E-Procurement Management System Using Search Result Ranking Algorithm

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Abstract:- Procurement processes in the Philippines include sales and purchase activities within two entities, comprising various aspects of searching, sourcing, discussion, requiring, and receipts, in post-purchase reproduction which results to a slow process, repetitive work, expensive and financially consuming. Sometimes it is tough to find a supplier because only a few of them have a website which is challenging to get low prices and rates. Hence, the E-procurement systems were made to address the solution. E-procurement has a ranking method that helps facilitate the customer's search on the products or suppliers. Present search ranking session is a common problem in making a consumer decision that takes a multi-step decision on clicking on products or supplier on the website. Thus, this study aimed to develop an e-procurement management system a centralized platform for business-to-business (B2B) and business to customer (B2C) that connects all suppliers and buyers across the entire archipelago in the Philippines where customer can avail good pricing and rate with the same quality of products. It also provides an alternative method in the procedure of a ranking system by applying the search results ranking algorithm that customer can rate suppliers by stars (0-5) according to their experience. The number of stars affects the order of search results (best supplier first). The reviews and scores are visible to users browsing the site. An average of user ratings for the supplier is calculated and displayed. Finally, to attest the general performance of the system researcher used the SUS evaluation tool with the result of the perception of the usability of the application is a 91.28 of Usability Percentile.

Categories and Subject Descriptors
K.6.1 Project and People Management: System Development
http://www.acm.org/class/1998/

General Terms:- The general terms are the following: algorithms, management, design, and human factors.

Keywords:- Information technology, E-Procurement, ranking system, search result ranking algorithm, Philippines.

I. INTRODUCTION

The impact of the internet in the business world is swift; in just a few years the web has become a way of communication and becoming a global sales tool, a platform for collaboration and critical nature of business strategy [2]. This has had an impact on the rapid growth of a country's economy and development, but in order to keep business competition, companies need to implement new technologies [3], which resulted in the use of E-Procurement, the electronic support of the professional acquiring process, which corresponds to the importance of a business to its suppliers [1]. E-procurement is one of the most critical business processes for many companies as it is small or large business [4] used in online shopping, payment fees, eBooks and e-mail. The companies that provide these services are Amazon, quikr, snapdeal, Flipkart, olacab and paytm. E-procurement is used because it uses transaction cost reductions and improves the level of customer services. It also has the universal accessibility of the market. Various categories of e-procurement are business-to-business, business-to-customer, customer-to-customer or customer-to-business.

Project Context
According to the study conducted by claritum, the traditional procurement process is characterized by being a slow and prolonged process, such as conventional processes with many small, repetitive tasks, managing processes invoicing. Invoices and bills are expensive because of the high value of the writing work [5]. Moreover, according to Samuel Greengard the author of "Route to Better Procurement", that traditional procurement can be costly because of having many ledgers associated with many suppliers [6]. Even in the Philippines, procurement process has a long process which involves sales and purchase activities between two entities, covering many aspects of search, sourcing, negotiation, ordering, and receipts, in post-purchase reproduction which resulted with a slow process, repetitive work, expensive and financially consuming. Also, most often happen is customer having difficulty finding a supplier especially if it is not in their area.

If they go online they are still having difficulty because only few suppliers have their website. This is why e-procurement has grown like Amazon and Taobao. However, E-procurement is not enough without a ranking system that helps to facilitate a customer's search on the product, an example of which is Alibaba Taobao, where a ranking system uses their products and Supplier who provide a valuable retail outlet to customer choice by clicking on the product they will buy. Still, the current ranking system has not been designed and is not sufficient to address the problem with the needs of customers resulting in only an additional communication cost [7].

In this paper, the researcher aimed to design and develop the Centralized Business-to-Business (B2B) and Business to Customer (B2C) E-procurement platform that connects all suppliers and buyers across the entire archipelago in the Philippines that aim to serve customers seeking products or services in a single centralized procurement platform. The system is passionate about helping businesses improve and expand their product or service to create more transactions to their website and increase more sales. It also provides promotions that bring exposure of customer's goods to exposure through the most significant Social Networking Services such as, Twitter, LinkedIn, and Facebook, indeed strengthening the Business Company exposure, as well as high target audience. One of the most critical website services is the system technological advantages which apply the search results ranking algorithm which precise deduces the supplier and brand; user prefers and gives them popularity in search results, without the burden of unnecessary manual interaction. With filtering methods, it supports search result rankings of the best suppliers and products by brands to provide a better demand of customers. The purpose of this system is to resolve a personalized brand-ranking problem. By using the ranking system, customers will not have the difficulty finding a product they want to buy; additionally, all the products branded or not are given an equal opportunity to market and achieve more sales.

The system enables users to search for the most appropriate products, suppliers or information through the function of search results ranking. The types of search results ranking that will support searching results ranking in terms of categories, suppliers, and products by brand. The algorithms of these types of ranking methods are generally similar – All of them are comprehensively sorted and only differ in minor areas. The algorithms are users- oriented, and they favor products or supplier that buyers need, because buyers mostly use the searching functions. Suppliers' information that matches buyers' needs or interests is promoted and would facilitate suppliers to have their products effectively displayed. When the users search or browse for items, they get a list of results. They can refine the results based on options they choose or customize the results to choose how items will appear in user results.

Purpose and Description

The primary use of this system is to design and develop a Purchasing Hub in the Philippines: An E-procurement management system with a goal to serve a Business to Business (B2B) and Business to Customer (B2C) to provide marketing and negotiating solutions that are able to connect anyone as buyers and business as a supplier. This study also puts forward proposals as of how the customers perform direct purchases to ensure that both the public and private sector even individuals benefit from this system to achieve full value. It will increase and enhance the services given to the customers here in the Philippines. Customers can find easily the desired vendor who offers Goods and Services. Besides, they can avail good pricing through the power of Purchasing Hub to select on which company has provided reasonable pricing and rates. Also, it aims to help local suppliers in the Philippines on equal opportunity to grow and to achieve more sales. It allows connecting buyers and supplier in one centralized procurement platform with the application of the users-oriented search result ranking algorithm that solves the personalized supplier and products over the brand ranking problem to avoid biases on suppliers and products.

Objectives

The proponent sets the following goals to come up with a working system,

General

To design and develop a web application for Purchasing Hub in the Philippines: an E-Procurement management system a centralized Procurement platform to provide an online marketplace which allows its users to offer, sell, buy, and tender products and connect anyone as buyer and business as a supplier.

Specific

In order to attain the general objectives, the study aimed to develop a website application to:

1. Perform the search result ranking algorithm to rank the best suppliers, based on its reviews from customer according to their experience.
2. Provide marketing and trading solutions for companies that offer products and services that gives lower pricing and rates for goods and services using the bidding system.
3. Evaluate the applications' performance of the usability according to established assessment instrument using the System Usability Scale.

