The Applications of Game Theory in Processing the Orders of Company OL-A and Company OL-B

Deceree Anne A. Haboy, Daniel John B. Sacramento, Ervin Josh P. Santos
Christine Angelie Y. Taw, Rene D. Estember
School of Industrial Engineering and Engineering Management
Mapúa University
Manila, Philippines

daahaboy@mymail.mapua.edu.ph, Djbsacramento @mymail.mapua.edu.ph,
ejpsantos@mymail.mapua.edu.ph, caytaw@mymail.mapua.edu.ph, rdestember@mapua.edu.ph

Abstract

There are a lot of things that you can do online, especially today where the internet is more accessible than before. One of the most common internet activities is the purchase of goods. The two online shops that are famous to different people are OL-A and OL-B. People have been increasingly interested in buying online, particularly during the Covid-19 epidemic, because they are obliged to stay inside their houses rather than going outside. Shopping online has been a trend for people during this pandemic, but there are still some problems that occur when shopping online. This paper tackles one of these problems which is about the ordering process of OL-A and OL-B. The researchers will also determine how these two online shopping stores can improve their ordering process and what part of their ordering process they should enhance. After gathering 52 respondents for the data, the researchers applied Game theory by using the Nash equilibrium for solving the data gathered. This enables the researchers to evaluate how OL-A and OL-B may improve or upgrade their shipping processes to better serve their consumers. This study identifies which aspects of the ordering process OL-A and OL-B could improve, and which aspects should be improved.

Keywords
Nash Equilibrium, Game theory, E-commerce

1. Introduction
Current Issues Related to the topic
Order processing starts with a customer placing an order, but in this process sometimes customers unintentionally place their orders wrong product quantity, and shipping address information. And there are also times that a consumer is unsure what type of product or service would meet his or her needs, they may seek guidance from a customer service. But during this exchange, problems may arise throughout this information transmission. It is possible that the consumer does not communicate clearly, or that the person who gets the request is inexperienced. As a result of these issues, a customer may receive a product or service that is inadequate. There is also an issue regarding the fulfillment, in here orders for actual objects and goods are picked and packed at the facility. When a customer order is picked, an employee searches a warehouse for the desired items, removes them from storage, and then adds them to the customer's order. An employee packs an order by taking the selected items and placing them in a shipping box or container. The usual mistake here is that the products, colors, and quantity are all wrong. From time to time there are missing products, incomplete orders, and incorrect packaging are the order packing issues that can result in product damage. (Reynolds, 2017)

Background of the Study
The most popular e-commerce platform in the Philippines is OL-A and OL-B. OL-B is a marketplace for online purchasing and sales. The Company sells products in a variety of areas including electronics, home-made goods, toys, apparel, equipment for sport and food. OL-A is a prominent Southeast Asia and Philippines e-commerce platform. It is a region-specific platform that offers both consumers and sellers smooth, safe, and quick online shopping experience

with robust payment and logistic support. An e-commerce platform is a large market that can reach most of all the places in the Philippines. The customers will be able to reach out to the seller, purchase the things that they want to buy anywhere and anytime by just using their mobile phone. E-commerce platforms have the advantage of having a lower price compared to the selling price in the mall. Sellers have more opportunity to sell and get customers because of the vast information that a customer can get to the products that they want. During this pandemic e-commerce platform grew to be more prevalent because most of the people cannot go out to buy in the mall, markets, boutiques, and in any physical stores where a customer can purchase anything. E-commerce is certainly a good choice to buy things that we want, but these platforms have their disadvantages. Late delivery issues, security of the items, lack of privacy, high labor cost is some of the disadvantages that a customer experiences in using eCommerce platforms.

Business-to-consumer (B2C) orders that are shipped directly to a single shopper's house are referred to as ecommerce order fulfillment. If shipping, taxes, and other expenses are excessively exorbitant, 61% of buyers will abandon their purchase. When it comes to reviewing their online shopping, 53% of shoppers feel quickness of delivery is a critical issue. If they have a bad delivery experience, 38% of buyers will never shop with that retailer again. Because of poor delivery times, 25% of customers have canceled an order. (Lopienski, 2003). Automating order processing can help streamline the fulfillment and shipping process, increase customer satisfaction, and improve operations. (Callarman, 2020). Both notions, client retention and satisfaction, are growing more significant for both online and offline businesses. (Vasic, et al., (2019).

