



# A Developed Eco-Sourcing Tool Based on Model View Control Architecture for Small and Medium Enterprise

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**Abstract:** This study aims to develop an eco-sourcing tool grounded on Model View Control (MVC) architecture for Small and Medium Enterprise (SME) to enable clients' select automobiles products online and order any automobile by just selecting the product using an internet enabled platform. Furthermore, once an automobile product has been selected from the tool the order will directly appear on the screen of the administrative support staff at the enterprise. Respectively, the system lessens the work of the staff thereby decreasing tedious task faced by the staff. Additionally, the developed eco-sourcing tool replaces the conventional system by reducing manual work in the form of managing various files autonomously. Moreover, the tool supports in maintaining and storing customers' information and save time by helping clients to order any automobile product whenever they want without visiting the enterprise. Next, the eco-sourcing tool was evaluated to test the applicability of the tool in managing automobile retail ordering based on survey data collected from fifty customers. Accordingly, descriptive analysis was carried out to analyze the collected data by deploying frequency and percentage analysis. Results from the analyzed survey data reveal that the eco-sourcing tool is applicable in supporting retailing logistics in SME.

**Keywords:** Eco-sourcing, Model view control, Retailing products, Small and Medium Enterprise, E-business, Descriptive analysis.

## 1. INTRODUCTION

Over the years traditional enterprise are utilizing web-based systems to overcome the confines of time and space [1]. It allows them to automate business activities and further provide a more custom-made service to their prospective clients [2, 3]. Thus, customers do not need to join queue to procure products, customer goes to the shopping website, chooses a catalog, orders the product catalog and an email is sent to the seller [4]. Thus, the term eco or environmental sourcing is derived from virtual or online shopping as it reduces the physical resources required by clients to source products.

Accordingly, Small and Medium Enterprise (SME) are taking advantages of the benefits of eco-sourcing system and it's being introduced all over the world [5]. Moreover, eco-sourcing is becoming progressively popular because of rapidity and comfort of use for end-users. Customers can pay their bills in an easy medium using their credit card or debit card over the online payment to merchants or sellers [6].

Findings from Bauer and Jannach [1] revealed that the numbers of consumers online are increasing as the year progresses. In the year 2017 as many as 65 per cent purchased goods and services through the internet during

the past year. It is obvious that eco-sourcing via online is rapidly gaining ground as an accepted business paradigm. This is evident from an increasing number of SMEs that run web sites that provide functionality when conducting business transactions over the web [7].

According to Zhao et al. [8] with a rapid change in technology especially in the SME sector, customers are demanding more value, less risk, and better integration of products, hence there is need to change the business strategies, which can result in improved performance thereby meeting customer demands [9]. Furthermore, in SME sales operation there is needs for a system which can integrate customers, products and suppliers with the help of Internet Technology (IT) [10]. Additionally, existing sourcing platforms deployed by SMEs do not have sales system with zero downtime that can reduced product error, aid in customer satisfaction, quick procurement changes [11].

Accordingly, the aim of this research is to develop an eco-sourcing tool for SME that retails products via the internet to facilitate the purchase and sale of products in real time. The proposed eco-sourcing tool is a virtual online store where customers can browse the catalog and select the products they are interested in and make order online. The eco-sourcing tool provides information

regarding the details of the staff, suppliers or some vital pending transactions. Besides, the tool reduces conventional filing process and provides adequate security for specific personnel accessing sales and customer information to avoid misplacement or unauthorized access of vital information.

Furthermore, the eco-sourcing tool supports SMEs by reducing the increased overall maintenance and inventory cost faced in the current traditional methods. The tool also decreases longer order processes and fulfillment cycles, provide customers with unlimited access to purchase automobile products from anywhere across the world, and retains customer's records. The organization of this paper is as follows. The theoretical background is presented in Section 2. The methodology has been presented in Section 3. Tool development is presented in Section 4. The results and discussion are presented in Section 5. The implication of study is presented in Section 6. Lastly, the conclusion, limitations and future works is presented in Section 7.

## 2. THEORETICAL BACKGROUND

### A. Overview of Eco-sourcing

As a general definition, sourcing is a business activity that includes all activities directly or indirectly involving the exchange of goods or services [12]. There are currently four major types of eco-sourcing which includes Business to Business (B2B), Business to Consumer (B2C), Consumer to Business (C2B) and Consumer to Consumer (C2C) [13] as depicted in Figure 1.

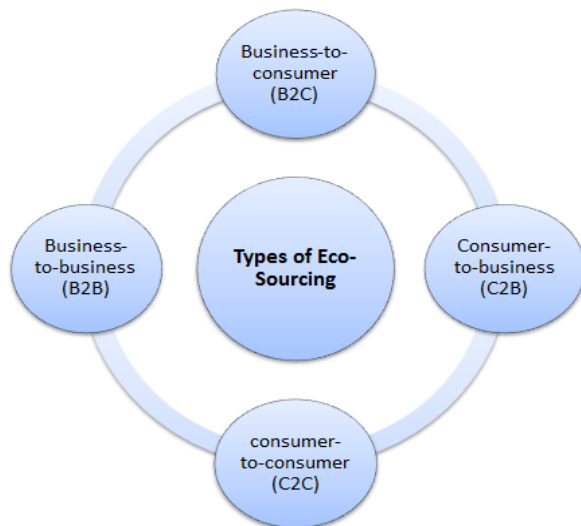


Figure 1. Types of eco-sourcing adopted from [11]

Figure 1 shows the four main types of eco-sourcing. Respectively, business-to-business entails those commerce transactions held between enterprises. In the

area of e-commerce, B2B sales volume is roughly double that of B2C, mainly because a typical supply chain has multiple B2B transactions including suppliers, manufacturers and distributors; while there is only one end-user B2C transaction at the end of the chain [11]. The B2C service describes all activities that involve enterprises that provide products or services to end consumers. B2C is a type of eco-sourcing with more B2B sales, but it is by far the best known among consumers and retailers [14].

In consumer-to-business, the B2C process is reversed, so the customer is the one who offers the goods or services of a company to complete an enterprise process or gain a competitive advantage [3]. Consumer-consumer is an online shopping where a third party facilitates electronic transactions between consumers [15]. The most popular example of C2C is an online auction where customers can bid for items that another consumer is selling for, while a third-party charge exchange commission [10].

### B. Future Trends in Eco-sourcing

Eco-sourcing has become a very important area in commercial environment. Since the inception of e-business years ago, the change in technology over the decades has led to intensified internet usage which has increased e-business operations [16]. Thus, Figure 2 shows that eco-sourcing sales have increased from January 2013 to December 2018.

