Selection of E-Grocery Platform Strategy in Highly Urbanized Cities in the Philippines Using Analytic Hierarchy Process (AHP) and Structural Equation Modeling (SEM)

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Abstract

Online shopping has become a trend and has changed for the better, but most people still do not feel being engaged with e-grocery as many people find the problems in ordering to be outweighed by the convenience. The ability of e-groceries to successfully perform in the Philippines is low as expected compared to other e-retailing formats. Accordingly, the immediate objective of this study is to determine the significant factors that drive the consumers in highly urbanized cities in the Philippines to go for e-grocery shopping, so that platform strategies that will address Filipinos needs, wants, and expectations can be developed. A total of 429 respondents from highly urbanized cities in the Philippines voluntarily answered the distributed survey questionnaire. Factors such as Political, Psychological, Technological, Economical, Social, E-grocery Platform, Consumer-centric, Customer Segmentation, and Consumer Engagement to Changes were used first where a theoretical model was evaluated using Structural Equation Modeling (SEM) which outputs were used in Analytic Hierarchy Process (AHP) to get the respective percentages of each criterion that produced the best alternative as the basis for the recommended strategy and its benefits to consumers and retailers in the Philippines.

Keywords

E-grocery, E-retailing, Online Shopping, Customer Preference, Online Platform

1. Introduction

E-tailing has influenced the retail business in transforming physical shops from pure brick-and-mortar stores to the hybrid brick-and-click format that includes e-commerce for online transactions from ordering thru delivery to payment that enhanced shopping experience and established the plausibility of going into pure online retail stores, including the grocery business. It can be a struggle to purchase fresh fruits and vegetables online as people are unable to see the quality of the item before purchasing it. Consumers need to look it up physically because of the lack, or none, of the important details, hence e-grocery lacks the appeal despite e-tailing growing popularity among the many other retail formats.

Due to the pandemic, e-retailing in the Philippines continued to grow at a strong pace. With the loss of jobs, many switched to selling goods online especially through e-commerce websites like Lazada and Shopee. This spike of growth in e-commerce indicates that people strongly support this platform and will most likely open the option for businesses to transition online.

It would be of interest that an answer is pursued to the question, "What beneficial changes do Filipino grocery patrons perceive that will positively influence their buying decision to go for e-grocery?" In this regard, it would be equally important to answer a corollary question on what environmental and internal factors can drive the retail grocery business to shift to the e-grocery format. Accordingly, the study aims to achieve the following objectives: 1) To determine the significant factors that will drive consumers in highly urbanized cities to go for e-grocery retail stores; 2) To identify e-grocery platform strategies that will address e-grocers needs, wants, and expectations; and 3) To recommend an e-grocery platform strategy that will best serve the mutual interests of consumers and retailers.

The results of the study could benefit the grocery business and retailers in better understanding their target customers and in getting insights on new trends employing e-commerce and e-tailing formats. The study can be used as a reference for crafting a transition strategy to shift to hybrid and/or purely online formats to grow their grocery business by offering more value-added services and adapting to the changing demographics and needs of consumers.

The study covered the grocery segment of the retail industry in the Philippines and in particular the research locale will be in the highly urbanized cities of the Philippines. The location of the population densities are high, internet connection is widely available, and disposable incomes of urban families are much higher to afford buying basic and household necessities from groceries. The challenge of conducting the study lay in the difficulty to conduct site observations and personal interviews in major grocery outlets, hence an online survey was done as the main instrument in gathering data needed to achieve the objectives of the study.

2. Methodology

2.1 Conceptual Framework

The conceptual framework presented in Figure 1 serves as the guide in determining the factors that influence grocery customers to shift and prefer buying from online grocery stores in view of the perceived beneficial changes in the use of e-grocery offerings.

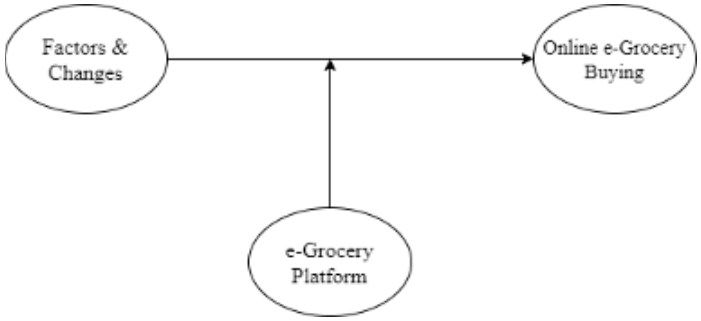

Figure 1. Conceptual Framework

The study discussed what drives the consumers in highly urbanized cities in the Philippines to go for e-grocery retail stores. Specifically, the study focused on recommending an e-grocery platform strategy that will best serve both consumers and retailers in the Philippines.

