment result on existing process of marketing and promotion; 4) Website development tools and platforms and 5) Quality characteristics of Software ISO-9126 on Functionality, Reliability, Usability and Efficiency.

2) *The Process:* Process, in this study, is presented with regards to 1) Data Analysis; 2) Physical and logical design of the system; 3) Development of ICT-based marketing system; 4) Website development; 5) Testing; and 6) System's output validation and Website Launching.

3) *The Output:* Output of this study is the Developed Coco-based Product Decision Support System: Basis for marketing and Promotions with some business intelligent features.

C. Statement of the Problem

This study titled "Coco-based Product Decision Support System: Basis for Marketing and Promotions" aimed to develop a system tool that complies with the International Standardization Organization (ISO 9126) in terms of functionality, reliability, usability and efficiency.

Specifically, it sought answers to the following:

1) What is the profile of the user participants with respect to:
    1.1   classification of business; and
    1.2   form of business ownership?
2) What is the assessment of the participants on the existing marketing and promotion processes with respect to:

    2.1   customers' awareness;
    2.2   coco-based products purchases;
    2.3   priority to buy; and
    2.4   customers' level of satisfaction?
3) What system can be developed to address the difficulties and problems of the existing manual system?
4) To what extent does the developed Coco-Based Product Decision Support System comply with the standard set by the International Organization for Standardization in terms of:
    4.1   functionality;
    4.2   reliability;
    4.3   usability; and
    4.4   efficiency?
5) Is there a significant difference in the assessment of the participants with respect to the extent to which the Coco-Based Product Decision Support System comply with the standards of the International Organization for Standardization?

II.   METHODOLOGY

This chapter presents the research design, research participants of the study, the data gathering tools, the data gathering procedures and the statistical treatment used in analyzing and interpreting the gathered data.

A. Research Design

The research design applied in the study is the descriptive mixed method, since it describes the nature of the situation as to what is actually happening at the time of the study. Gathering of data is required to exactly described events and then organizes, tabulates, depicts, and describes the data into pattern needed in the decision process (Myers 2012).

The Research and Development (R&D) Method by Penuel et. al. (2011) and Burkhardt et. al. (2003) was also employed as a guide for the activities conducted in the research particularly with the development of the software.

With the end product being a software system for actual production use, the sequential nature of R&D is particularly suitable for the application of basic research, applied research and project development.

B. Participants of the Study

In this section, participants of this study were the following:
1) Clients were participants from the twenty-five (25) barangays of the coastal municipalities of Cagayan province (e.g Sanchez Mira, Pamplona, Claveria, Sta.Praxedes) and Sta.Marcela of Apayao province. The participants were randomly selected.
2) IGP implementers were CSU employees and part-time Income Generating Project workers from the twenty-five (25) barangays that were involved in the study.
3) IT Experts consisted of six (6) Deans, five (5) Information Technology instructors with D.I.T and Ph.D. units of the College of Information Technology of Cagayan State University System and two (2) Information Technology experts from the Philippine Coconut Authority and Agri-based Farmers cooperative.

Table 2 shows the frequency and percentage distribution of the participants' profile, the one with the highest number of respondents comes from the coco-based product clients with 52 respondents or 57.78% followed by the University IGP implementers with 25 participants or 27.78% and IT experts with 13 respondents or 14.44%.

Table 2. Frequency and Percentage Distribution of the participants' Profile

Participants	Frequency	Percentage
Clients	52	57.78
IGP Implementers	25	27.78
IT Experts	13	14.44
Total	90	100.00

C. Research Instruments

The researcher made use of questionnaires designed to obtain data on a topic of interest from research subjects. It provides information such as the purpose of the instrument, the population, and the variables measured.

The researcher prepared a questionnaire in gathering data most pertinent to the study. It was accompanied by a letter to explain the objectives of the study and consists of three (3) parts.

Part I: Covers the profile of the participants. This part of the questionnaire included the following variables:

For the participants:

1) They are described by the following:

a)   Clients;

b)   IGP Implementers; and

c)   IT Experts.

2) Classification of Business is represented by the following:

a)   Industry - refers to machinery, manufacturing plants, materials, and other goods or component parts for use or consumption by other industries or firms where a participant is presently working; and

b)   Academe - refers to place in which instruction is given to students.