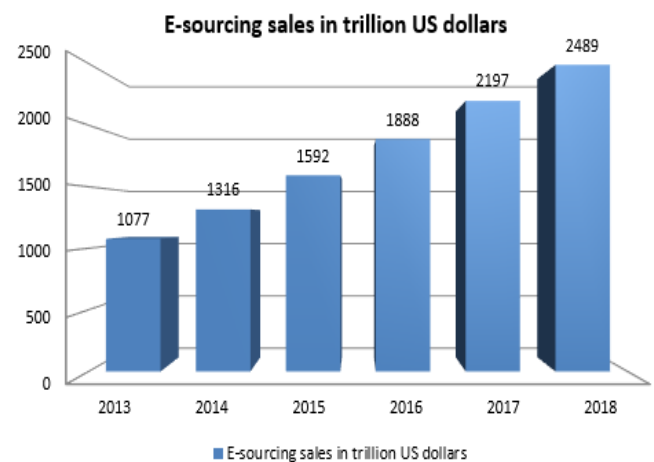


Figure 2. Eco-sourcing sales worldwide from 2013 to 2018

Figure 2 shows that the global online purchases have increased steadily. In 2014 eco-sourcing increased by 21 percent compared to the previous year. Similarly, worldwide eco-sourcing is expected to grow by more than 10 percent each year and \$ 2,489 trillion in 2018. Moreover, as Nisar and Prabhakar [17] mentioned this is due to the price transparency offered by the Internet and increased competition between enterprises, price increases have shifted from producers to consumers. Statista [18]



stated that global online sales of online purchases amounted to approximately \$ 8 billion in 2013 and nearly 40 percent of global internet users were procuring online products in 2013. In addition, expected growth of \$1.5 trillion by 2018 is expected with sales rising year-on-year, as seen in Figure 2. A survey of nearly 200 senior enterprise managers has concluded that the customer satisfaction metric is very useful in managing and reviewing enterprise operations [18].

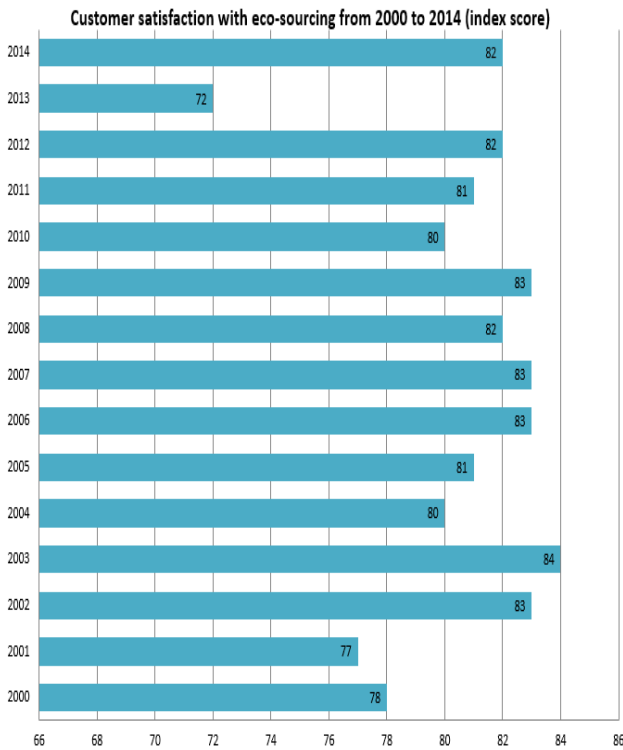


Figure 3. Customer satisfaction with eco-sourcing from 2000 to 2014 (index score) [17].

Correspondingly, over the past decades, eco-sourcing has been developing continuously with B2C sales in the region amounting to almost 35% of international total B2C sourcing sales in 2013. Moreover, within 14 years (2000–2014), the consumer satisfaction index score of eco-sourcing in United States (US) has increased from 78 in 2000 to 82 points in 2014, which is quite high within the 0–100 scale [18] as seen in Figure 3. Likewise, Figure 4 shows the distribution of product categories ordered using eco-sourcing in 2013 based on findings presented by Purwaningsih and Adison [19] in their studies. The results revealed that apparel such as clothing and wears was the most ordered product in 2013. In respect to this study, results indicate that only 2.8% of sales related to automobile as at 2013 based on the result presented by Purwaningsih and Adison [19]. Hence, there is need for an eco-sourcing tool to facilitate retailing operations in SMEs that deals on automobiles.

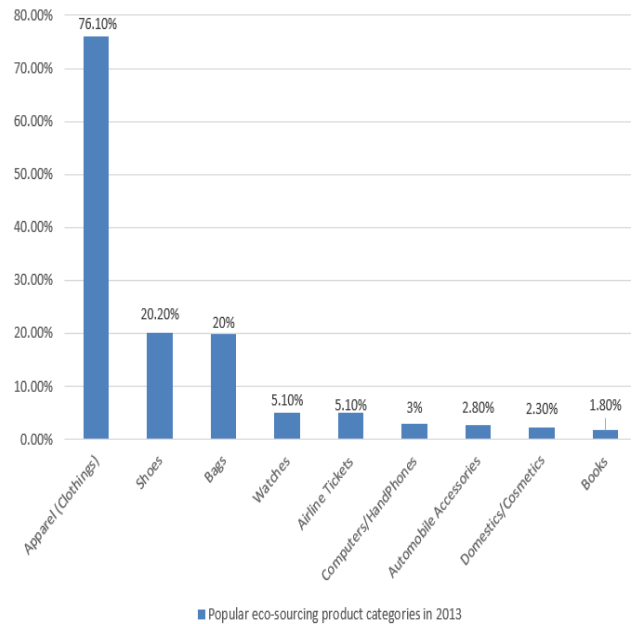


Figure 4. Popular online product categories on 2013 [19]

C. Related Works

Over the decade studies have been published that contributed to support online sourcing. Among these studies Cheng et al. [20] implemented a Video2Shop for exact matching products in videos to online shopping products images. The authors proposed a novel deep neural network that addresses the discrepancy that exists in cross-domain sources between products trajectories in videos and online shopping images, and the strict requirement of exact matching. Also, the authors integrated more product attributes to further improve the performance of the system. Besides, Jayapandian et al. [12] developed a method of using MD5 algorithm at the server to encrypt the original data before transition and secure the personal information in order to secure data from theft. The authors aimed to prevent un-authorized access of individual details of the customer like bank account number, password and so on while transacting the money that occurs doing online sourcing activities by deploying Message Digest 5 (MD5) algorithm to face the consequences in the online transaction. However, their work is only based on securing online banking payment services, other important function was not explored.