Gap of Missing Information
E-commerce platforms have a lot of strategies to have the best satisfactory level for their customers. Using game theory, online shops use game theory to analyze the stable state of a marketplace. Game theory in E-commerce platforms dealt with the study of Jianya, Li, Zhang, Xu entitled e-Commerce Game Model Balancing Platform Service Charges with Vendor Profitability. In this study, the researcher used game theory for determining the best billing rate for an e-commerce platform. A dynamic game between two actors, the platform host, and the union of e-retailers, was used to represent e-commerce behavior based on game theory. Backward induction was used to calculate the Nash equilibrium of this game. And, when this model was applied to a real data set of Alibaba's transaction records in a case study, Alibaba's profit grew 5.87 times above the present profit value, while e-retailers' profit increased 1.41 times. An enhanced version of E-CGM is also proposed to include the unpredictability generated by the existence of distinct product categories, thereby considering extra characteristics of a real-world business environment. Therefore, it proves that game theory helps the researcher to find out if a company will enhance or improve its strategy. However, their study had limitations. For example, the platform must have a monopoly on its market, leaving e-retailers with no other options and unable to negotiate service fees., This paradigm significantly weakens the position of e-retailers, potentially leading to a worsening societal crisis. To mitigate the impact of these issues, the Nash equilibrium can be examined and determined as a percentage of the closing cost, resulting in a more accurate service charge calculation approach, and reducing these constraints. In this current study, we will be using game theory to analyze the possible changes for the ordering process of the two companies to have a better satisfactory level for their customers. Moreover, there will be a different factor that will be considered, and these are all related to the processing of order.

1.1 Objectives
The main objective of this study is to determine the processing orders of OL-A and OL-B using Game Theory. The specific objectives of this study are as follows: (1) Determine the relevant factors that a customers want in terms of their satisfaction.; (2) Determine which among the factors may have advantage on OL-B or OL-A.; (3) and to determine the possible recommendations on how to handle or enhance the processing of orders on OL-B and OL-A.

2. Literature Review
There are a lot of people these days that rely on e-commerce platforms such as OL-A and OL-B. One of the key factors that OL-A and OL-B need to take to have complete customer satisfaction is the accuracy of time delivery. Delivery services are the offline characteristics of an online shop. (Handoko, 2016). This can be determined if the time of delivery of the item that the customer ordered is either on time, early, or late. According to a research paper from Vietnam, one of the problems that they saw from OL-A getting negative reviews is the delivery, and customer satisfaction (Dang, 2021). During this time of pandemic E commerce has been a huge help for people, especially since not everyone can go outside to get what they want. A study also shows that one of the factors that influence the customer's satisfaction on buying on E commerce applications is the accuracy of the time of delivery (Shaari et al., 2020). It is important for e-commerce companies such as OL-A and OL-B to improve their delivery time because this

might also affect the customer's influence on using their application. According to the findings, the delivery procedure in online purchases has a major impact on consumer satisfaction and the decision to buy from an online shop. (Cosar, et al., 2017). A new approach using game theory helps to solve the process regarding the concern of production and transportation planning in decision making. The Coordination is supported by Mathematical models that were implemented in linear programming which simulates the process within the various possible pools of partners or coalitions (Yiti Wang, 2018). According to the nature of partners, the collaboration between homogeneous partners concerns its multiple transports such that in the other case it is more on heterogeneous partners. This includes one manufacturer and the multiple transport operators.

When online selling and online buying, it is important for both seller and buyer to connect with each other. According to a study about the relationship between buyers and sellers, homophily, reciprocity, and structural equivalence are the general mechanisms that drive them following both buyers and sellers (Xiao et al., 2015). It is important to have a connection between buyer and seller when shopping online because unlike shopping face to face, there are still information that the buyers want to know before buying an item.