3) Forms of Business ownership can be;

a)   sole proprietorship - refers to business owned and run by one individual with no distinction between the business and the owner;

b)   partnership - refers to business owned and operated by several individuals; and

c)   corporation - refers to business or organization formed by a group of people, and it has rights and liabilities separate from those of the individuals involved.

Part II: Assessing the extent to which the Coco-Based Products Decision Support System of CSU comply with ISO 9126-1 include the following domains;

i)   Functionality;

ii)   Reliability;

iii)   Usability; and

iv)   Efficiency.

To know the participants' (e.g user participants, IT experts) responses on the assessment on the extent to which the coco-based products decision support system of CSU comply with ISO 9126 standards in terms of Functionality, Reliability, Usability, and Efficiency, a Likert-range conversion was used as presented in Table 3.

Table 3.   Likert-Range Conversion Table for the Assessment on the extent how the Coco-Based Product Decision Support System: Basis for Marketing and Promotions of CSU comply to ISO 9126.

Likert-Point	Range	Descriptive Interpretation
5	4.20 - 5.00	Very Great Extent/Accepted Unconditionally
4	3.40 – 4.19	Great Extent/Accepted with minor condition
3	2.60 – 3.39	Moderate Extent
2	1.80 – 2.59	Low Extent/Accepted with major condition
1	1.00 – 1.79	Very Low Extent/Reject

D. Data Collection Procedure

In this section, the researcher moved to source out documents and baseline data which are important both in the assessment of the present coco-based product marketing and promotion processes and to the proposed system development as well.

The following steps were done to pursue this research:

1) The researcher sought permission from the participants by means of the prepared certificate of consent asking their voluntary participation in the conduct of the study;
2) The researcher personally administered the research instruments (e.g. interview and floating of questionnaires) to the participants of this study;
3) The questionnaires were retrieved from the participants; and

The data was electronically tallied and analyzed using Statistical Package for the Social Science (SPSS), data analysis software or excel application.

E. Data Analysis

The data collected were tabulated, analyzed, interpreted and summarized using both descriptive and inferential statistics. Descriptive statistics, like frequency counts, percentage, mean and standard deviation were used to test the significant difference on the extent of the developed coco-based products decision support system for Cagayan State University – Income generating projects.

III. RESULTS AND DISCUSSION

This chapter presents the results and discussions of findings on the present process of coco-based product marketing and promotions of the Cagayan State University Income Generating Project. Likewise, the acceptability of all stakeholders (e.g customers, IGP implementers and experts) on how the developed Coco-Based Product Decision Support System comply with the standard set by the International Organization for Standardization in terms of Functionality, Reliability, Usability and Efficiency.

A. Profile of the Participants

In this section the profile of the respondents in terms of their present business association and ownership are described.

Table 4   Classification of Business distribution of the user participants

Classification of Business	Frequency	Percentage
Academe	20	22.20
Industry	65	72.30
Others	5	5.50
Total	90	100.00

Table 4 shows that most of the participants have industry related work and observed with 65 persons or 72.30 percent, academe is 20 or 22.20 percent and the remaining 5 percent have no association with either academe or industry.

Table 5.   Business Ownership distribution of the user participants

Form of Business Ownership	Frequency	Percentage
Sole proprietorship	21	23.33
Partnership	21	23.33
Corporation	11	12.22
Others	37	41.12
Total	90	100.00

Table 5 shows that others, as respondents with no association to any form of business ownership and do not operate any business, has a frequency of 37 or 41.11 percent, sole proprietorship and partnership are equally observed to 21 or 23.33 percent, corporation is 11 or 12.22 percent. Likewise, Table 7 records on others have the probability that a portion of the presented number may be possible to be the initial online customer or user   and likewise coco-based product online customers.

B.   Assessment of the participants on the on-going marketing and promotion processes

In this section, assessment of the present processes on coco-based product marketing and promotions in terms of their awareness, coco-based products purchases, customers list of products priority to buy and their level of satisfaction as coco-based products users are described.