Scope and Limitations

Users Agreement

The Purchasing Hub in the Philippines provide website features and other goods and services to a user when they visit the site, register as users of purchasinghubph.com, use goods, and services, use PHub E-shop, use software produced by Purchasing hub in juncture with any of the Services mentioned above. The user agreement, system privacy policy, and all policies posted on the site that set forth the terms in which the Buying, Purchasing Hub offers users to access and use of the services. All procedures are included in customer agreements; users need to accept to abide by all of the above terms when obtaining or using PH Services.

About Purchasing hub and its services

Purchasing Hub in the Philippines is an online marketplace, which enables its users to submit, trade, purchase, and tender goods and services, that promote local suppliers inside the Philippines. The actual business for sale and purchase is directly between supplier and buyer.

The system may provide pricing, listing and other direction in Services, such instruction merely is informational, and a user may choose to follow it or not. The Purchasing hub in the Philippines has no control overall, and does not support the presence of the quality, safety or validity of the goods or services displayed on the system, and the authenticity or accuracy of the content or list of users; the understanding of supplier to trade products; the capacity of customers to pay for items; or a client or trader will provide a purchase or replace an item. Purchasing of hub services is only accessible to certified members or users of sites. A user who purchases or acquires any goods or service in purchasing hub referred as a "Customer," and a user who trades or renders any goods or service in purchasing hub also designated as a "Supplier.".

Using Purchasing Hub

By using purchsinghub.com and its Services, the user consents to the latter provisions. Purchasing Hub offers a broad variety of Services, and sometimes, additional sessions may utilize. If users use the services, they also subject to guidelines, provisions, and arrangements suitable to that Service.

In juncture with the procurement or use of the purchasing hub service the customers should not: Post or upload unsuitable content on sites; Revoke or bypass any laws, third party rights of systems; use PH Services if the user does not make right forced agreements, Post wrong, fallacious, misleading, ambiguous, annoying or harmful content; Shift the site accounts to another individual without consent; Deal or post spam, Spread viruses or any other technologies that may harm the site.

Also, it infringes the copyright, brand, advertising, right, database or other mental property rights that refer to or authorized to purchsinghubph.com. Acts that may create violation are reproducing, operating, promoting, sharing, cloning, decompiling, dismantling, or preparing acquired operations from content that belongs to purchsinghubph.com and its users;

Any purchsinghubph.com application, data, or software connected with such use, except with the prior license of purchsinghubph.com.

If purchasing hub noticed users are violating the site, the admins could make a proper action without notice or other assistance to limit, discontinue, or stop user account (s) to restrict users from using the services of the system. Purchasing hub may remove unconfirmed accounts or accounts that have been inactive for a long time or change or discontinue Services.

Geographic Focus

The whole operation or the coverage of the purchasing hub will be in the entire Philippines, and the headquarter is in Davao, City, Philippines.

Mode of Payments

The Purchasing Hub provides website payments in connection with the online transactions concluded on and over the sites. The payment method caters to the system will be PayPal including cash on delivery (COD) and credit cards.

Research Project Duration

The proposed system project will cover the whole 1st Semester for Capstone 1, and 2nd Semester for Capstone 2.

II.   REVIEW OF RELATED SYSTEMS

Overview

Electronic Procurement (EP) is usually related to as sourcing of goods or services electronically, generally over the Internet [10]. Electronic procurement systems sustained a continuous diffusion in the late 1990s [11], due to the improvements and adoption of information technology and the internet, the massive potential savings attainable via this tool. According to a study conducted by Haslinda, E-procurement enables companies to reduce business expenses, purchasing time, streamline purchasing process and to access a broader market. Procurement is the process of identifying and acquiring goods and services. These include buying sourcing and involving all activities from classifying potential suppliers by delivering from suppliers to users or recipients. The acquisition is an essential activity in the supply chain. The technologies are empowering e-procurement scale from commonly available communication tools, such as email, to multiple systems, such as e-marketplaces or Enterprise Resource Planning (ERP) system [12].

The ranking product is a process to rank various products. Firstly a single product is ranked then a grouping of products is performed, and the groups of a product are ranked. For example, let us consider product cell phones; they are grouped based on their companies like Samsung, Huawei, Apple, HTC and more. Then, they will be sub-grouped according to their model, and at each step, the ranking is performed [6]. The e-procurement ranking algorithms are the algorithms used for product recommendations and product listings alongside the input inquiry or the browsed goods on the given shopping gateway. The goods ranking thresholds require the number of computations by various factors for the calculation of the ranks of the assigned products. Numerous local and online elements grouped for the general evaluation of the product ranks based on the input keywords especially on the first stage product lookup on the shopping sites.

Alibaba.com [25].

The goal of this platform is to serve B2B, B2C and C2C marketplace. Alibaba websites meet the challenges of today on how the customers choose the best supplier on the site. According to its website, alibaba.com is unable to assure that they will give 100% competent to trade with suppliers on

their site. However, they do have some advice for clients on how to buy safer: first, deal with Gold Suppliers on Alibaba.com. The underlying company data of Gold Suppliers has been validated and authenticated by a third- party agency to recognize the reality of companies. In other words, gold suppliers are much more trustworthy than non-gold suppliers so if a customer does not want to get scammed; it is best to go with a gold supplier. One of the solutions of Alibaba on dealing with a legit supplier is to make the ranking system to rank their best supplier particularly on a search engine results on its website. Search Results Ranking is customer-oriented, and the algorithm sorts search results from the customer' perspective through different stages. Take search results ranking by-product as an example. The algorithm consists of three major phases: trick filtering, matching, and sorting. Hence, the systems are not supporting supplier and brand-brand level ranking that unable to solve personalized ranking problems.

Neha Verma [29].

The researcher has formulated an algorithm referred to as the "SNEC web page rating algorithm" which is the Semantic and neural based e-procurement page ranking algorithm. Their rating classification is using several terrific aspects to improve the client to choose the excellent product among different products. By this algorithm, the agencies can be comprehended about their weak point and grant the consumer with the improvised product. The consequences furnish many concrete results. But, the drawback of this algorithm is that it consists of a limited quantity of features.

Shinde and Girase [30].

Has adopted the PageRank algorithm, the most regularly used algorithm for ranking various pages is the Page Rank algorithm. GOOGLE is a choice search engine worldwide which uses PageRank depending on the web structure link to determine the importance of web pages. To order its search results, GOOGLE uses PageRank so that documents that look greater to move up in the results of a search respectively. The performance behind the PageRank algorithm is that a page with a vast number of links (a link from a critical page) to it, then its outgoing links to other pages also become primary. It gives more attention to backlinks of a web page and propagates the ranking over links.