As time goes by, more people will start relying on e-commerce for buying things online. Especially since it is accessible and convenient for the customers to use, because of this OL-A and OL-B will need to satisfy more and more customers if they do not want to get bad reviews. When running a business online, there will obviously be advantages and disadvantages that will affect the customers and the sellers as well. That is why it is important to continuously improve the online business and form strategies (Baker El-Ebiary et al., 2021). One way that OL-A and OL-B can improve their customer's satisfaction is by improving the way that they process the customer's orders. One of the factors that can make a customer loyal to your business is customer satisfaction. A study says that simultaneously and partially experiential marketing variables and customer satisfaction have a positive and significant effect on customer loyalty at the online shop (Sanjaya et al., 2020).

Recently, global mobile use has increased at an unprecedented rate, which has been mirrored in the popularity of smartphones. Numerous businesses have created their respective applications to exhibit their brand recognition and have begun to use them as an online marketing medium, sending push alerts and notifications to their customers' handheld devices. Consumers who got push alerts had a greater average monthly expenditure in markets than individuals who had labeled applications but did not acquire notifications (Costacurta, 2019). Notifications in online shopping are becoming more common since it enables a mobile app (or application software) to notify the customer of relevant messages without requiring the user to keep the program open. With this, users will receive the most up-to-date discounts, promotions, and even track orders from shopping apps such as OL-B and OL-A if app alerts are enabled. As a result, notifications are a one-way channel of communication via which manufacturers may directly communicate with customers (Sluis, 2014). Conversely, some claims were made those notifications are invasive and unpleasant, and that they can lead to client loss (Sluis, 2014; Taylor, 2014).

Order notifications are short messages that tell customers (the merchant) that a request was made or that an order notification has been sent. They are a great method to stay on top of your business and client issues. Customers have gotten accustomed to purchasing goods and services via the website because of the proliferation of online businesses and greater trust in payment processors. With that, order accuracy is a crucial statistic to monitor since it has a significant influence on customer satisfaction. Delivering inaccurate notifications in processing the orders ruins the trust of the customers and may also be expensive and time-consuming because you will have to invest more time and effort to correct it (Callarman, 2020). You must guarantee that your service is constantly dependable to ensure that every one of your clients has a pleasant overall experience. Giving consumers correct service notifications will motivate them to return because they will ensure they will not be underserved. While speed, precision, and dependability are all vital aspects of effective customer support, none of them operate as well on their own as they do together (NUeditor, 2017). Behavioural monitoring provides the information needed to 'tailor' pages, offers, and prices to the shopper's preferences. (Alreck, et al., 2007)

If a customer has been satisfied when online shopping at a certain application such as OL-A or OL-B, they will start promoting it to their colleagues, friends, or anyone close to them. This shows how important customer's satisfaction is. According to "signaling-theory", an effective customer service can convey product quality and after-sales information to the consumers (Lei et al., 2021). This can also reduce the impact of information disadvantage on consumer behavior since misinformation is one of the problems that buyers and sellers experience during online shopping.

One of the primary factors driving customer adoption of internet purchasing has been convenience. Buying and selling things on the internet has become a big part of many people's lives. People may buy from the safety of their own homes while not having to deal with a salesman. Online marketplaces offer a novel and better convenient way to trade almost any sort of product or service. Both firms and customers have embraced internet sales as a more cost-effective and easy method of doing business. Prior research on online customer satisfaction has highlighted numerous service comfort aspects specific to virtual commerce, showing some of the factors that make up the level of service quality, such as simplicity of use, immersiveness, information seeking, information complexity and diversity, and reliability (Jiang et al, 2013). In this study, the authors conduct in-depth concentrate team discussions with online customers to determine the characteristics of online buying convenience, and then construct and verify a five-dimension scale to evaluate online shopping convenience using data obtained from the target groups. The result shows that access, search, evaluation, transaction, and possession/post-purchase convenience are the five factors of online buying convenience. This result may be used as a starting point for more research into e-commerce customer service administration and can help companies identify and overcome major roadblocks to providing customers with a very convenient online purchasing experience.
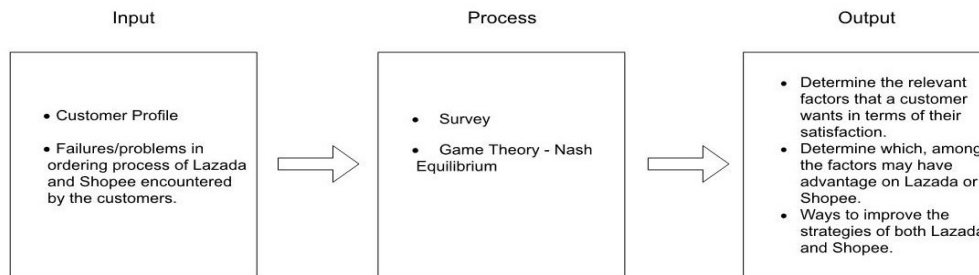
3. Methods