Table 6.   Customers' awareness on coco-based products Food and Non-Food category

Category	Coco-based Products	Frequency	Percentage
Non Food	GeoTexttile/Net	14	56.00
	Biolog	10	40.00
	Peat Dust	13	52.00
	Peat Brick	11	44.00
	Rope	13	52.00
	Lamp Shade	16	64.00
	Coconut Chips	23	92.00
	Coconut Chandelier	20	80.00
	Coconut Seedling	18	72.00
Food	Coconut Vinegar	21	84.00
	Pickled Nata de Coco	13	52.00
	Nata de Coco	23	92.00
	Bukayo (Sweet Candy)	23	92.00
	Virgin Coconut Oil	17	68.00

On customers' awareness, Table 6 shows that under coco-based products non-food category, seven (7) or 77.77% of the nine products presented are in the range of 52.00% - 92.00% customers' awareness while two (2) of the nine (9) products presented are under 50.00% customers' awareness. Likewise, Table 6 shows that coco-based products offered under food category exceeded the 50.00% level of customers' awareness.

The records on customer's awareness to both categories of coco-based products imply that the manual process of coco-based product marketing and promotions is performing. The developed ICT-based system may help CSU-IGP on marketing and promotions of coco-based products especially in reaching out to more people because nowadays online users increase rapidly (Chalise, 2013).

Table 7.   Customers' purchases on Coco-based product

Category	Frequency	Percentage
Less than a week ago	13	52
Less than a year ago	12	48
Total	25	100

On customers' record of their recent purchase of coco-based product, Table 7 shows that 13 or 52.00% bought any of the coco-based products "less than a week ago" while 12 or 48.00% of the interviewed participants bought any of the coco-based products "less than a year ago".

This implies that due to customers' awareness of the products presented in Table 7, this is one of the factors why customers include coco-based products in their list of need to purchase products.

Table 8.   Coco-based product position on customers list of priority to buy

Category	Frequency	Percentage
First	2	8.00
Second	17	68.00
Third	6	24.00
Total	25	100.00

On Customers' record of list of priority to buy as assessed by the interviewed participants, Table 8 shows that most customers put coco-based products second in their list of coco-based products priority to buy with 17 or 68.00%, 2 or 8.00% answered "First" and 6 or 24.00% answered "Third". This implies that coco-based products have the potential to be tried by more people should coco-based product marketing and promotion be facilitated by the developed system.

Table 9. Coco-based products users' satisfaction

Response	Frequency	Percentage
Yes	19	76.00
No	0	0.00
Not always	6	24.00
Total	25	100.00

On customers' record of user's satisfaction as assessed by the interviewed participants, Table 9 shows that most customers are satisfied with 19 or 76.00% answered "Yes" and 6 or 24.00% answered "No". This implies that satisfied users may become regular consumers of any of the coco-based products.

C.   Developed system to address the difficulties and problems of the existing manual system

In this section, the phases of the developed coco-based product decision support system that were applied and adopted during the period of system development including system cost and benefit analysis are described.

Since the researcher had to develop customized system for the University, the need to understand the present processes on coco-based products marketing and promotion is important. In conformity to what Hallar (2017) has in his study, the purpose of immersion is necessary. The researcher underwent immersion in the University Income Generating Project office. This activity gave the researcher a chance to gather substantial data and get deeper insight on the internal and external factors that cause the present problems as encountered by the office of the University Income Generating Project on coco-based products marketing and promotion. Figure 4 describes most of the problems encountered in the operation of the present coco-based products marketing and promotion of Cagayan State University Income Generating Project.
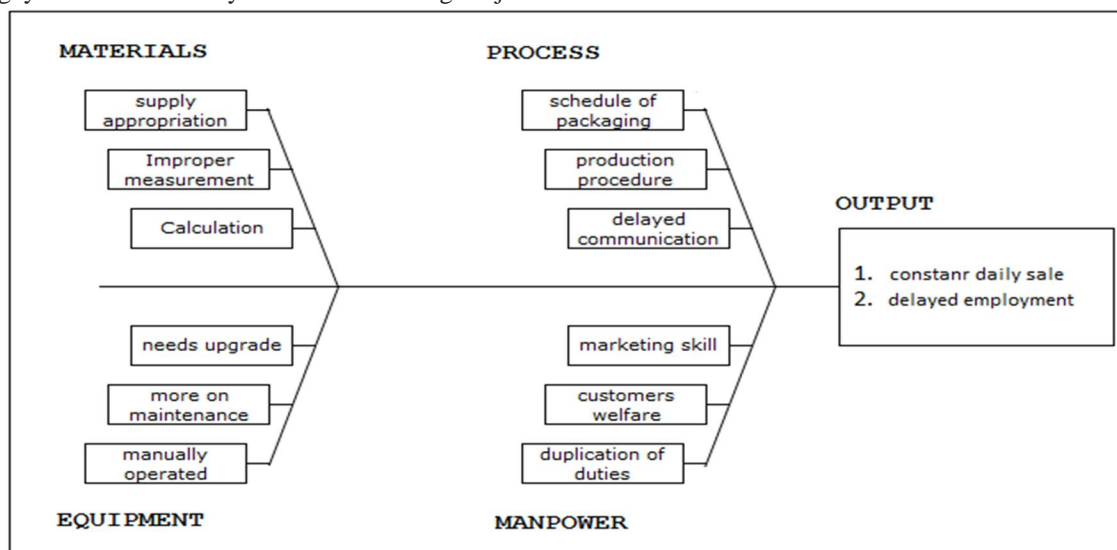
Figure 4: Cause and Effect Diagram (Ishikawa. K., Lu. D. J. trans 1985)