Sessoms, Matthew, and Kemafor Anyanwu [31].

Authors apply model algorithms in allowing a Query Semantic Query on Web Queries. The queue query is combined with multiple questions that help get a mixture of semantic web resources. The challenge with subclass is called "skyline package queries." and this and Contrast with package queries of a separate model of relational, the RDF model defines the type of skyline package of ternary relations in varied operations. Various combinations of new operators for skyline queries relational query operator queries, and RDF's storage data models have developed four analysis strategies. The author lacks the use of further optimization methods such as prefetching as well as combining top-k methods.

Malhotra, Dhairya [32].

The backpropagation neural network was utilized for in-depth net mining to enhance and renew the internet web page rank. Due to the amplifying of internet data sources, the internet is creating at a quick rate. However, its large dimension raises the difficulties all through the research process in acquiring the required statistics from the internet. This trouble may additionally be overshadowed through the usage of a personalized web search. However, the consumer must current his / her facts to continue privacy. In the paper, the creator discusses all the issues as referred to above by using the usage of the backpropagation neural community for imposing a page ranking system.

Table 1. Comparison of Different Ranking System

KEY REFERENCES	PAPER TITLE / PLATFORM	TECHNIQUE USER	ADVANTAGES	DISADVANTAGES
[25]	Rules on Search Results Ranking on www.alibaba.c om	The authors have formulated the Search results ranking algorithm which ranks the supplier and products on the system	They have established the ranking of classes of products and supplier. They have explained the classification of categories of product and provider to support a good business surrounding and to produce beautiful services to suppliers.	Did not include the supplier and brand-level ranking to solve personalized branding problem
[29]	E-commerce Ranking on Using a Website in Semantic Web Mining and Neural Computing	There are authors design an algorithm named "SNEC ranking page the algorithm" which is The. semantic and neural based e-commerce page ranking algorithm.	When it matched to the Google page rank model, The results have shown a more significant rate of accuracy.	Include a limited number of features.

[30]	A Survey of different Web Page Ranking Algorithms	The authors have worked for the Web page Ranking algorithm	The experimental results are shown to be extremely accurate, and with a higher order of properties for the prediction model exists in a system	This paper lacks the basic idea and introduction of the web: just only Mining and its related techniques on a ranking system.
[31]	Enabling a Package Query Paradigm on the Semantic Web: Model and Algorithms	The authors have made the model algorithm for enabling a Package a criterion of the query Semantic Web.	They cleared the Duration of the skyline package. The package query is especially useful for situations where a user needs multiple things to meet some of the limitations.	The author has less of his use of further techniques for optimization such as prefetching as well as integrating top-k techniques.
[32]	Intelligent web mining in adjust the use of a Web Page Rank Back- Propagation neural network	In this study the author uses the back neural propagation Intelligent system web mining to upgrade web page rank.	Improve the handling of the deep web by using the personalized Web search. Such deep web data is available via various authentication measures through query interfaces.	The user has to give his personal information to manage privacy, and it is not broadly flexible for the Indian E- commerce portals because it relies on the web specific parameters.

III. TECHNICAL BACKGROUND

Development Tools

The Purchasing hub in the Philippines: an E-Procurement Management System will be built from different web technologies components. The components are the following: First is a Drupal Framework, A content management system (CMS) used to generate and execute digital content inscribed in PHP, With a customized design using different languages such as Html5 the popular programming language for specifying the elements and form of Web pages. These days all major browsers (Safari, Google Chrome, Mozilla, Opera, and IE) offer HTML5 support, which makes it the newest HTML technology used today. HTML 5 is the latest Hypertext Markup Language (HTML). It is easy to perform, and it works with CSS3 [18]. CSS3 is the language for describing the appearance of Web pages, including colors, design, and fonts. It supports one to adjust the performance to different types of devices, such as big screens, small screens, or printers [19]. Bootstrap is used to build templates for typography, models, buttons, charts, navigation, models and image carousels. It also gives backing for JavaScript plugins. Bootstrap's responsive CSS adjusts to phones, tablets, and desktops [20]. Also, JavaScript has been used on the web, its downsides, and how to use it responsibly. For the Web server, it will be utilizing Amazon Elastic Compute Cloud (Amazon EC2) is a web service that provides safe, resizable measure capacity in the cloud with SSL Certificates the minor data files that digitally drag a cryptographic key to an organization's information.

Once established on a web server, the next will be stimulated with the padlock and the https protocol(over port 443) and agrees to acquire connections from a web server to a browser. Regularly, SSL is utilized to guard credit card activities, data transferral, and logins, and more in current times is becoming the standard when acquiring browsing of social media sites.

Conceptual Framework

The study utilized the Input-Process-Output Model also known as IPO model. As a functional model and conceptual schema of this study for implementation, an IPO chart classifies a program's input, outputs, and the processing steps required to transform interrelated variables.
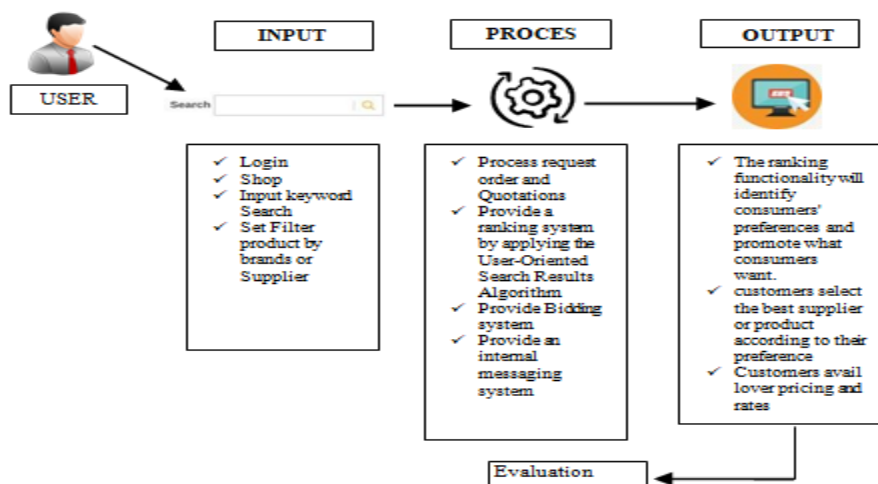

Figure 1. The framework of purchasing hub

Figure 1 illustrates that the user is required to log in, shop using the Existing And Traditional Ranking Systems

Take search results ranking as example results of different ranking systems given the query paints. Red lines highlight important brand-related information.