Figure 1

The framework illustrates the relationship between the three major parts of this research, which are: input, process, and output. The input is about the customer's profile, and failure or problems in the ordering process of OL-A and OL-B encountered by the customers. The process involves the use of a survey questionnaire which was the predominant measuring device used in this research, and game theory Nash equilibrium that will determine the result in maximum gain or minimum loss in their information flows in the system operations. The output or the outcome of this research are determining the relevant factors that a customer wants in terms of their satisfaction, which among the factors may have advantage on OL-A or OL-B, and ways to improve or enhance the strategies of both OL-A and OL-B. The respondents are people in the Philippines who use both OL-A and OL-B. For all variables in this research, the researchers used the 5-point Likert-type scale, ranging from (5) strongly agree to (1) strongly disagree. The primary objective of this research was to determine which among the factors may have advantage on OL-A or OL-B and Game theory of Nash equilibrium process was used to determine it.

4. Data Collection

For the data collection, the researchers gathered data regarding the processing of orders of the customers in OL-A and OL-B conducted through the initial survey. This includes the ordering process which are the order placement, payment details, picking and packing inventory, time of shipping out the item, and the delivery process. For the final survey, the researchers picked (4) four of the most problems that the customers encountered in the order processing in the initial survey. And those (4) four are: the updates of the delivery process, incorrect or damaged items in the picking and packing inventory, breach of confidential data in payment details, and lastly the false advertising. The survey was distributed online, and it is focused on determining the customer ratings for the ordering process. In this study, the researchers use game theory Nash Equilibrium method in order to meet the needed data for the study.

In this study, decision analysis was used to evaluate the data obtained in order to achieve the study's objectives. The Decision Analysis Process is used to assist decision-making bodies in evaluating technical, cost, and scheduling concerns, options, and the uncertainties associated with them. In this research, it aims to determine the relevant factors that customers want in terms of their satisfaction, determine which among the factors may have advantage on OL-B

or OL-A, and to determine the possible recommendations on how to handle or enhance the processing of orders on OL-B and OL-A.

We computed the data using the Nash equilibrium in game theory before doing the decision analysis to determine the optimal strategic choice. In this study, there were 60 respondents, 8 of whom used either OL-A or OL-B, and 52 of whom used both OL-A and OL-B.

5. Results and Discussion

5.1 Numerical Results
Nash Equilibrium Result
OL-A and OL-B are the game's players, with OL-B being the Player 1 and OL-A being the Player 2. The researcher divided the game into four sections since this study contains four criteria: no update delivery procedure, incorrect/damaged item, breach of confidential data, and false advertising. The researchers calculate the overall average value of each strategy based on the criteria, and these are the values used in the game. The game begins with selecting the highest payoff in each strategy from left to right, followed by selecting the highest payoff from top to bottom. After getting the highest payoff in each column and row, the researcher found the Nash equilibrium wherein the highest payoff meets and these are the shaded part in the figure. The red ones in the table are the highest payoff in both column and row. The first numbers which are on the left side of the data in the table is for Player 1 OL-B, and beside it with a slash on the right side is the data for Player 2 OL-A.