Generally, this fishbone diagram is used to present causality and it has two causes, primary and secondary. The first one is the primary cause which could directly lead to the effect while the secondary cause is the one that could lead to a primary cause which directly does not have an end effect.

As mentioned above, the causes are grouped into key categories so as to be able to recognize sources and causes for any variations. Those categories included the following:

Materials refer to the components needed in the production of coco-based products. It has something to do with appropriation, measurement and calculation of the required raw product components.

Process refers to the manual activity being implemented in the system. It includes schedule of packaging, production procedure and communications.

Equipment is the mechanism being used to facilitate some system routine. It should be operated, maintained and needs upgrade to ensure smooth operation of the system.

Manpower or human resources are the people of a workforce in an organization. They manage and oversee the implementation of all system routines. It also represents the total number of people working together to get something done. It includes workers' duties, skill and employee welfares.

Output, in economics, is the "quantity of goods or services produced in a given time period, by a firm, industry, or country", whether consumed or used for further production. It includes daily sales and affects people employment.

1) *Development Process:* The adopted process of development for the University coco-based products decision support system includes five different phases (see Figure 5).
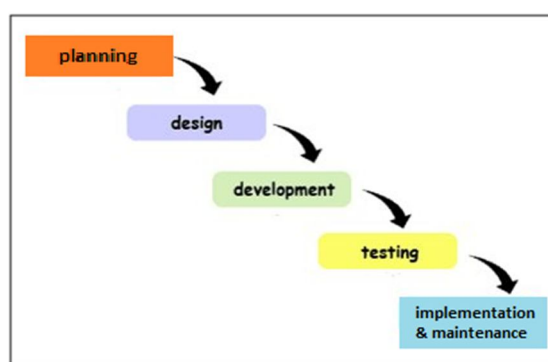
Figure 5: System Development phases

2) *Project Description:* The study aimed to provide Cagayan State University Income Generating project a web-based, user-friendly and standard compliant decision support system. The system is planned to equip with functions and features to help the University Income Generating project facilitate the present process on coco-based product marketing and promotion.

3) *System Objectives:* The system aimed to accomplish the following:

a) Automate the existing manual process of coco-based product marketing and promotions of the University with an IT-based system.

b) Provide a feature on selling of coco-based product online.

c) Keep customer records upon registration for reporting and future customer reference on new coco-based product promotion.

d) Provide on time sales report through generated charts or line graphs by period.

4) *System Scope and Limitation*

Summary of Capabilities

a) Automated processing

i) The system helps facilitate the process of marketing and promotion of all coco-based products by providing to customers or would-be users of the online system, the needed product data for decision-making.

b) Internet / Web based

i) The system takes advantage of the capabilities of online technologies to reach out to would-be customers situated in other places where internet connection is available.