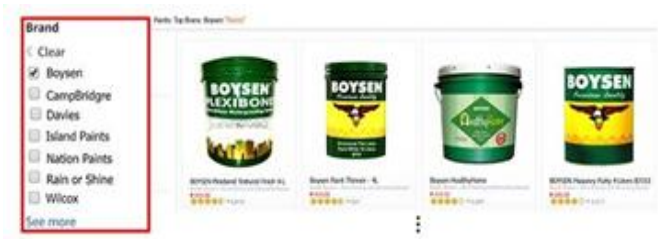*Figure 2 Results of Unfiltered search results for the query "paints" with existing ranking systems*

Figure 3 Search results for the query "paints" using traditional ranking systems after clicking the "Boysen" checkbox

As shown in Figure 2, the ranking results from most current recommender systems mixed the items of different brands. It is not easy to enjoy users with a strong desire for some brands because they will only waste time browsing large quantities of products from other brands. There are some specialized tips to improve with this issue: Figure 2 shows here that a brand is ranked in the ranking and ranks ahead of the product that a customer wants but when it is noted that other brands are a still involved product. Figure 3, it turns the items into checkboxes to see different brands where the customer chooses by clicking on the box, however it results in different brands, in addition to the customer clicks the checkbox if they want to see different brands, in the end, creates only the extra time and negative experience with customers.

The Proposed Ranking System and the Search Facility.

The Search page is the core function of the site. Any Item - Product, Company, Customer Request, News Article, and Advertisement can be searched for using this form.

search engine, user can input the Evaluationord or set filter with sorted categories of products or suppliers, etc., Afterward, the system will process the request order and quotations made by the users and will also process the ranking system using the search results ranking algorithms. Provide a bidding system and internal messaging system. Then, it will give searching results ranking regarding its categories, brands, and suppliers, all of them are systematically sorted. Now users can select the best supplier

or products and avail good pricing and rates. The Output should be evaluated using the System Usability Scale (SUS). In line with this, to uphold a fair business environment and to provide excellent services to suppliers and due to the drawbacks of existing systems mentioned above, the researcher will implemented the algorithm search result ranking that aims to solve the supplier and personalized brand ranking problem. With the use of an assortment and product filtering method, the clusters of the same brand are grouped, and brand is ranked based on customer brand preferences A demo of the proposed ranking system has been demonstrated in Figure 3.4.1 the systems provide and optimize a search tool for easy access to information needed by every User - the search tools placed on the top portion of one page for easy accessibility. It is optimized to search almost all possible combination to quickly find what the user is looking for, from products to suppliers. (See a demo below).

Figure 4 Supplier Review Rating Process

Step 1. Registered user will click the Review button that opens a drop-down panel allowing them to review these Suppliers regarding their experience of trading with them.
Step 2. Buyers may rate Supplier by stars (0-5) according to their experience.
Step 3. Leave text reviews or Feedback comments. Step 4. Click Submit
Step 5.   Now the System will Calculate the customer ratings with the following formula:

Table 2. Database

Supplier 1		Supplier 2		Supplier 3	
No. User	Rating	No. User	Rating	No. User	Rating
1	5	1	4	1	3
2	3	2	3	2	3
3	4	3	3	3	2
4	4	4	4	4	3
5	3	5	3	5	3
5	21	5	19	5	16
4.2/5 stars		3.8/5 stars		3.2/5 stars	

Count = 5
Sum = 19

Total = sum/count (21/5)
New total = 3.5 or rounded = 4 Average = 4/5 stars

- A user now will rate from 1-5, then get the sum of user and the sum of total rating afterward Get the overall rating by dividing the count of users and sum of rating. The results will be the average score of a supplier was displayed on the system.
- As shown on the table, the supplier one will rank one on

the search results that got the highest the average rating of 4.2/5 stars, place second the supplier 2 with the 2nd highest average rating with 3.8/5 stars and supplier 3 places at the bottom with the lowest average rating of 3.2/5 stars.

Step 6. The number of stars will affect the order of search results (best Supplier first) if two companies have the same rating they will be sorted alphabetically.
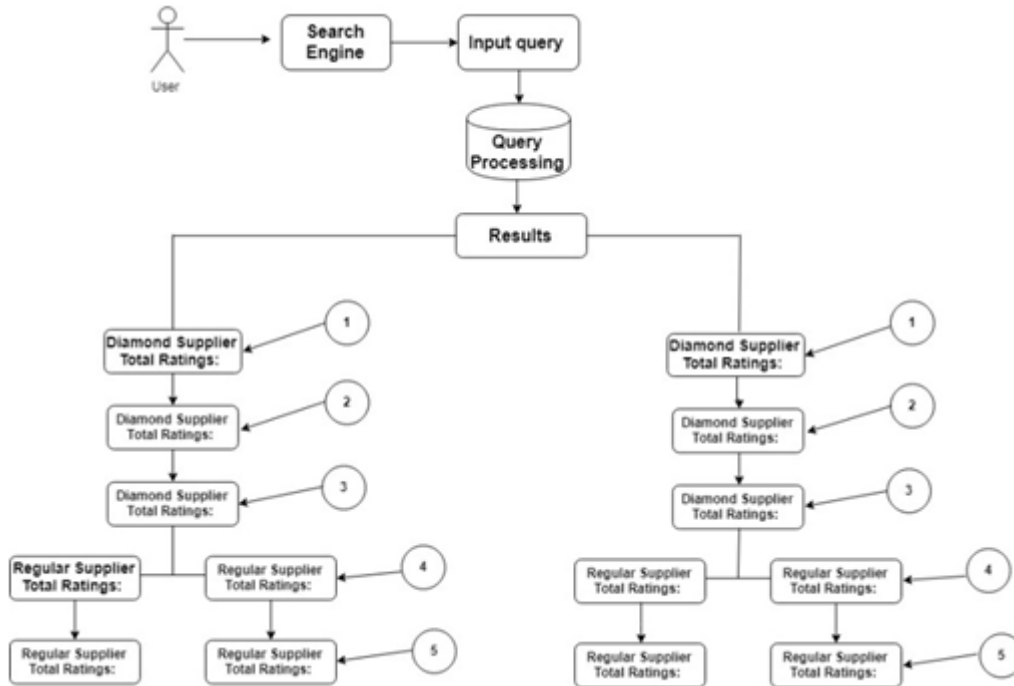