5.2 Graphical Results

Figure 2

Figure 2 shows the results from the data gathered by the researchers regarding the criteria "No Update on Delivery Process". The table shown in figure 1.1 has four questions, all about the No Update on Delivery criterion. Nash Equilibrium is performed on the data gathered by the researchers, and the results show that OL-A should enhance their delivery process by updating the customers regularly during the delivery process, and OL-B should enhance their delivery process by updating the status of the customer's delivery and by informing the customer when the delivery is going to be delivered. The rest of the questions that are not shaded in the table should be improved by both companies.

Figure 3

The table shown in figure 3 is the results for the Nash Equilibrium on the criteria "Incorrect/Damaged item" for OL-A and OL-B. The results show that for OL-B and OL-A, they should enhance their delivery process by continuing serving their customers the correct items. The rest of the questions that are not shaded in the table should be improved by both companies. The results also show that OL-A and OL-B need to improve on delivering the customer's items undamaged. An estimated 20-30% of those returns were due to damage, which was more than twice the rate of typical retail returns. can be important. (Farrel, 2019).

Figure 4

The table shown in figure 4 shows the results of the Nash equilibrium performed on the data gathered for the criteria "Breach of confidential data". The results show that for OL-A and OL-B to enhance their delivery process, they should enhance their security for the customer's online transactions. Both companies should also improve their security aspects in deciding whether to purchase in their stores.
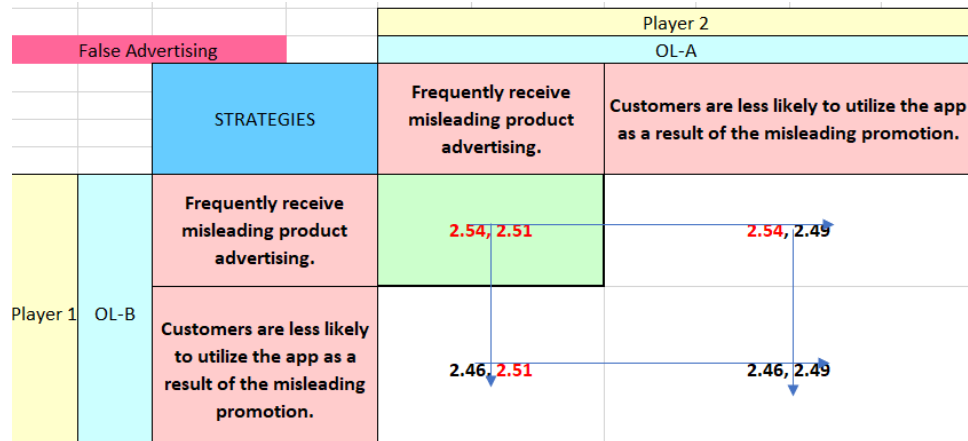
False Advertising			Player 2	
			OL-A	
	STRATEGIES		Frequently receive misleading product advertising.	Customers are less likely to utilize the app as a result of the misleading promotion.
Player 1 OL-B	Frequently receive misleading product advertising.		2.54, 2.51	2.54, 2.49
	Customers are less likely to utilize the app as a result of the misleading promotion.		2.46, 2.51	2.46, 2.49

Figure 5

The table shown in figure 5 shows the results of the Nash equilibrium performed on the data gathered for the criteria "False advertising". The results show that for OL-A and OL-B to enhance their delivering process, they should lessen the misleading product advertising in their store. The results also show that they should improve on lessening their misleading promotions to get more customers to utilize their applications. According to a recent study, misleading and deceptive advertising across various platforms is on the rise. (Grazioli, etal. 2003). A reduction in trust, satisfaction, and loyalty is one of the negative consequences of deceptive advertising. (Fayyaz, etal. 2015).

6. Conclusion

OL-A and OL-B are the Philippines' two most prominent e-commerce sites. These e-commerce platforms have procedures in place to ensure that customers are satisfied with their orders. However, these e-commerce sites have drawbacks when it comes to order processing. In this study, we focus on the four challenges that customers encounter and how they impact customer satisfaction. These are No update on delivery, Incorrect/Damaged item, Breach of confidential data, and Misleading advertisement.