c) Real-time customized sales chart generated by period for decision making purposes

i)   Collected sales data from registered customers are processed by the system for safe-keeping and future sales report generation.
d)   Expandability
i)   The system could be adopted by other University campuses to facilitate activities of their other IGP-activities.
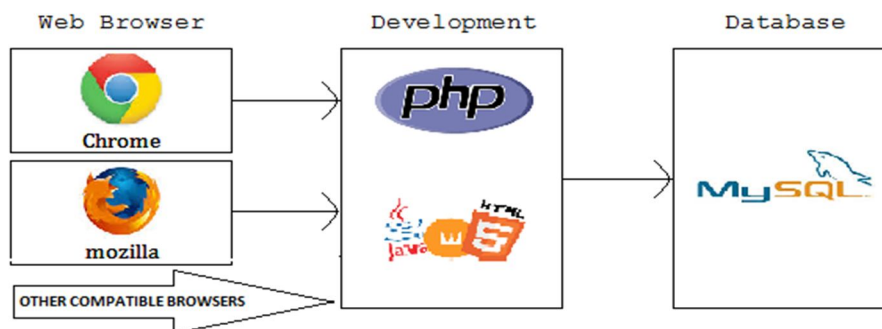   Architectural Design
   Development Architecture

Figure6: Development Architecture Design of the System

On systems architectural design, Figure 6 presents information technology supporting application and programming languages needed in the development of the system. Initially, Google Chrome or Mozilla are the browsers needed where the system runs. PHP, Java, and CSS are important for the logical and interface design in the entire process of system development. MySQL was used for the database, data keeping feature of the system as well as during the database data manipulation and processing.

In addition, Internet Service Provider connection is required to finally make the system work for its purpose. Systems gathered data from a registered online user are directly kept into a centralized server managed by an authorized system administrator assigned by the University. Coco-based products information are all kept in a separate table of the server and can also be rendered to whoever system user, upon their request for viewing.

D. Tangible Benefits

The benefits from the developed coco-based products decision support system compensate the cost during system development and on its implementation.

Increased sales on coco-based products may be observed through the running online decision support system. This may be followed by a higher demand and increased volume of coco-based product production portraying manual practices on chart preparation and reporting of either important events or record of unexpected change and chart presentation by period. The purpose of the feature is to support better business decision making and the system execution of this feature is on data-driven basis (see Figure 19, Figure 20, Figure 21, Figure 22, and Figure 23).

E. Intangible Benefits

The intangible benefits are the advantages that the system may offer to the IGP-implementers, the customer-users, and to the coconut community. Usually, these benefits are expressed through users' satisfaction and appreciation by the coconut community as supplier of the needed coco-based materials. Table 10 shows the intangible benefits of the developed system.

Table 10.   Intangible benefits of the developed system

Beneficiary		Advantages
1. CSU-IGP		Easier dissemination of product information.
	ii)	Better decision making
	ii)	Increase customers
	iv)	Wider market access
2. Coconut Community	v)	Increased income
	vi)	Better way of living
3. Customer	ii)	Faster transaction when buying
	ii)	No physical appearance needed
	ix)	Easier to monitor product updates

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F. System Business Intelligence Features

Marakas, G. (2007) in his study titled "Decision Support System: In the 21st Century", explained that developed systems for decision supports helps managerial decisions and thorough understanding of the data on hand. Baseline information (e.g results of cognitive processes and decision-making perspective) are issues that require managerial intervention and applications to advance accurate results and facilitate quick solutions on those issues. His study included examination of data warehouses, intelligent software agents and DSS system development, as well as an introduction to decision support systems, decision in the organization, modeling decision processes, group decision support and groupware technologies, executive information systems, expert systems and artificial intelligence, knowledge engineering and acquisition, and data mining and data visualization.