Figure 5 The algorithm of Search results ranking Model

Figure 5 Proposed Ranking System Model
Step 1: Registered look for the search engine.
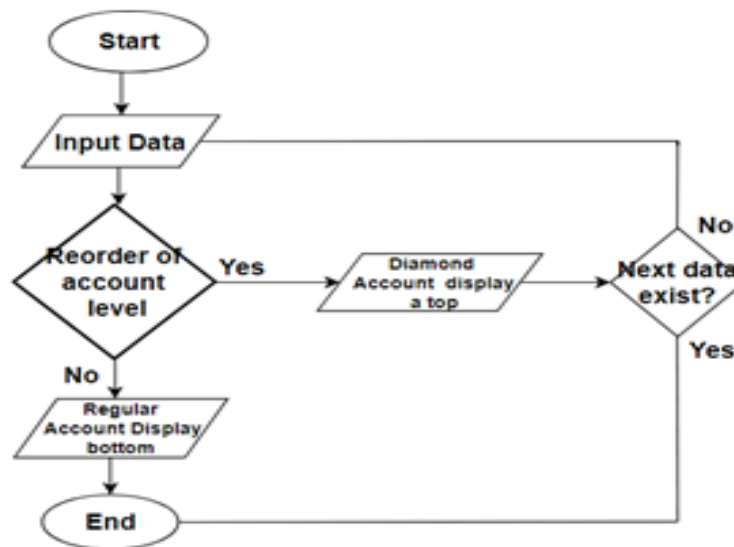Step 2: Filter or Input query
Step 3: Query Processing for Algorithm

Figure 6 Flow chart

Algorithm
a) Input data
b) Reorder of account level. If yes, the diamond account displays a top. If no, regular account display bottom.
c) The algorithm processes which the diamond account user will always put on the top, if two users have the same account level, it will be sorted alphabetically. The regular account will display at the bottom regardless of supplier-customer rating.

Step 4: Displays the Search Results Ranking on the System. The diamond account will always display a top with the highest total average of ratings and regular accounts displayed at the bottom and sorted alphabetically.
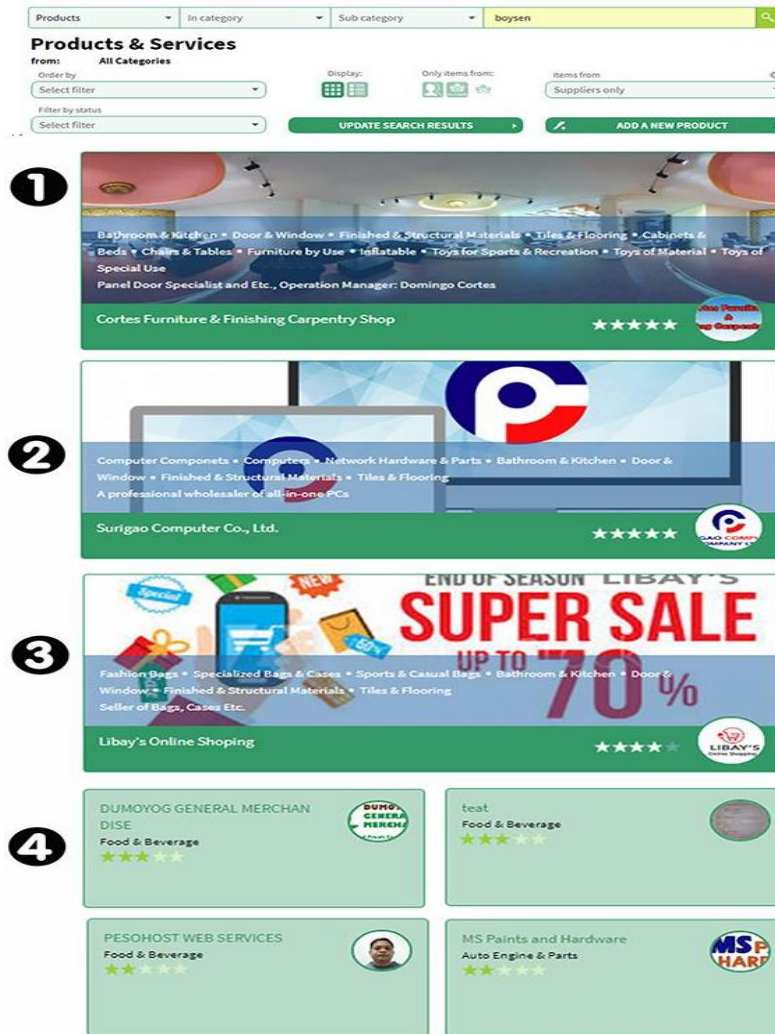
Search Results ranking for Suppliers.

Figure 7 Search results ranking for the Supplier using the Product assortment and filtering Results of the algorithm of search result ranking

Step 1. Registered user clicks the supplier list button.
Step 2. Click best review company first.
Step 3. Process the Algorithm.

    Instance as an example. The algorithm is consists of three important stages: filtering, matching, and grouping deceit. The algorithm filters out deception products as a first step and then selects products that fit what is searched via product class relevance and product descriptions. Finally, search consequences are sorted according to consumers 'preferences, products, and exceptional of suppliers' maintenance. Figure 3.5.1 below is the sketch for the product rating method.

Supplier Maintenance
   Quality

Step 4. An average of User Ratings for this company is calculated and displayed.
Step 5. The search results ranking show the diamond account will display the diamond accounts on the top with a total five-star rating lower ratings will follow. Also, the regular accounts will display the bottom and rank best on the user's review accordingly.

Search Results ranking for Products by brand.

Figure 8 Search results for the query "BOYSEN" using the Product assortment and filtering Results of the algorithm of search result ranking

Step 1. Registered user input a query "BOYSEN." Step 2. Click enter or Search button
Step 3. Process the Algorithm
Step 4. The search results ranking will display it by brand Boysen. Paints are first grouped by brands, e.g., Boysen. The system will then rank Boysen at a higher position if it learns the user prefers Boysen from users input via filter items or input keywords.

Definition and Purpose of Search Results Ranking

Description and Purpose of Search Results Ranking
The search feature is crucial to websites and permits customers to get what they pick quickly. The ranking is the way how outcomes are displayed. Purchasing hub endeavors to enable consumers to search for the most suitable goods, suppliers or data thru the function of search results listing.

Types of Search Results Ranking
Purchasing hub supports searching results ranking regarding Purchasing hub supports regarding effects ranking involving categories, products, suppliers, and merchandise through brand within a specific employer Showroom on the site. The types of ranking algorithms are similar, and all have a placement and differ only in specific aspects.

The Search Results Ranking algorithm
The algorithm is customer dependent because they often use the search feature for identifying and selecting products and suppliers on the site.