2.2 Data Collection

The study focuses on a sample of Filipinos who are currently living in highly urbanized cities in the Philippines and uses e-commerce platforms, especially during the COVID-19 pandemic. The survey was distributed through any social media platform such as Facebook, Instagram, and LinkedIn and all participants agreed to take the survey questionnaire voluntarily. A total of 429 people answered the survey questionnaire between March to April 2021 made by the

researchers. The participants of the study ranged from 18 to 47 years old and above with 45.5% identified as female and 54.5% as male. Also, people from Manila have the highest number of respondents of the survey among the other highly urbanized cities which is 24.5%.

2.3 Questionnaire

The first factor with listed questions with respect to knowledge observation in terms of being affected by the political stability, employment laws, and restrictions defined as Political Factors (P). The second factor focuses on what influences the consumer decisions defined as Psychological Factor (PS). The third factor with listed questions regarding how the platform will be user-friendly and run smoothly with minimal error identified as Technological Factor (T). The fourth factor is Economical (E) which focuses on how fully aware the consumers can inflation, taxes, and demand and supply affect their online shopping experience. The fifth factor consisted of questions regarding how the consumers behave as a consumer itself and what brings them to purchase in the market identified as Social Factor (S). The sixth factor is Consumer-centric (C) which focuses on how the price, brand image, past online shopping experience, and utilitarian aspect affect the consumers' future online shopping experience. The seventh factor focuses on how the consumers expect, need, and want the e-grocery platform run accordingly defined as the E-grocery Platform factor (EP1). The eight factor is Customer Segmentation (CS) which focuses on the consumer ordering behavior, intention to purchase, monthly personal income, demographic, and family size. Lastly, the Customer Engagement to changes (CE) towards e-grocery online shopping in keeping with their expectation, needs, and wants. All indicators were measured using a 5-point Likert scale ranging from strongly disagree (1) to strongly agree (5).

2.4 Structural Equation Modeling (SEM)

Structural Equation Modeling (SEM) as it is an important technique for multivariate analysis that is commonly used in the social sciences and its applications range from basic relationship analysis between variables to advanced control equivalence assessments for the first and relatively high constructs. IBM SPSS and AMOS 22 were used to assess the fit of the research model that derived the SEM of the study with the Maximum Likelihood estimation approach. Figure 2 demonstrates that the SEM framework had nine latent variables. For Incremental Fit Index (IFI), Tucker-Lewis Index (TLI), and Comparative Fit Index (CFI), all recommended minimum cut-offs were 0.80 or above in order to be considered as a good fit. However, Ferdinand (2014) and Wijanto (2008) mentioned that if the Incremental Fit Index (IFI), Tucker-Lewis Index (TLI), and Comparative Fit Index (CFI) provides a value ranging from 0.80-0.90, it is said to be a marginal fit or acceptable model. For absolute fit measures, the model fit was evaluated by the goodness of fit index (GFI), adjusted goodness of fit index (AGFI), and root means square error of approximation (RMSEA).

2.5 Analytic Hierarchy Method (AHP)

Analytic Hierarchy Method (AHP) is a quantitative multi-criterion decision-making (MCDM) process that Saaty first introduced to address problems that could be represented by a hierarchy or network system (Higgins and Benaroya, 2020). AHP was used to capture the strategic priorities as a collection of weighted criteria that was used to score projects and know the best alternative strategy for the e-grocery platform that will best serve the mutual interests of consumers and retailers in the Philippines. Table 1 demonstrates the identified e-grocery platform strategies.

Table 1. List of Variables and its Strategy Names

Variable	Strategy
X1	Brick-and-Click + Contract Couriers
X2	Brick-and-Click Grocery + Drop-off Delivery or Pick-up
X3	Brick-and-Click + Customer Pick-up
X4	Brick-and-Click + In-House Delivery

X5	Virtual Grocery (Central Warehouse + Home Delivery)

Table 1 shows the variables and its names of each strategy used for the AHP that was done for the study while Table 2 demonstrates the rubrics used in order to identify the values of the variables in Table 6 for the computation process. The table 2 shows the rubrics used to measure the alternatives and those were obtained in respect to the Likert scale used in the survey since it follows the 1-5 scoring. There are no guidelines, what scale to use for a specific decision problem, and the choice of the "best" scale is an ongoing discussion (Goepel, 2019). Multiple decision-makers are preferred most of the time rather than choosing a single decision-maker to prevent the bias and to lessen the chance of having wrong assumptions in the selection process (Bilsel et al, 2006). Therefore, the SEM-AHP technique was used as the multiple decision-makers in the selection of the strategy. The SEM facilitates testing of the causal relationship between different variables, model generation, and criteria weighting. Meanwhile, AHP provides an evaluation of alternatives based on parameters, allowing decision-makers to obtain a full ranking (Gbongli, 2017).