Furthermore, Yogananth et al. [21] designed a novel framework to support customer demanding products in online shopping. Accordingly, in the designed framework buyers can bid or buy instantly, and sellers can use website to get rid of unwanted items. Hence, the scope of the project is to develop an application for the user to shop by bidding their desired product online, then acquiring that product. Furthermore, the online payment deployed by the authors is not secured using MD5 hash algorithm. Subsequent, Singh et al. [22] proposed a mobile application for automobile online shopping system to



improve the services in online automobile internet-based business. The proposed system consists of several modules such as searching desired items, registration and login, items selection, payment options (net banking, debit or credit card or cash on delivery), payment confirmation, and item delivery tracking. The limitation of the work relates to security issues not fully addressed.

Likewise, Jung et al. [23] utilized evolutionary programming to develop a recommendation-based system for online sourcing. The proposed interactive evolutionary programming-oriented recommendation system for online shopping estimates the human preference based on eye movement analysis. Based on the level of human preference, their approach suggests new products that close the human preference by operations such as selection and mutation. Although the system cannot provide recommendations without the customer viewing other products image first. Also, Mahmud et al. [24] carried out a comparative analysis of online shopping information platform's security based on customer satisfaction. The authors further provided suggestions for the development of large online shopping portal that help to improve customer satisfaction on the security of the online sourcing information platforms. In addition, irrespective of the strength of their work the author did not address system design issues.

In addition, Yamamoto et al. [25] suggested an enhanced Internet of Things (IoT)-aware online sourcing system. The authors aimed to derive insights about products users are interested in or not and to adapt the system accordingly. In addition, the authors developed system architecture of their proposed system which includes Java Script, PHP and MySQL. The work is limited since the authors did not address security measures in their system. Likewise, Li and Luhua [26] designed an online sourcing system grounded on the struts framework which is a prevalent web application development framework based on Model View Control (MVC) architecture. Besides, the developed system improves platform's security and stability. The limitation of the work is that without the struts framework the online shopping system will not properly be functional.

Moreover, Romadhony et al. [27] implemented an online sourcing recommender system using hybrid method. The system provides recommendations for customers to narrow the search space on searching the specific products suitable for their needs. Furthermore, the developed system generates two types of recommendation which includes personal and item-based. Personal-based collaborative filtering is implemented to produce personal recommendation. The limitation of the system is that recommendation can only be provided by the system after other users have added their opinions and suggestions. Lastly, Lan-juan et al. [28] implemented an online sourcing system for digital arts products in order to facilitate customers in sourcing online more conveniently. Furthermore, the authors developed the online sourcing

system based on eclipse software and My Structured Query Language (MySQL) database to achieve a series of functions of digital arts products transaction that can help clients to search online, browse, and purchase multi-media works. However, the system database is not secured using Message Digest (MD5) hash algorithm.

Based on the ten reviewed studies it is evident that there is lack of study that developed an eco-sourcing tool for SMEs apart from researchers such as Singh et al. [22] who developed a mobile system for automobile online commerce system. However, the system implemented by the researchers was only applicable for handheld devices. Therefore, there is need for an eco-sourcing tool for SME to facilitate the management of retailing activities where products can be procured from any location via the internet to facilitate the procurement and sales of automobiles virtually. Besides, the eco-sourcing tool to be developed will support customers to make automobile order effortlessly in an operational way.

### 3. METHODOLOGY

As previously mentioned, the proposed eco-sourcing tool for SME is to be developed using Model View Control (MVC) architecture to support clients and sales staffs in managing out automobile retailing procedures. Accordingly, this section presents the designed MVC based architecture as seen in Figure 5 to illustrate how clients and sales staff deploys the eco-sourcing tool in managing procurement activities. Respectively, The MVC architecture involves the following:

- **Model:** This is the data layer responsible for database management. This module provides data access to clients and sales staff. The consumers and sales staff use this module to carryout creates (insertion), read (selection), update and delete (CRUD) functions based on MySQL server connection using Transmission Control Protocol/Internet Protocol (TCP/IP) at port 3306.
- **View:** this module is responsible for the eco-sourcing tool graphic theme and presentation. In this paper the view module is composed of Hypertext Markup Language (HTML) and Cascading Style Sheets (CSS) scripts. Besides, the view module supports the system in conveying data between Hypertext Preprocessor (PHP) and MySQL at port 8080.
- **Controller:** this module comprises of control action functions or methods. This module is deployed by PHP scripts that resides inside the web server that transmit request to the view component by using Hypertext Transfer Protocol (HTTP) protocol to transmit data in form of request to the view components for clients and sales staff.

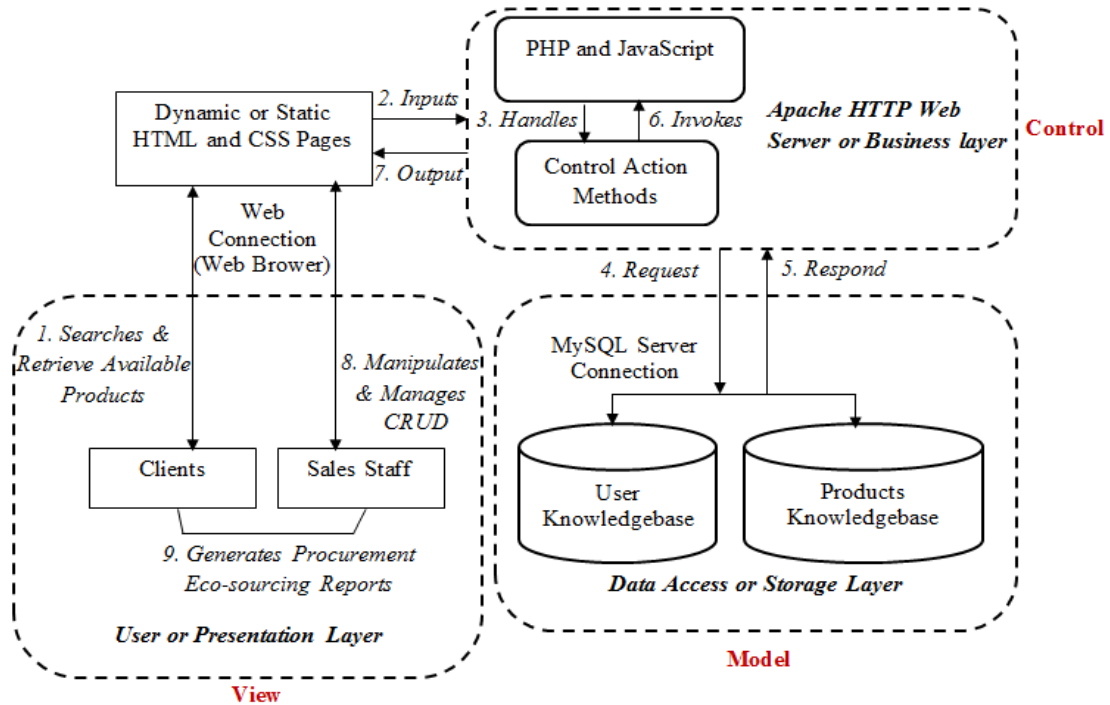


Figure 5. Designed model view control architecture for eco-sourcing tool

Figure 5 shows the designed MVC eco-sourcing architecture. It comprises of the model, view and control architecture which is aligned to the client or presentation layer, web server or business layer and lastly data access or storage layer. Also, Figure 5 illustrates how the clients and sales staff uses the eco-sourcing tool to carry out operations via a web browser connected to the internet supported by control action method which retrieves data from the user and product knowledgebase. The MVC based eco-sourcing architecture employs PHP and JavaScript, which are web scripting language for the eco-sourcing tool implementation.