The developed Coco-Based Product Decision Support System: Basis for Marketing and Promotions can provide graphs, charts and reports and they are visually presented similar to the succeeding figures. These are ICT-based system processed outputs presented based from the stored data collected from previous system users as customers of the University coco-based products.
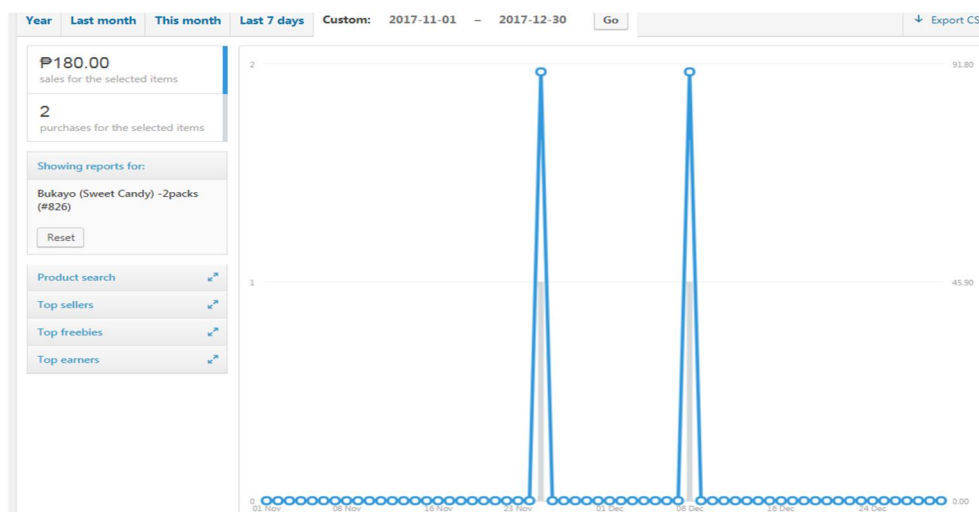
Figure 7.   Chart on Sales by Product
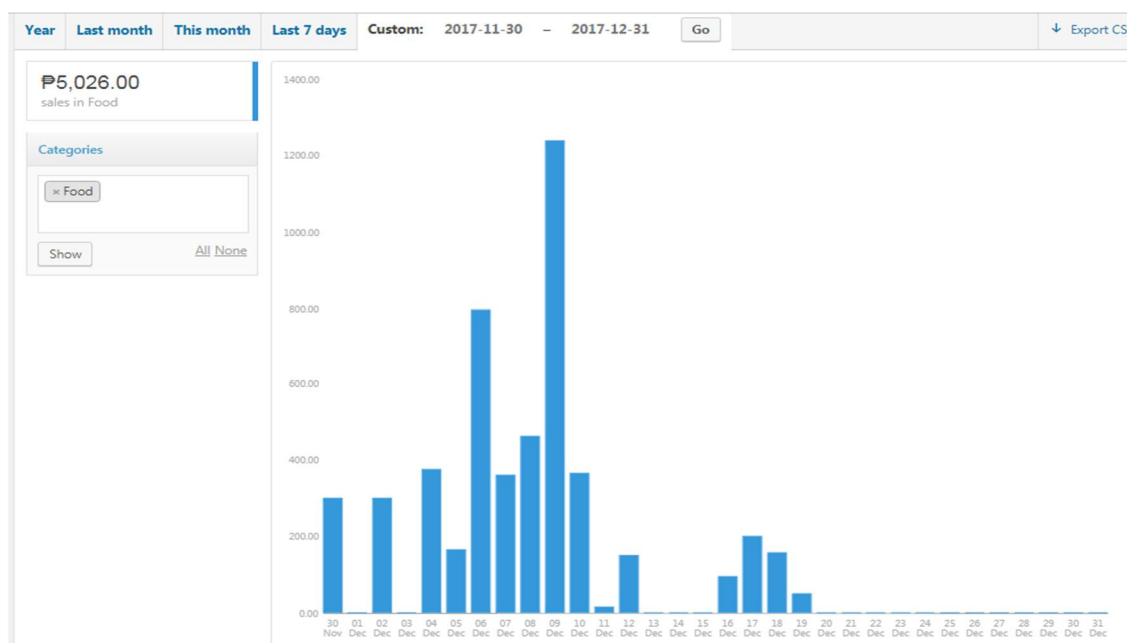
Figure 8.   Chart on Sales by Category (Food)
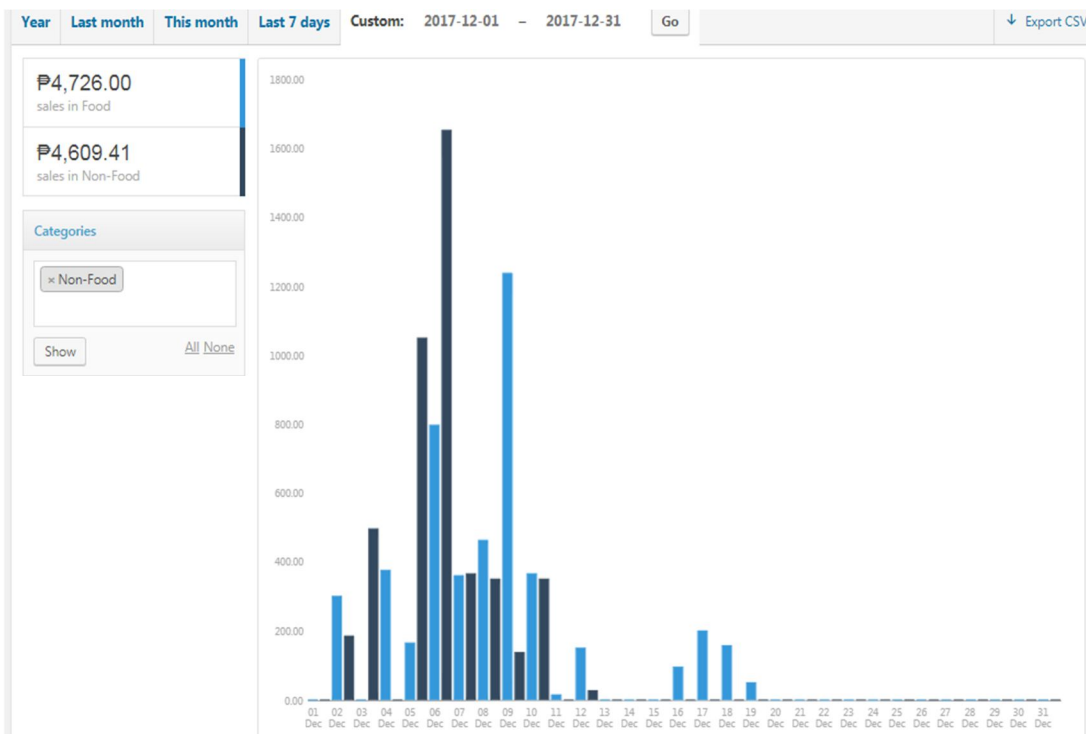
Figure 9.   Chart on Sales by Category (Food and Non Food)