An algorithm of Search Results Ranking Model
Ranking Search Results are organized towards consumers and the algorithm effects in search outcomes from consumers' viewpoint for many stages. Bring effects to search consequences utilizing
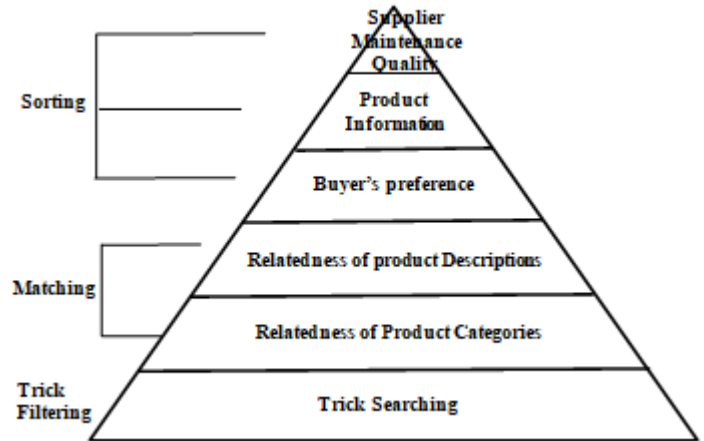

Figure 9 Algorithm of Search Results Ranking Model Diagram

Matching
It is a technique in determining results that are associated with the critical phrases entered with the aid of the users. The two exceptional factors to be considered are the Relatedness of goods classes and relatedness of goods Classifications.

Relatedness of Product Classifications
The search performance ensures that goods classifications are appropriate for what is consumer asked and give the appropriate results accordingly.

Relatedness of Product Specifications
Purchasing hub suppliers are stimulated to exercise the proper and suited goods arrangements when placing the goods.

Sorting
Aforementioned enables quality goods, best suppliers or customer's choices to be presented in top advantage. The three main reasons that have an effect on sorting customer's choice, goods data and provider is carrying condition.

Goods Details
The higher ranking will be geared up with correct and understandable and right data.

Supplier's maintenance quality
The higher ranking will be given to suppliers within complete and comprehensive data on its goods and actively providing updates.

Customers' wants
The ranking role will understand what the customer needs to improve what they need.

Trick Searching

Some suppliers purposely reproduce goods or Misclassified goods under wrong product classifications for deceitfully getting more opportunities to be examined.

Replicate products

Some suppliers deliberately duplicate their products to increase their rankings in search results still have lowered the rankings.

Misclassified Goods

Some suppliers carefully list products below inappropriate classes for deceitfully getting more opportunities to be searched. The system shall lower the ranking of these products or prevent them from being searched once identified. Suppliers are advised to post goods under classifications following their creation and correct descriptions for optimizing the uncertainty of outcomes being search.

Business Model

3.7.1 Income Stream of the system

Purchasing Hub in the Philippines is a marketplace where suppliers and buyers meet. The system makes money by charging commissions from the suppliers of the mainland of the Philippines as a percentage per transaction value of goods sold. Also, Phub has promotions of the companies and banners with equivalents amount traded on the website.

IV. METHODOLOGY

Requirements Specifications

Requirements Specifications

The project specified by the researcher is not a new form of technological development but innovation and improvement on the existing procurement systems. The researcher developed the Purchasing Hub in the Philippines that allows its users to offer, sell, buy, and tender products and services. It will improve and enhance the services given to the customers here in the Philippines. Customers can find comfortable, the desired vendor that offers Goods and Services that will supply to them. Also, they can avail good pricing through the power of purchasing hub to select on which company has provided reasonable pricing and rates.

System Features and Services

One of the critical features of the system is applying the search results ranking algorithm and quick field search methods with independent, original field rights.

Matching

Provide matching services, recommending Suppliers and buyers alike that are within the scope of every member's interest.

Matching Features

Business-to-Business (B2B) Integration

Purchasing hub is optimized to cater to the companies looking to sell, partner, and collaborate with other organizations.

Bidding System

One of the primary system features is the bidding system; this system will enable consumers to choose the best of the items, and they can correlate to local supplies or companies in the Philippines. This also used to sustain commerce to make the system usable again by the user.

Business-to-Customer (B2C) Integration

The system is combined with a PHub E-Shop which the products and services can be included in the site E-shop for retail.

Advertising

The purpose is to give a broad scope of promotion assistance to help all customers fulfill their dreams and to grow.

Advertising Features

3.7.2.1.1 Social Media Advertising

Social Media has a vital impact in the field of business; even for small business or a large company.

Banner Advertising

Users can make their appearance more critical in the system using banner deployments.

Brand Story

Purchasing hub gives its users the chance to write regarding their corporation, giving them further relatable and convenient.

Software Components

The researcher utilized Drupal a content management system (CMS) as the primary software for the development of the system. Programming languages such as PHP, Bootstrap, HTML5, CSS, and JavaScript. The system is a desktop and mobile responsive that can run into different devices such as desktops, and tablets with Platform any platform in the form of iOS and Android.

Analysis

This preliminary research determined whether the system was technical, financially, and operationally feasible. The primary goal of attending the feasibility study was to consider all factors associated with the project and determined if the investment of time and other resources yielded a desirable result. It is a critical document which defined the initial application concepts, objectives, requirements, and alternatives. The work breakdown Structure was also specified.

Technical Feasibility

The purchasing hub in the Philippines website is technically feasible because it is a mobile responsive web application that able to run in android and iOS platform which is mainstream nowadays.

Economic Feasibility

The Purchasing Hub web application is economically feasible because the users of this system are coming from the entire island of the Philippines where online procurement already dominates most of the people. The system will be available always; the researcher provides updates as well.

Operational Feasibility

The system is operationally feasible. The customer does not have to expend money on seminars and pieces of training since the system is easy to use. Its environment is made to be user-friendly and can easily be manipulated, and a user manual is posted on the site.

Design

Operational Framework

In this section, the researcher discusses how the system work form is registering the new user account and the collaboration process of customer and supplier on the system.

Registering a New Account

To register an account:
1. Register
2. type the required information
3. Click Submit Profile
4. Select a paid account
5. After all the process, the customer will be able to enter his dashboard.

Registering Via Social Media Accounts

The system allows Registration and Login using Facebook.

Account types

Selecting "Buyer," "Supplier," "Both" only affects the trading preference and information to be displayed upon registration and login. All registered users able to buy and sell regardless of their chosen trading preference.

Accounts type

The system offers two (2) types of membership level such as Regular Membership and Diamond Membership.

Accessing Users Details

Upon registration, each user will have a dashboard where they can access the details that they will display on the system.