For the knowledgebase, MySQL which is a relational database management system, is utilized. MySQL saves and retains both user details and automobile product details as seen in Figure 5. Also, MVC architecture was adopted in this study because it provides convenience for the system programmers in carrying out system maintenance, data manipulation and code reusability. Furthermore, MVC separates all components from each other to makes the maintenance of the system to be more reasonable and convenient, thus simplifying web page development. The designed MVC based eco-sourcing architecture provides clients with easy navigation and retrieval of products information.

Likewise, the eco-sourcing tool is developed as a web application in PHP, because PHP offers simplicity, improved performance, built-in security and scalability. PHP uses TCP/IP connection to interact with the MySQL

knowledgebase as it offers in-memory caching that removes the need to communicate with the knowledge base server frequently and it can be simply deployed to maintain PHP application [29]. Moreover, this study opted for MySQL as back-end database as it is one of the most common databases that provide quick data access. In addition, MySQL is easy to configure and simple to use.

Accordingly, in the designed MVC architecture for eco-sourcing tool, the client and sales staff search and retrieves products from the view component which is then sent as input to the control component to PHP which handles the request sent to the model component [30]. Then data is retrieved from the knowledgebase [31] and is responded back to the control component which invokes and outputs the retrieved data which is used by the client and can also be managed or manipulated by the sales staff to carryout CRUD operations. Lastly, the client and sales staff can also generate and view or download procurement retail sales report.

#### 4. TOOL DEVELOPMENT

System development is the designing and coding of a tool or a software product. Respectively, this Section presents the Unified Modelling Language (UML) use case diagram, class diagram and Graphical User Interface (GUI) of the developed eco-sourcing tool for SMEs which is based on the designed MVC eco-sourcing architecture (see Figure 5). Thus, Figure 6 shows the use case diagram of the eco-sourcing tool.

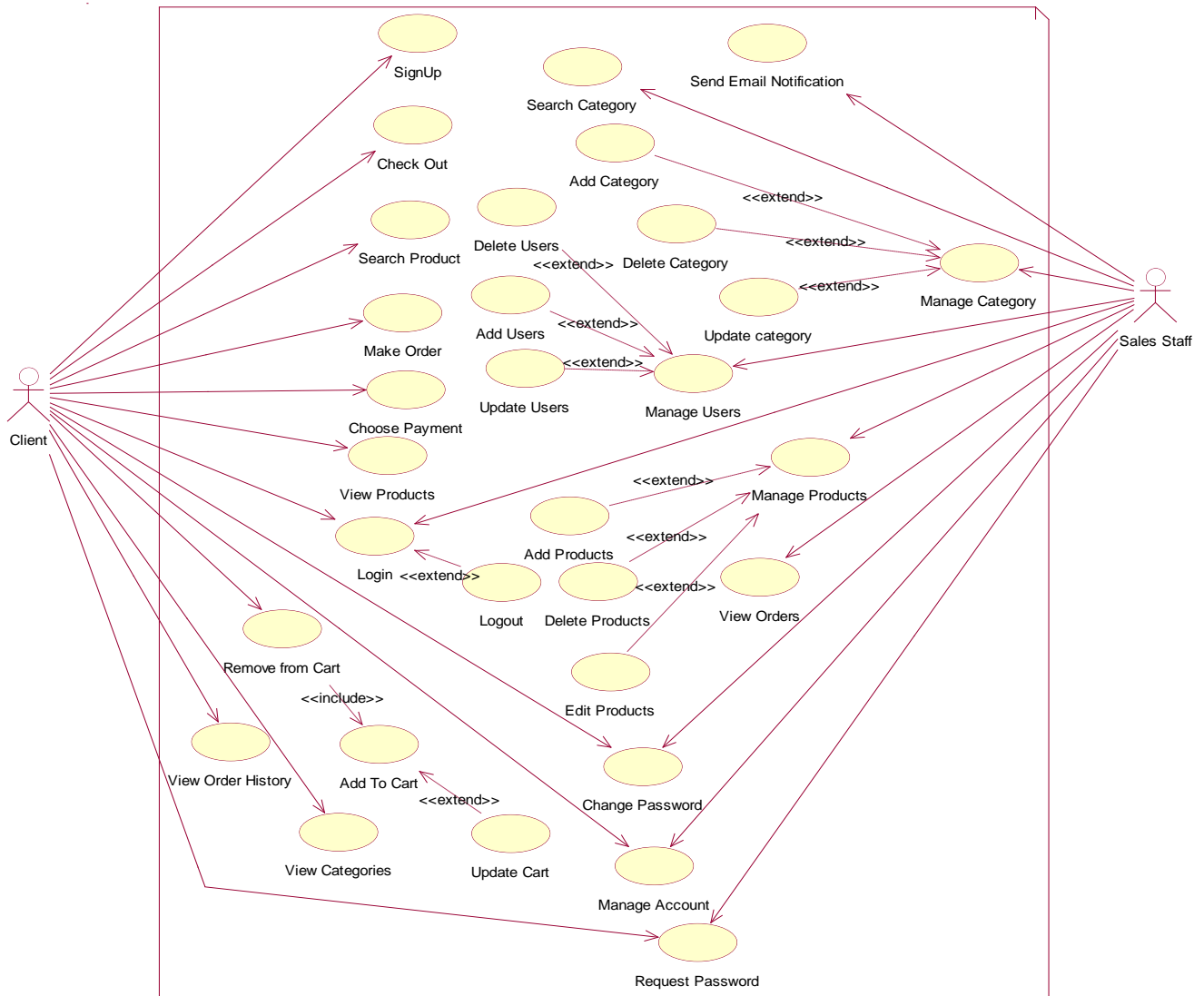


Figure 6. Use case diagram for the eco-sourcing tool

Figure 6 depicts the use case diagram of the proposed e-sourcing innovative system which describes the relationship among users and use cases (functionalities) within the eco-sourcing tool. Thus, Figure 6 also shows the users and functionalities provided by the tool. Likewise, Figure 7 shows the class diagram of the proposed eco-sourcing tool for SMEs. Where, the class diagram shows the relationship between classes, thereby displaying the structure of the whole environment. The class diagram is divided mainly into three sections (layers); the topmost being the class name, followed by the class attributes and lastly the class methods as seen in Figure 7. Besides, Figure 7 depicts the class diagram for the e-sourcing system. Next, a few interfaces of the developed eco-sourcing tools are presented as seen in Figure 8.