In this research, the researcher used Nash Equilibrium from game theory. The Nash Equilibrium results show that there is room for improvement in No Update on Delivery when it comes to updating the status of the customer's delivery, by informing the customer when the delivery is going to be delivered, and delivery process by regularly updating the customers during the delivery process. Incorrect/Damaged Items must improve the delivery process by continuing to provide the correct items to their customers. Breach of confidential data results in enhancing their security for the customer's online transactions. Misleading advertisement results in their delivering process, they should lessen the misleading product advertising in their store.

Based on our findings, OL-A offers more benefits and is easier for users to utilize. OL-A was rated more effective by 60% of respondents, while OL-B was rated 40% more

References

Alreck, P., L., Settle, R. (2007). Consumer reactions to online behavioral tracking and targeting. https://link.springer.com/article/10.1057/palgrave.dbm.3250069
Callarman, S. (2020). How Automated Order Processing Accelerates Your Ecommerce Business. https://www.shipbob.com/blog/automated-order-processing/
Callarman, S. (2020, November 17). How to Increase Order Accuracy within Fulfillment Centers. Retrieved from https://www.shipbob.com/blog/order-accuracy/
Coar, R., Panyi, K. (2017). Try Not to Be Late! - The Importance of Delivery Service in Online Shopping. https://www.researchgate.net/publication/336246162_Try_Not_to_Be_Late__the_Importance_of_Delivery_Service_in_Online_Shopping
Costacurta, R. (2019, November). The Effects of Promotional Push Notifications from Supermarket Branded Apps on the Purchase Behavior. Retrieved from https://www.researchgate.net/publication/338177487_The_Effects_of_Promotional_Push_Notifications_from_Supermarket_Branded_Apps_on_the_Purchase_Behavio

Dang, H. H. (1970, January 01). Improving e-commerce service for better customers' satisfaction: Case: OL-A Viet Nam. Retrieved from https://www.theseus.fi/handle/10024/493585'

Farrel, J. (2019). Damaged customer relationships – the real cost of poor packaging and product breakages. https://www.itproportal.com/features/damaged-customer-relationships-the-real-cost-of-poor-packaging-and-product-breakages/

Fayyaz, N., & Lodhi, S. (2015). Deceptive advertising practices and customer loyalty: A case of mobile phones in Karachi, Pakistan. International Journal of Scientific and Research Publications, 5(11),469–474

Graziolo, S., Jarvenpaa, S. (2003). Consumer and Business Deception on the Internet: Content Analysis of Documentary Evidence. https://www.jstor.org/stable/27751079

Handoko, L., P. (2016). The Effect of Product Quality and Delivery Service on Online Customer Satisfaction in Zalora Indonesia. https://media.neliti.com/media/publications/2991-EN-the-effect-of-product-quality-and-delivery-service-on-online-customer-satisfacti.pdf

ICTMT (2019). Factors Influencing Purchase Intention on Online Shopping of the University Student. Retrieved from https://books.google.com.ph/books?hl=en&lr=&id=fA78DwAAQBAJ&oi=fnd&pg=PA132&dq=OL-A and OL-B time of deliveries&ots=2MFkOtEH6D&sig=hg7fcu-Rrcrlmu7iYWZjnhHIZ30&redir_esc=y#v=onepage&q=OL-A and OL-B time of deliveries&f=false

Jianya, Z., Li, D., Weigang, L., Zhang, Z., Xu, H. (2014). e-Commerce Game Model Balancing Platform Service Charges with Vendor Profitability. https://www.researchgate.net/publication/262791155_e-Commerce_Game_Model_-_Balancing_Platform_Service_Charges_with_Vendor_Profitability

Lei, H., Lu, D., & Zhang, H. (2021). Research on Promotion of Consumers' Application of After Service in Online Shopping Based on Evolutionary Game Theory-- Introduction of Smart Contract. Retrieved from

Lopienski, K. (2003). Ecommerce Fulfillment: The Unappreciated Yet Vital Strategy Brands Use to Win Loyal Customers. https://www.bigcommerce.com/blog/ecommerce-fulfillment/#understanding-the-order-fulfillment-process