Registered users on the system will be provided with BUSINESS TOOLS where they can access, add, edit and change their information. Business Tools that are displayed will be dependent on the trading preference and membership level of the user; this can be changed over time if the user decides to do so.
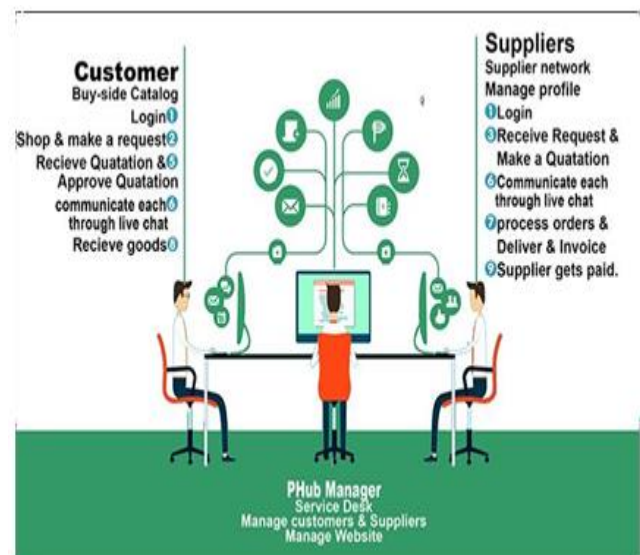

Figure 10 Collaboration or Bidding System processes of Customers and supplier on the system

Purchasing Hub: an E-procurement management system a platform connecting the customer and supplier in one marketplace. Also, streamlines the buying and selling of complex products and services. Buyers, suppliers, and PH manager collaborate in the cloud to improve the PH manager work in the cloud to enhance the spend visibility and control, attain cost savings and productivities and to decrease hazard and waste.

1. Users required to Login
2. Shop via Filter the products or can automatically make a request. There are two types of request it can be a direct request to the specific supplier or a request going to all registered Suppliers on the system.
3. Once submitted the Buying Request would be available for other users, where they will, in turn, can send a Quote.
4. The supplier makes a quotation send back to the buyer.
5. Through biding, a buyer now will choose a good Quotation (meaning a Quotation with a reasonable offer in Terms in low pricing and rates.)
6. Buyer will approve the Quotation he chooses.
7. Both supplier and buyer will now communicate each through chat. The Live Chat serves for easier communication between users aside from the Internal Messaging System. It can be turned on or off every time the user is online or available for inquiries.
8. The Live Chat module will be displayed on the screen with the online status of the Buyer to the Supplier, and vice versa, for easier communication between two parties, in regards to the Quote.
9. Buyers will pay and received the products or services.
10. Supplier gets paid.

Ethical Consideration

Privacy and Confidentiality
The purchasing hub in the Philippines knows that a dignified user understands how to use and share information about him, and Phub appreciates their confidence to make them cautious and wise. The user notifies that this page contains rules regarding the collection, use, and disclosure of Personal Information when they will use the services of the site.

By using the Phub Services and the registration for a phub account, they must acknowledge and accept the Terms and Conditions and our User Agreement, and they allow the acquisition, use, disclosure, retention, and protection of their personal information as described in this User Privacy Policy and confidentiality.

Personal Information
The Phub website uses the personal information of a user for the repair and improvement of the Service, and the user must agree on the collection of data and the use of his knowledge following this policy. The data get from the user help the Phub site personalized and improve the user's experience. The Phub collect the following data:

User's Data gives to Phub
Phub receive and store any data they enter on the site or user give in another way. The user can choose not to provide the data, but they have not able to avail other features on the site. Phub use the data to give the users request, creating their profile and providing the best services and to communicating the user. Phub will keep the user records on the system confidential as far as permitted by law.

Log Data
Phub receive and keep some data type when the user interacts on the system or when the user has used a web browser on accessing the site.

Cookies
Phub use a cookie to collect data and to help the website keep track of user's visits and activity. Users can refuse to use cookies. However, they cannot enjoy some portions of Phub services.

Service Providers and Information Sharing
Phub has third party individuals that facilitate Phub services. These third parties have access to personal user data only to perform the task on behalf of Phub team, and they are obligated not to disclose or use data for any other purpose.

Security
A user's data security is vital to Phub, but it should be noted that there is no 100% safe in every data transmission using the internet. However, the Phub seeks to use commercially acceptable ways to protect the Personal Information of the user; the Phub does not guarantee its full security.

Plagiarism
This project was written using researchers own words and ideas, except for excerpts from published and unpublished sources which were indicated and recognized as such. Researcher knows that using ideas from other works or a definition of such material without recognition is considered as plagiarism. Also, the researcher uses a Grammarly software detector to avoid plagiarism.

Authorship
The researcher has declared the Authorship of this thesis and work presented in it, and it was assisted by John mark Dumanig as an adviser and co-author of this work, and not used any sources other than listed in the bibliography and identified as references.

Development and Testing
The researcher developed the system design using the waterfall Approach of the System Life Cycle (SDLC). The six phases under this Approach together with the development of the system are; Requirement Gathering and Analysis, System Design, Implementation, Testing System Deployment, and Maintenance. The researcher also used the Evaluation Method and tools in evaluating the performance of the system regarding usability.
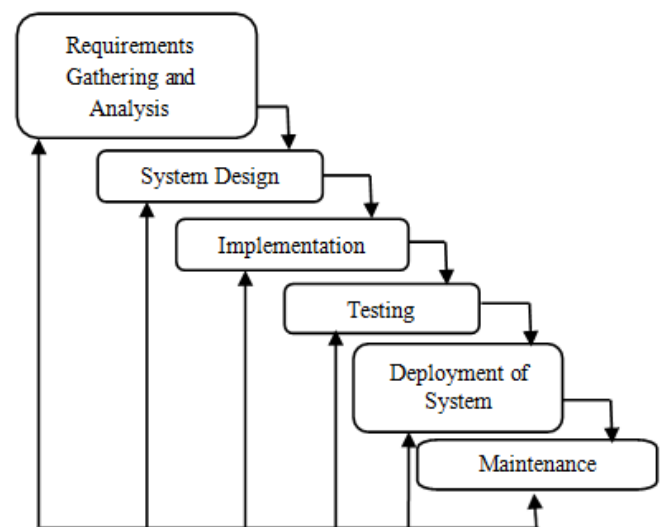

Figure 11 the Waterfall Approach

System Model
The researchers developed the system design using the Waterfall model Approach of the System Development Life Cycle (SDLC). The six phases under this approach together with the development of the system are:

Requirement Gathering and Analysis
The researcher will gather the validated data from the expert in procurement processes in both local and private institutions and individuals. The researchers will explore the ways of addressing the system needs. The researchers then plan the system structure as a basis for developing the system. Precise analysis and thorough researches are made.

System Design

The researcher used Drupal, a Content Management System with a customized designed using HTML5, PHP, JavaScript, CSS, AJAX and Bootstrap languages as a developing tool for the development of the System, which can run in both mobiles, and desktop Platform. The database to be used for web app compatibility will be SQL Lite and yourself for PHP.

Implementation

In building the application, tasks will be made by the researcher — also, the one to create the program codes of the web app and design the Graphical User Interface (GUI) of the application.

Testing

The researcher tested the proposed system using the different testing method to check if it performs correctly.

Functionality Testing

The researcher will test all the functionality of the system; these include all the links in web pages, the bidding system, the search results ranking, bidding system, Phub-Eshop, database connection, and Cookies testing to see that there are no missing links.

Usability Testing

The researcher tests the usability of the system which process by the human-computer interaction characteristics of a system is measured, and weaknesses are identified for correction. It includes the testing for website navigation, menus, buttons and more.