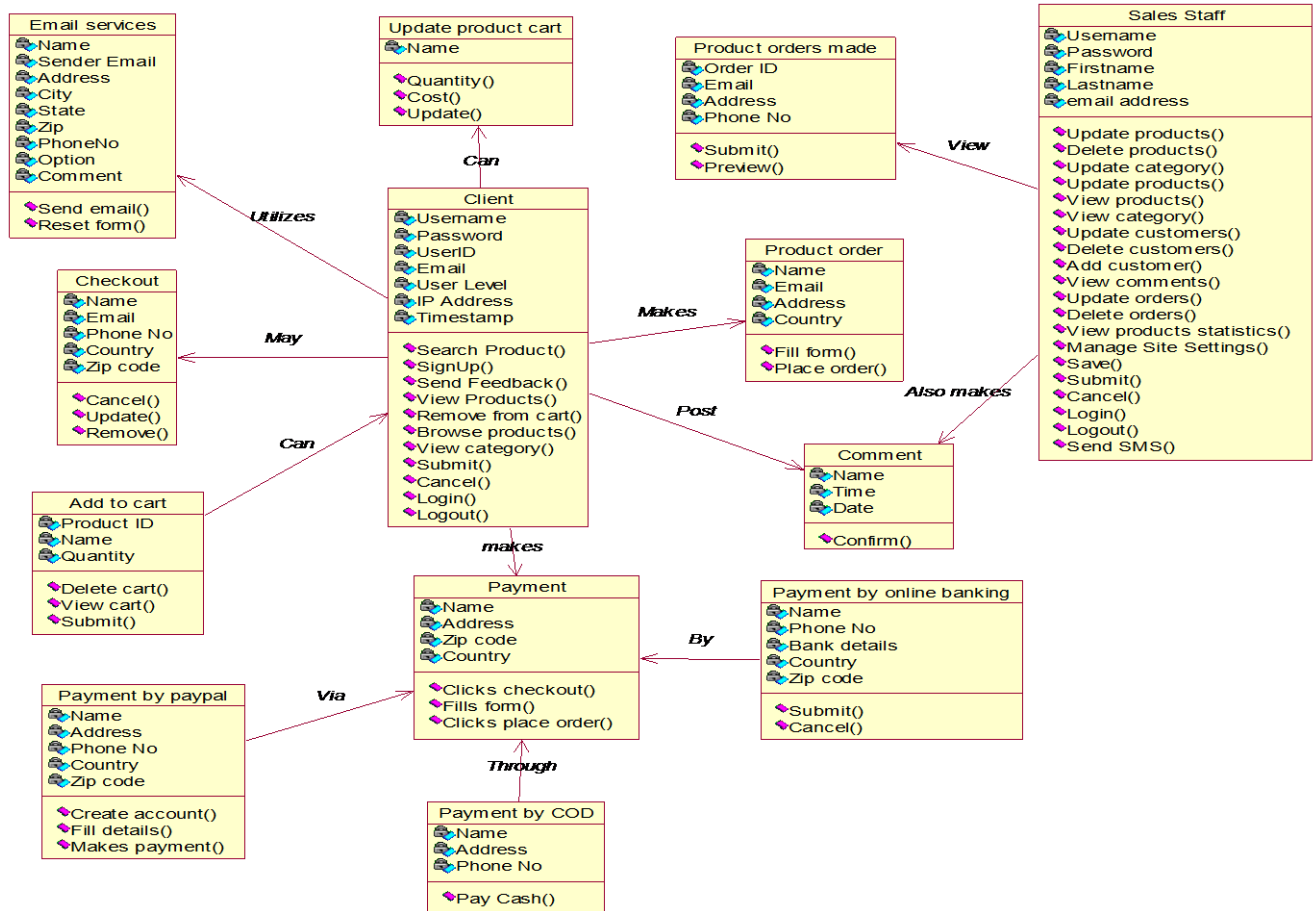


Figure 7. Class diagram for the eco-sourcing tool

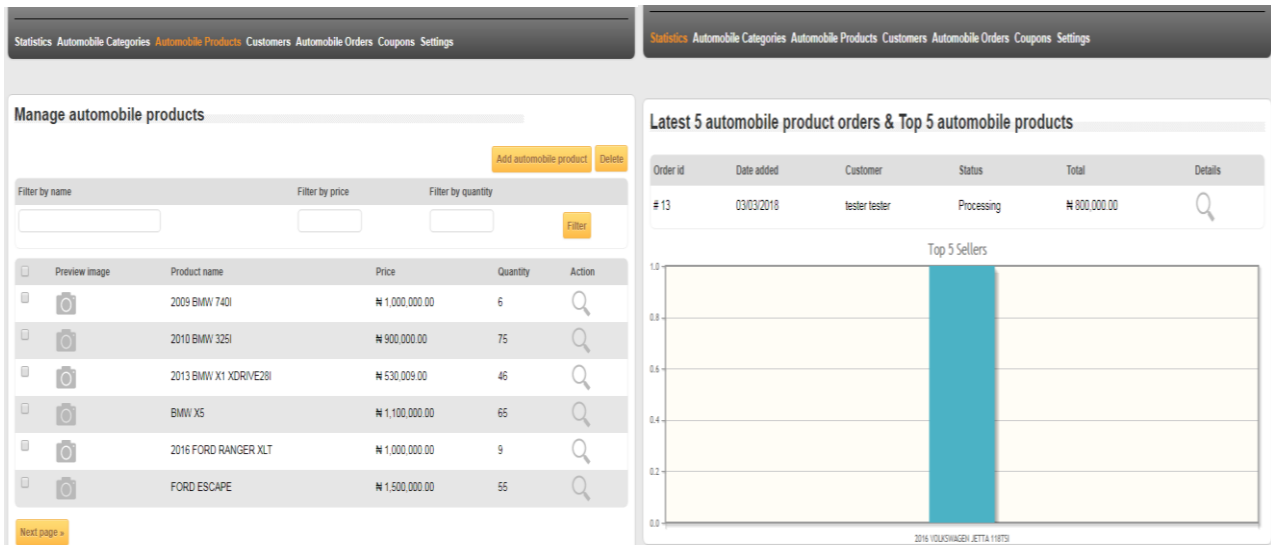


Figure 8. Support staff interface of the eco-sourcing tool

5. RESULTS AND DISCUSSION

Data was collected using questionnaire instrument to assess the applicability of the developed eco-sourcing tool by measuring the perception of respondents regarding how the tool facilitates clients and sales staffs in carrying out procurement and management of products. The questionnaire was sent to a specific group of respondents who are familiar with eco-sourcing operations in Malaysia. Thus, 60 copies of questionnaires were sent out and 50 questionnaires were received back which is 93.67% of the response rate. Microsoft excel was employed as a statistical tool to analyze the collected data using descriptive statistics to interpret the data based on the replies of respondents. The demographic characteristics of the respondents involve 67 per cent male and 33 per cent female respondents as seen in Figure 9. Moreover, results from Figure 9 depicts that out of the 50 respondents, 5 are between 16-20 years, whereas 12 are between 21-25 years old, then 10 are between 26-30 years old and 14 are between 31-35 years old. Lastly, 9 are 36 and above.

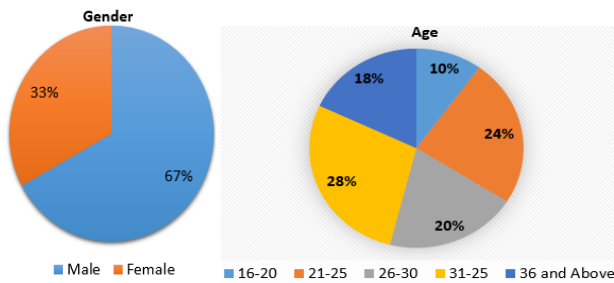


Figure 9. Gender and age distribution

The bar chart in Figure 10 shows the result of clients that wants the proposed eco-sourcing tool for SME.

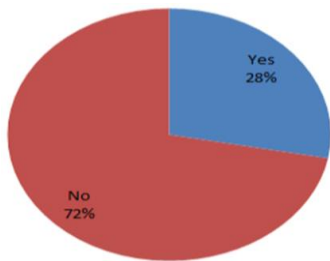
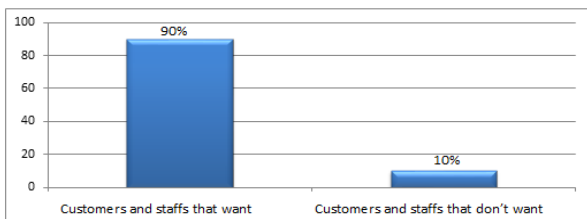


Figure 10. Customer preference and prior use distribution

The pie-chart in Figure 10 depicts users that have previously procured a product using an online system. The results from Figure 10 reveal that 72% of the

intended users have used online platform for procurement activities before, while 28% of the intended users have not utilizes such system before.