Figure 10.   Report on CSU-IGP Products

Figure 11.   Report on Customers' ordered Products

G.   Compliance of the developed Coco-Based Product Decision Support System with the standard set by the International Organization for Standardization (ISO-9126)

In this section, results of the evaluation for the developed system assessed by the participants with regard to its compliance to ISO-9126 standards and systems degree of validity are described.

1)   Extent of compliance of the developed coco-based products Decision Support System with the quality standard characteristics of software as defined by ISO/IEC 9126-1

Table 14 shows result of validation performed by the users (i.e customers, IGP implementers) who evaluated the

Table 14.   Extent of compliance of the developed coco-based products decision support system with the quality standard characteristics of software as defined by ISO/IEC 9126-1

Category	Sub-Attributes	Mean	Category Mean	Description
Functionality	Suitability	4.28	4.31	Very Great Extent
	Accuracy	4.34		
	Interoperability	4.25		
	Security Access	4.37		
Reliability	Maturity	4.21	4.27	Very Great Extent
	Fault Tolerance	4.38		
	Recoverability	4.21		
Usability	Understandability	4.46	4.45	Very Great Extent
	Learnability	4.42		
	Operability	4.46		
Efficiency	Time Behavior	4.33	4.41	Very Great Extent
	Resource Behavior	4.48		
OVERALL MEAN			4.36	Very Great Extent

overall performance of the developed Decision Support System.

On System's extent of compliance to ISO standards, Table 14 shows an overall weighted mean of 4.36 or "very great extent". This implies that the existing system is compliant to the software quality characteristics of (1) Functionality with attributes on suitability, accuracy, interoperability and security access; (2) Reliability with attributes on maturity, fault tolerance and recoverability; (3)

Usability with attributes on understandability, learnability and operability; and (4) Efficiency with attributes on time behavior and resource behavior.

2) Degree of validity of the developed Coco-based Product Decision Support System as evaluated by information Technology experts

Table 15 shows result of validation performed by the information technology experts who evaluated the overall performance of the developed Decision Support System.

Table 15. Degree of validity of the developed Coco-based Product Decision Support System as evaluated by information Technology experts