NUeditor. (2017, October 30). The Importance of Speed, Accuracy, and Reliability in Customer Service. Retrieved from https://3ccontactservices.com/importance-speed-accuracy-reliability-customer-service/

Rigollet, D., & Kumlin H. (2015, May 25). Consumer Attitudes towards Push Notifications. Retrieved from https://www.diva-portal.org/smash/get/diva2:816600/FULLTEXT01.pdf

Reynold, M. (2017). Order Processing Problems. https://bizfluent.com/about-6082929-order-processing-problems.html

Thompson, LO., Leoneti, AB., Alcantara, RB., Pires, EC. (2016). Using game theory to assess multi-company strategies in watershed management. https://www.scielo.br/j/ambiagua/a/zsqDB8y4k86Lc5FhrStgD6f/?lang=en

Vasić, K., Kilibarda, M., Kaurin, T. (2019). The Influence of Online Shopping Determinants on Customer Satisfaction in the Serbian Market. https://scielo.conicyt.cl/scielo.php?script=sci_arttext&pid=S0718-18762019000200107#B7

Xiao, B., Huang, M., & Barnes, A. J. (2015, October 08). Network closure among sellers and buyers in social commerce community. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S1567422315000733

Yiting W. (2018). A game theory approach for the collaborative planning of production and transportation activities in the supply chain. Computer Science and Game Theory [cs.GT]. Université de Bordeaux, 2018. English. https://tel.archives-ouvertes.fr/tel-01801037/document

Yousef A. Baker El-Ebiary, E. A. (n.d.). The Effectiveness of using Electronic Commerce Mobile Applications During Covid-19 Pandemic. Retrieved from https://www.turcomat.org/index.php/turkbilmat/article/view/5507

Acknowledgements

Biography / Biographies

Deceree Anne A. Haboy was born in 2000 in Cotabato City, Philippines. She graduated Senior High School at Davao Merchant Marine Academy of Sothern Philippines in Davao City. She took the strand Technical-Vocational and Livelihood Major in Welding. In her Senior High School years, she took Practical Research and contributed to the paper entitled "The Effect of the Female Marine Engineers at Work in Cargo Ships". Currently, she is taking a degree in Bachelor of Science in Industrial Engineering at Mapua University. Her recent work is entitled as "Perceived Effect of Temperature Level to the Mental Fatigue Level of Students During Online Class".

Daniel John B. Sacramento, born on September 6, 2000 and is currently a student in Mapua University and is taking an undergraduate degree in B.S. Industrial Engineering.

Ervin Josh P. Santos, born on August 18, 2001 and a 2nd year Industrial Engineering student of Mapua University. He currently lives at Paranaque City, and is the eldest son of Janet Santos. He took his primary education at Mother Maria Madalena Starace school he graduated grade school as top 3 in his class. He then studied high school at St. Andrew's School Paranaque, where he also received different academic achievements. At senior high school he transferred at Mapua University and took the STEM course. At grade 12 his group received the best research paper award. He studied at Mapua University until college, where he took Bachelor of Science in Industrial Engineering program.

Christine Angelie Y. Taw, born on February 07, 2002 in Metro Manila, Philippines and a 2nd year Industrial Engineering student of Mapua University. She currently lives at San Nicolas Manila, and is the sole daughter of Julie Yeo. She took her primary to senior high school education at Philippine Academy of Sakya and graduated high school as top 5 in her class, and in senior high school she took the STEM course and graduated with honors.

Rene D. Estember is a Professor in the School of Industrial Engineering and Engineering Management at the Mapua University in Manila City, Philippines. He earned his B.S. in Management and Industrial Engineering from Mapua Institute of Technology, Master's in Business Administration from Ateneo de Manila University, Master of Science in Industrial Engineering from the University of the Philippines, and finishing his Doctorate in Business Administration from the Pamantasan ng Lungsod ng Maynila (PLM), all located in the Philippines. He is presently undertaking consultancy work on quality management systems documentation and also involved as a regular resource speaker of a training company conducting technical trainings. His research interests include human factor and ergonomics, manufacturing, risk management and optimization