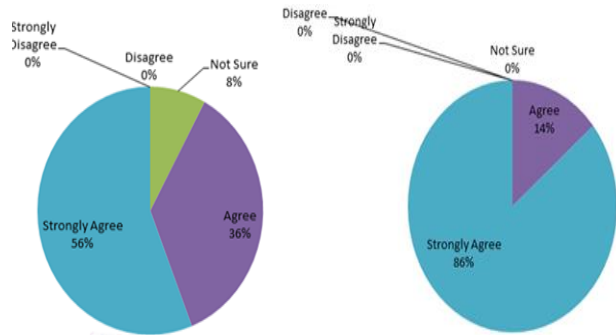


Figure 11. Effective, efficient, and search function preference

Furthermore, the first pie-chart in Figure 11 assesses if the developed eco-sourcing tool for SME is effective and efficient. Accordingly, 56% of the intended users strongly agree, 36% agree, 8% are not sure, 0% disagrees, and likewise 0% strongly disagrees. Next, the second pie-chart in Figure 11 evaluates if clients should be allowed to search for available products. The results reveal that 86% strongly agrees, 14% agrees, 0% are not sure, 0% disagrees, and 0% strongly disagrees.

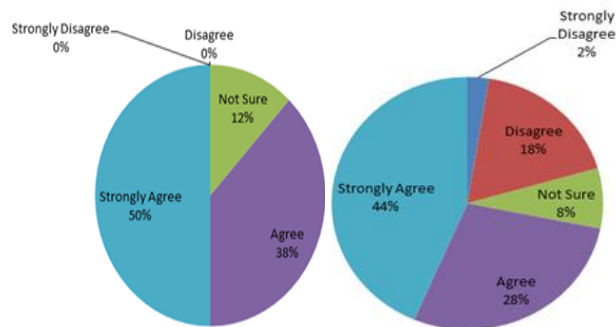


Figure 12. Eco-sourcing priority, and eco-sourcing versus manual preference distribution

Moreover, the first pie-chart in Figure 12 investigates if the developed eco-sourcing tool should be a priority for SMEs and the results suggest that 50% of the intended users strongly agree, 38% agree, 12% are not sure, 0% disagrees, and 0% strongly disagrees. The second pie-chart in Figure 12 assesses if the eco-sourcing tool is preferable than the manual sourcing approach and the results as seen in Figure 12 suggest that 44% of the intended users strongly agree, 28% agree, 8% are not sure, 18% disagrees, and 2% strongly disagrees.



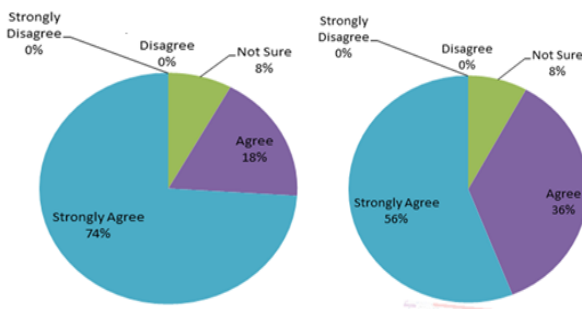


Figure 13. Eco-sourcing priority, and eco-sourcing versus manual preference distribution

Following, in Figure 13 the first pie-chart shows the result that investigates if developed eco-sourcing tool should include feedback page and the result suggest that 74% of the intended users strongly agree, 18% agree, 8% are not sure, 0% disagrees, and 0% strongly disagrees. Whereas, the second first pie-chart assesses if using the developed eco-sourcing tool to register and purchase products is quick and the results suggest that 60 % of the intended users strongly agreed, 30% agree, 10% are not sure, 0% disagrees, and 0% strongly disagrees.