Performance Criteria		Mean	Interpretation
1.	Executes and processes at a normal speed.	4.44	Accepted Unconditionally
2.	There is little or no delay encountered in accessing the website's functions.	4.29	Accepted Unconditionally
3.	The website is demonstrably effective with the intended audience, including people of varying abilities and experiences.	4.46	Accepted Unconditionally
4.	Information generated by the system can be easily be read and understood.	4.58	Accepted Unconditionally
5.	The functions of the on-screen buttons/controls and navigation icons are easily identified.	4.48	Accepted Unconditionally
6.	The system is free from distracting images and text.	4.44	Accepted Unconditionally
7.	The system uses standard equipment that is reliable, widely available, and applicable to a variety of uses.	4.46	Accepted Unconditionally
8.	The website is visually attractive and interesting. It motivates users to continue using the program.	4.52	Accepted Unconditionally
9.	The organization of the system is clear, logical, and effective, making it easy for the intended audience to understand.	4.46	Accepted Unconditionally
10.	The buttons, icons and dropdown menu are responsive.	4.38	Accepted Unconditionally
11.	The visual aspects of the website webpages are consistent across different platforms or computer systems.	4.56	Accepted Unconditionally
12.	Text, images and the colors of the user interface is appropriate and relevant.	4.52	Accepted Unconditionally
13.	Complete functionality is provided which enables the quick and accurate access to information.	4.42	Accepted Unconditionally
14.	The language in the website and in the user's guide is clear and easily understood to the intended audience.	4.48	Accepted Unconditionally
15.	Printouts are clear, well-organized and dated.	4.40	Accepted Unconditionally
16.	The purpose of the system is well-defined and clearly explained to the user.	4.58	Accepted Unconditionally
17.	The website acknowledges input, feedback on user responses is employed effectively.	4.44	Accepted Unconditionally
18.	The system is reliable and error-free in normal use.	4.63	Accepted Unconditionally
19.	The user can operate the software independently, creating his or her own sequence of presentation and review.	4.60	Accepted Unconditionally
20.	The software achieves its purpose.	4.67	Accepted Unconditionally
	TOTAL	4.49	Accepted Unconditionally

Based on the total weighted mean of 4.49 as shown in Table 15, with a value of 4.49, the validity of the developed decision support system as evaluated by the information technology experts was interpreted as "Accepted Unconditionally".

H. Test for Significant difference in the assessment of the participants with respect to the extent to which the Coco-Based Product Decision Support System: Basis for Marketing and Promotions comply with the International Organization for Standardization.

In this section, test for significant difference of among the standard characteristics of the developed system as assessed by the participants is presented, interpreted and analyzed.

Table 16.   Test for Significant difference in the assessment of the participants on the compliance of the developed decision support system

Standard Characteristics	Participants	Mean	Category Mean	Computed T-test	P-value	Remarks
Functionality	User	4.31	4.38	776.28	0.001	Significant
	IT Expert	4.45				
Reliability	User	4.27	4.36	345	0.001	Significant
	IT Expert	4.45				
Usability	User	4.45	4.46	737	0.001	Significant
	IT Expert	4.48				
Efficiency	User	4.41	4.49	324	0.001	Significant
	IT Expert	4.58				

On the system's test of significance as assessed by the participants (e.g user participants, IT experts) with regards to its compliance to the International Organization for Standardization. Table 16 shows result of Chi-Square test p-value for the system characteristics such as: functionality (776.28), reliability (345), usability (737), and efficiency (737). These p-values are more than 9.488 for an alpha level of 0.05, which means that there is significant difference on the extent to which the system complies with the International Standardization Organization (ISO-9126). The developed system business intelligence feature is useful in generating data graphs, charts, and facilitates the preparation of timely reports primarily needed as basis for a better business decision making.

IV.   CONCLUSIONS

Based on the findings, the following conclusions are drawn:

The Coco-based Product Decision Support System: Basis for Marketing and Promotions was found to be ISO-9126 compliant rated both by users (i.e customers, IGP Implementers) and Information Technology experts.

The system business intelligence features were found to be useful through system generated graphs, charts report and can be used to facilitate the preparation of the needed University IGP business reports. Therefore, the system generated output can be used as guide for any decision making needs by the CSU-SM IGP to better the process of coco-based product marketing and promotions.

The system with its characteristics was customized to provide the needs of the would-be users' and IGP- implementers as well.

V.   RECOMMENDATIONS

Based on the findings and conclusions reached, the researcher hereby recommends the following

A. That the developed coco-based product decision support system be presented for approval and deployment by the Cagayan State University – Income Generating Project to help in the process of marketing and promotion of coco-based products.

B. Cagayan State University – Income Generating project staff assigned to be the system administrator may be instructed and trained for proper system management and customer's database upkeep.

C. Further research may be conducted to include other features into the system so that it can be used by other campuses in their other income generating projects.

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