Interface Testing

The researcher tests the server side interface by verifying the communication on the website is working correctly. Also includes the compatibility of the server with software, hardware, network, and database.

Compatibility Testing

The researcher tests the compatibility of the website. These include browser compatibility, operating system compatibility, and mobile browsing.

Performance Testing

The researcher tests the performance of the system include the web load testing on the system handles the simultaneous request, large input data from users. Also the web stress testing on how the system reacts to stress and how recovers from crashes.

Security Testing

The researcher tests the system security. These include the test on unauthorized access to secure the pages, and the restricted files should not be downloadable, the check sessions and the use of SSL certificates.

Crowd Testing

Then the researcher examined it to a group of civilians to determine its functionality or usefulness and to know further improvements for the application.

Search Results Ranking System testing

The users (Customer/Supplier) test the functionality of the search results ranking of the system.

Bidding System Testing

The users (Customer/Supplier) examine the functionality and usefulness of the bidding system.

System Deployment

After the testing process, the application was now available to the market.

Maintenance

The researchers always updated information on a web app. Discoveries or information updates are still available on the Platform.

Evaluation methods and tools

The researcher used the System Usability Scale (SUS) in this study. SUS is an inexpensive, yet useful tool for assessing the usability of a website or other interactive system. It is the tool used by the researcher in evaluating the performance of the policy regarding usability. The SUS is composed of ten statements, each having a five-point scale that ranges from Strongly Disagree to Agree Strongly. The researcher distributed the questionnaires with 40 respondents in measuring the perceptions of system usability. Frequency counts and percentage distribution were used in the analysis of data gathered. Then, the data were tallied, analyzed and interpreted using SUS.

Strongly Disagree 1	2	3	4	Strongly Agree 5
○	○	○	○	○

Figure 12 Response FormatThe SUS uses the following response format of the figure below in answering the instrument

Statistical Treatment

The researcher used the following formulas to analyze and get the mean of each item in getting.
1. $\sum fx) = X1(F1)+X2(F2)\ldots ln)$
Where:
f = Frequency
x = Respondents
2.   Mean (M) =
Where:
N = total number of respondents
M = represents the total numerical value of the squared mean

4.6.1 Scoring and Interpreting SUS Results

SUS yields a single digit representing a composite total of the usability of the system being studied. It is noted that the scores for individual items do not seem to be significant on their own. To calculate the SUS score, first total the score contributions from every item. Each item's score contribution can vary from 1 to 5. For odd number digits, the score contribution is the scale position minus 1. For even number

digits, the input is five (5) minus the scale position. Multiply the sum of the scores by a pair of 2.5 to get the total value of SUS. SUS scores have a vary of 0 to 100.

Based on the research, a SUS score above 79 is measured to be higher than average, and everything below 79 is lower than average. However, the best way to interpret results includes "normalizing" the scores to generate a percentile rank. The figure below shows comparisons of category ratings in the normalized percentage of SUS scoring ranking or the average SUS score.
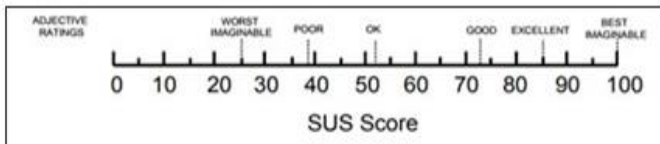

Figure 13 Comparisons of Adjective Rating and Average SUS Score

V. RESULTS AND DISCUSSION

Table 3 below shows the results based on the various tests conducted by the users on the website from the functionality, usability, interface, compatibility, search results ranking system, and bidding system tests, all have been operational; the search results algorithm is a systematic approach towards providing a better experience to the customer that the functions are outstanding. However, the capacity of the server used is small which resulted in a slow response to browsing links, especially in search results that require higher memory on the server to make website search results faster. The bidding system is excellent, but then again need to improve the processes to speed up the transaction. The security test of this website is remarkable because it is encrypted all the transactions between customers and suppliers on the site. In general, the tests results have been successful, showed in table 4 evaluation results.

Table 3 Test Conducted Results

USABILITY OF THE SYSTEM	f (5)	f (4)	F (3)	F (2)	f (1)	∑f x	Mean	Converted Responses
I think I would like to use this website often	36	2	2	0	0	194	**4.31**	3.31
I found in the website unnecessarily complicated.	0	2	1	5	32	53	**1.18**	3.82
I thought the website was users friendly	38	1	1	0	0	197	**4.38**	1.38
I need the help of admin support to be able to operate the system.	0	1	2	7	30	54	**1.20**	3.80
I found that the different functions of this website were well integrated.	32	8	0	0	0	192	**4.27**	3.27
I believe there is too much difference in this site.	0	0	2	1	37	45	**1.00**	4.00
I would visualize that most people would absorb to use the website very quickly.	38	1	0	1	0	196	**4.36**	3.36
I found the website very unwieldy to use.	0	0	2	1	37	45	**1.00**	4.00
I felt very confident using the website.	35	2	2	1	0	191	**4.24**	3.24
I wanted to acquire many things before I could get going with this website.	0	0	2	4	34	48	**1.07**	3.93
Usability Percentile								36.11
								91.28

Table 4 Evaluation Result

Testing Categories	Results	Remarks
Functionality Testing	operational	excellent
Usability Testing	operational	excellent
Interface Testing	operational	excellent
Compatibility Testing	operational	excellent
Performance Testing	operational	excellent
Security Testing	operational	excellent
Search Results Ranking System testing	operational	Increase server capacity especially when the database is large
Bidding System Testing	operational	Excellent. However, Improve the process
System Deployment	operational	excellent

The table underneath gives the result of the perception of the usability of the application. There is a 91.28 of Usability Percentile. As compared to the adjectival rating, the usability percentile of the form is excellent.

RECOMMENDATION

The researcher recommends the improvements on some of the functionalities of the system like on the messaging system to include the documents attachment automatically and include a camera, also to implement it on the international market that provides for multi languages and multi-currency. Add space on RAM server to improve the performance the loading response of the system, Also to develop a version on a mobile application that can run without the use of a browser.

On the algorithm, it can be further extended to recognize fake reviews using the final score generated. In case a review fails to achieve a minimum threshold score or reviews submitted by a particular user are frequently assigned low scores, then the probability that those reviews are fake is very high. Also if a large number of reviews is submitted for a supplier in a small period, there is a huge possibility that all of those reviews are fake. In such cases, a check for similarity between those reviews can be done to Generate originality score and also considered to use the A Brand- level Ranking System with the Customized Attention-GRU Model which feature engineering tailored explicitly for the personalized brand ranking problem and then rank the brands by an adapted Attention-GRU model containing three essential modifications.

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