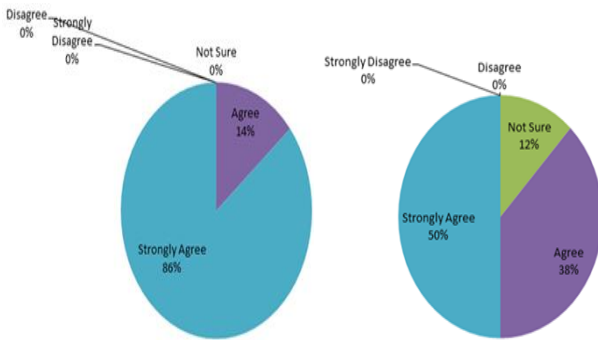


Figure 14. Eco-sourcing tool is efficient and reliable to buy or sell at ease, and privacy and security distribution

Similarly, the first pie-chart in Figure 14 evaluates if the eco-sourcing tool is efficient and reliable to buy or sell at ease and the result reveal that 86% strongly agrees, 14% agrees, 0% are not sure, 0% disagrees, and 0% strongly disagrees. In the second pie-chart in Figure 14, the question assesses if the eco-sourcing tool provides privacy and security of customers' data and 50% of the intended users strongly agrees, 38% agree, 12% are not sure 0% disagrees, 0% strongly disagrees that customers' privacy and data are secured in eco-sourcing tool.

In addition, the last question assesses if the developed eco-sourcing tool saves cost and time of customers and sellers. Results from Figure 15 in the first bar-chart reveal that 44% of the intended users strongly agree, 28% agree, 8% are not sure, 18% disagrees, and 2% strongly disagrees. Moreover, the second bar-chart in Figure 15 evaluates eco-sourcing tool should be popularly deployed in SMEs and the result indicates that 74% of the intended

users strongly agree, 18% agree, 8% are not sure, 0% disagrees, and 0% strongly disagrees.

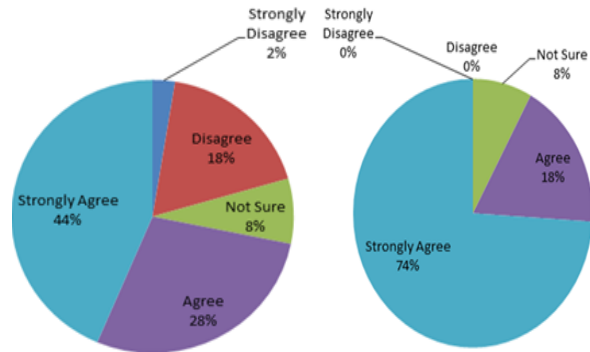


Figure 15. Eco-sourcing tool saves cost and time, and full deployed in SMEs distribution

Respectively, based on the data from questionnaire analysis, results suggest that clients only procure products manually by visiting the enterprise or retailers directly, after which they make payment either by credit card or cash. Accordingly, the current approach can be referred to as being inefficient due to the following weaknesses that were found out in the questionnaire, such as poor client service and inadequate client and sales management. To this end there is need for the developed eco-sourcing tool for SMEs.

## 6. IMPLICATIONS OF STUDY

### A. Theoretical Implications

This study develops MVC based eco-sourcing architecture that facilitates clients to search and make product order online without either going through long queue, hence easing the stress encountered at conventional procurement approaches. In addition, the designed MVC eco-sourcing architecture enable clients to sign-up, login, search through the category of products available, select products by adding to list, view and update the product list, delete from product list and make payment. Likewise, the MVC eco-sourcing architecture proves to be of great benefit to clients based on the rapid growth of internet.

Accordingly, sales staff can carry out administrative tasks like adding, updating, and deleting of products virtually. Besides, the eco-sourcing tool can reach larger number of clients since it is a web-based system. It has a less-complex easy to use interface which also is flexible and compactible to operate with other systems to support e-business processes. Moreover, sales staff can utilize the tool to add new products so that clients can make order of products from the developed eco-sourcing tool. Theoretically, this paper provides a set of questionnaire questions that can be applied in e-business research in evaluating the applicability of developed web-based systems.



### B. Practical Implications

At the moment SMEs are faced with high inventory costs due to the need to stockpile supplies that result in the inefficiencies of a manual process. Also, there are longer order processes and fulfillment cycles in the current system. Hence, it takes time to process orders and this leads to increment in administrative costs resulting from increase in processing costs through the traditional processes. Accordingly, this study develops an eco-sourcing tool that provides a user-friendly platform that enable clients to select the right product of their choice from the comfort of their homes and offices.

Practically, the developed tool provides clients with the ability to track the delivery status of ordered products purchased and the system acts as a marketing tool to promote products and services. Moreover, the eco-sourcing tool enables customers to make order easily in an effective way. The tool connects clients to the SMEs by creating a point of convergence between them. Technically, the eco-sourcing system limits obstacles between the sales staff and their clients by providing an online sourcing-based system with a secure payment method using credit cards to improve the service and guarantee security of procurement transaction carried out.

### 7. CONCLUSION

With the rapid change in technology especially in the SMEs sourcing sector, customers are demanding more value, less risk, and better integration of products, hence there is need to change business strategies, which can result in improved performance thereby meeting the client demands. Furthermore, in SMEs sales operations there is need for a tool that can integrate customers, products and sales staff with the help of internet technology. Currently, SMEs don't have sales system with zero downtime that reduces product error, aid in customer satisfaction, and facilitates procurement operations.

Therefore, this paper adopted MVC architecture to design MVC based eco-sourcing architecture that was further utilized to develop an eco-sourcing tool towards address problems faced by clients and sales staffs in SMEs sourcing management. The developed tool was validated using data from questionnaire instrument to assess the applicability of the tool. Results from the data analysis reveal that respondents accept the developed eco-sourcing tool for SMEs. Also, the respondents preferred the developed eco-sourcing tool than the conventional sourcing approaches.

Furthermore, every research is faced with limitations as such one of the limitations of this study is that empirically the developed eco-sourcing system was evaluated with data from only 50 samples. Thus, there is need to collect data from more respondents to further evaluate the applicability of the tool. Secondly, data was collected from respondents familiar with e-sourcing and retailing management in Malaysia only. Thus, results

from this study cannot be generalized to other sectors and country. Accordingly, future work will involve collecting data from more respondents from different sectors and countries to further assess the applicability of the developed tool.

### REFERENCES

- [1] J. Bauer, and D. Jannach, "Optimal pricing in e-commerce based on sparse and noisy data," *Decision Support Systems*, vol. 106, pp.53-63, 2018.
- [2] M. Yadav and Z. Rahman, "Measuring consumer perception of social media marketing activities in e-commerce industry: Scale development & validation," *Telematics and Informatics*, Vol. 34, pp.1294-1307, 2017.
- [3] D. Di-Fatta, D. Patton and G. Viglia, "The determinants of conversion rates in SME e-commerce websites," *Journal of Retailing and Consumer Services*, Vol. 41, pp.91-108, 2018.
- [4] D. Zhang, P. Zhu and Y. Ye, "The effects of E-commerce on the demand for commercial real estate," *Cities*, vol. 51, pp.106-120, 2016.
- [5] J. Shao, H. Yang, X. Xing and L. Yang, "E-commerce and traffic congestion: An economic and policy analysis," *Transportation Research Part B: Methodological*, vol. 83, pp.91-103, 2016.
- [6] M. Hudák, E. Kianičková and R. Madleňák, "The importance of e-mail marketing in e-commerce," *Procedia engineering*, Vol. 192, pp.342-347, 2017.
- [7] T. Oliveira, M. Alinho, P. Rita, and G. Dhillon, "Modelling and testing consumer trust dimensions in e-commerce," *Computers in Human Behavior*, vol. 71, pp.153-164, 2017.
- [8] Y. Zhao, G. Kou, Y. Peng, and Y. Chen, "Understanding influence power of opinion leaders in e-commerce networks: An opinion dynamics theory perspective," *Information Sciences*, vol. 426, pp.131-147, 2018.
- [9] Y. Yu, X. Wang, R.Y. Zhong and G.Q. Huang, "E-commerce logistics in supply chain management: Practice perspective," *Procedia CIRP*, vol. 52, pp.179-185, 2016.
- [10] J.P. Dias, and H.S. Ferreira, "Automating the extraction of static content and dynamic behaviour from e-commerce websites," *Procedia Computer Science*, vol. 109, pp.297-304, 2017.
- [11] M. Kadłubek, "The Selected Areas of E-logistics in polish E-commerce," *Procedia Computer Science*, vol. 65, pp.1059-1065, 2015.
- [12] N. Jayapandian, R. Menagadevi, S. Abinaya and O.S. Sampoorani, "To Enhance Consumer Privacy and Security for Online Shopping Using MD5 Algorithm," *International Conference on Innovations in Information, Embedded and Communication System*, pp. 1-4, 2017.
- [13] S. Kabanda and I. Brown, "A structuration analysis of Small and Medium Enterprise (SME) adoption of E-Commerce: The case of Tanzania," *Telematics and Informatics*, vol. 34, pp.118-132, 2017.
- [14] Y. Kim, and R.A. Peterson, "A Meta-analysis of Online Trust Relationships in E-commerce," *Journal of Interactive Marketing*, vol. 38, pp.44-54, 2017.
- [15] K. Bredzel-Skowera, and T. Turek, "The prospects of E-commerce in Poland," *Procedia Computer Science*, vol. 65, pp.1114-1123, 2015.

- [16] B. Anthony Jnr, "A developed software agent-knowledge-assisted procurement management tool for retailing enterprise: A feasibility study," *VINE Journal of Information and Knowledge Management Systems*, vol. 49(1), pp. 54-75, 2019.
- [17] T.M. Nisar and G. Prabhakar, "What factors determine e-satisfaction and consumer spending in e-commerce retailing?," *Journal of Retailing and Consumer Services*, vol. 39, pp.135-144.
- [18] Statista, "Statistics and Facts about E-commerce in the United States," [Available online] <http://www.statista.com/topics/2443/us-ecommerce/> (Accessed 11 February 2018), 2015.
- [19] R. Purwaningsih, and B. Adison, "Path analysis method to identify factors affecting consumer interest on online shopping," *2<sup>nd</sup> International Conference on Science in Information Technology*, pp. 20-25, 2016.
- [20] Z.Q. Cheng, X. Wu, Y. Liu and X.S. Hua, "Video2Shop: Exact Matching Clothes in Videos to Online Shopping Images," *IEEE Conference on Computer Vision and Pattern Recognition*, pp. 4169-4177, 2017.
- [21] P. Yogananth, K. Priyadharshini, S. Mahalakshmi, R. Udhayasanthiya and A. Shilpasree, "Customer demanding products in online shopping—A novel framework," *International Conference on Algorithms, Methodology, Models and Applications in Emerging Technologies*, pp. 1-4, 2017.
- [22] D.A.A.G. Singh, P.M. Thamizhthendral, M. Shalini and E.J. Leavline, "Mobile Application for Online Automobile Accessories Shopping System," *International Journal of Computer Science and Mobile Computing*, Vol. 5, pp.605-610, 2016.
- [23] J. Jung, Y. Matsuba, R. Mallipeddi, H. Funaya, K. Ikeda and M. Lee. "Evolutionary Programming based Recommendation System for Online Shopping", pp. 1-4, 2016.
- [24] S.H. Mahmud, M.A. Kabir, O.A. Salem and K.N.G. Fernand, "The comparative analysis of online shopping information platform's security based on customer satisfaction," *5<sup>th</sup> International Conference on Computer Science and Network Technology*, pp. 157-161, 2016.
- [25] Y. Yamamoto, T. Kawabe, S. Tsuruta, E. Damiani, A. Yoshitaka, Y. Mizuno, Y. Sakurai and R. Knauf, "Enhanced IoT-Aware Online Shopping System," *12<sup>th</sup> International Conference on Signal-Image Technology & Internet-Based Systems*, pp. 31-35, 2016.
- [26] Z. Li and Z. Luhua, "Design and Implementation of Online Shopping System Based on the Struts Framework," *The Open Automation and Control Systems Journal*, Vol. 6, pp. 387-392, 2014.
- [27] A. Romadhony, S. Al Faraby and B. Pudjoatmodjo, "Online shopping recommender system using hybrid method," *International Conference of Information and Communication Technology*, pp. 166-169, 2013.
- [28] G. Lan-juan, L. Quan, and J. Xue-mei, "The Design and Implementation of the Online Shopping System for Digital Arts," *Ninth International Symposium on Distributed Computing and Applications to Business, Engineering and Science*, pp. 414-416, 2010.
- [29] B. Anthony Jnr, "Validating the usability attributes of AHP-software risk prioritization model using partial least square-structural equation modeling," *Journal of Science and Technology Policy Management*, vol. 10(2), pp. 404-430, 2019.
- [30] B. Anthony, M. Abdul Majid, and A. Romli, "Heterogeneous agent-enabled decision system for evaluating Green IT performance in industrial environments," *Journal of Decision Systems*, vol. 27(1), pp. 37-62, 2018.
- [31] B. Anthony Jr, M. Abdul Majid, and A. Romli, "A collaborative agent based green IS practice assessment tool for environmental sustainability attainment in enterprise data centers," *Journal of Enterprise Information Management*, vol. 31(5), pp. 771-795, 2018.



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