Table 2. Rubrics used to measure Alternatives

Rubrics	Description
0	No sub-criteria checked
1	1 sub-criteria checked
3	2-3 sub-criteria checked
5	4 sub-criteria checked

In order to calculate for the weights of the alternatives, the following rubrics were prepared. The rubrics were in respect to the likert scale values used in the survey so that the values will be uniform. And it is also identified to be scale in 0, 1, 3, and 5 because it is common to always use odd numbers to make sure that there is a reasonable distinction among the measurement points (Vargas, 2010). A checklist was used to verify if the identified alternatives fulfilled the description of the sub-criterias.

3. Results and Discussion

Both average variances extracted (AVE) and composite reliability (CR) is necessary to ensure that the degree of reliability exists in the data of the SEM. As well as the Cronbach's alpha as it is a fairly low approximation of reliability in practice since non-homogeneous test items will breach the model's conclusion. As well as the Cronbach's alpha as it is a fairly low approximation of reliability in practice since non-homogeneous test items will breach the model's conclusion. As can be observed with Table 3, all latent variables were all considered except for economical (AVE=0.409, CR=0.580). For Cronbach's alpha, all latent variables were considered acceptable since it surpasses the cutoff range, while customer engagement to changes appeared to be at a very good level as it is higher than 0.80 but not higher than 0.95 since it might be an indication of redundancy (Hulin et al., 2001).

Table 3. List of Factors with its Factor Loadings, Reliability, and Validity Measures

Factor	**Code**	**Loading (>0.70)**		**Cronbach's α**	**Average Variance Extracted (AVE)**	**Composite Reliability (CR)**
		Initial Model	**Final Model**			
Political	**P1**	0.48	0.48	0.762	0.403	0.728
	P2	0.83	0.84			
	P3	0.76	0.76			
	P4	0.65	0.65			

Psychological	**PS1**	0.65	0.59	0.76	0.474	0.73
	PS2	0.82	0.78			
	PS3	0.71	0.71			
	PS4	0.12	-			
Technological	**T1**	0.8	0.8	0.847	0.571	0.799
	T2	0.75	0.7			
	T3	0.86	0.83			
Economical	**EC1**	0.71	0.73	0.673	0.409	0.58
	EC2	0.7	0.7			
	EC3	0.44	-			
Social	**S1**	0.49	0.52	0.816	0.488	0.79
	S2	0.79	0.74			
	S3	0.8	0.81			
	S4	0.84	0.72			
Consumer-centric	**C1**	0.76	0.73	0.67	0.402	0.666
	C2	0.45	-			
	C3	0.57	0.56			
	C4	0.6	0.58			
E-grocery Platform	**EP1**	0.73	0.73	0.792	0.482	0.786
	EP2	0.49	-			
	EP3	0.83	0.83			
	EP4	0.7	0.69			
	EP5	0.52	0.52			
Customer Segmentation	**CS1**	0.68	0.48	0.758	0.416	0.73
	CS2	0.82	0.67			
	CS3	0.61	0.65			
	CS4	0.57	0.67			
	CS5	0.25	-			
Customer Engagement to Changes	**CE1**	0.81	0.81	0.938	0.5	0.869
	CE2	0.89	0.89			
	CE3	0.85	0.85			
	CE4	0.93	0.93			
	CE5	0.86	0.86			

Figure 2 with the support of Table 3 showed the initial SEM framework of the study and based on the figure, there are latent variables that are considered insignificant. Accordingly, a total of five indicators from different latent variables were eliminated. PS4 with a factor loading of 0.12 and CS5 with a factor loading of 0.25 were both removed since Hair et al. (2010) stated that if the standardized factor loadings are greater than 0.70, all of the standardized factor loadings should be statistically significant. If the factor loadings are less than 0.70, they are still significant. Moreover, the calculation contains more variances than explained variance (Hair, 2010). Since an optimal standardized factor loading is greater than 0.40 (Ertz et al., 2016), and preferably 0.70 or higher (Barrett, 2007), a revised model was developed by removing many indicators with standardized factor loadings less than 0.40. Whereas the other three indicators such as EC3 with a factor loading of 0.44, C2 with a factor loading of 0.45, and EP2 with a factor loading of 0.49 were eliminated as well as studies have found that factor loadings should be greater than 0.5 for better results (Truong & McColl, 2011; Hulland, 1999), while Chen & Tsai (2007) used 0.5 as a cut-off for suitable loadings in the tourism context.

Figure 2 shows the initial SEM framework of factors that drives the consumers in highly urbanized cities to possibly go for e-grocery retail stores rather than going to physical stores. Based on the Figure 2, five paths towards Customer Engagement to Changes were not significant and only Consumer-centric had a significant effect on Customer Engagement to Changes (β=0.843, p=0.001) which indicates that the customers' past online shopping experiences and how the consumer compare the brand matters on their past and future behavior especially when trying to use an online grocery platform.

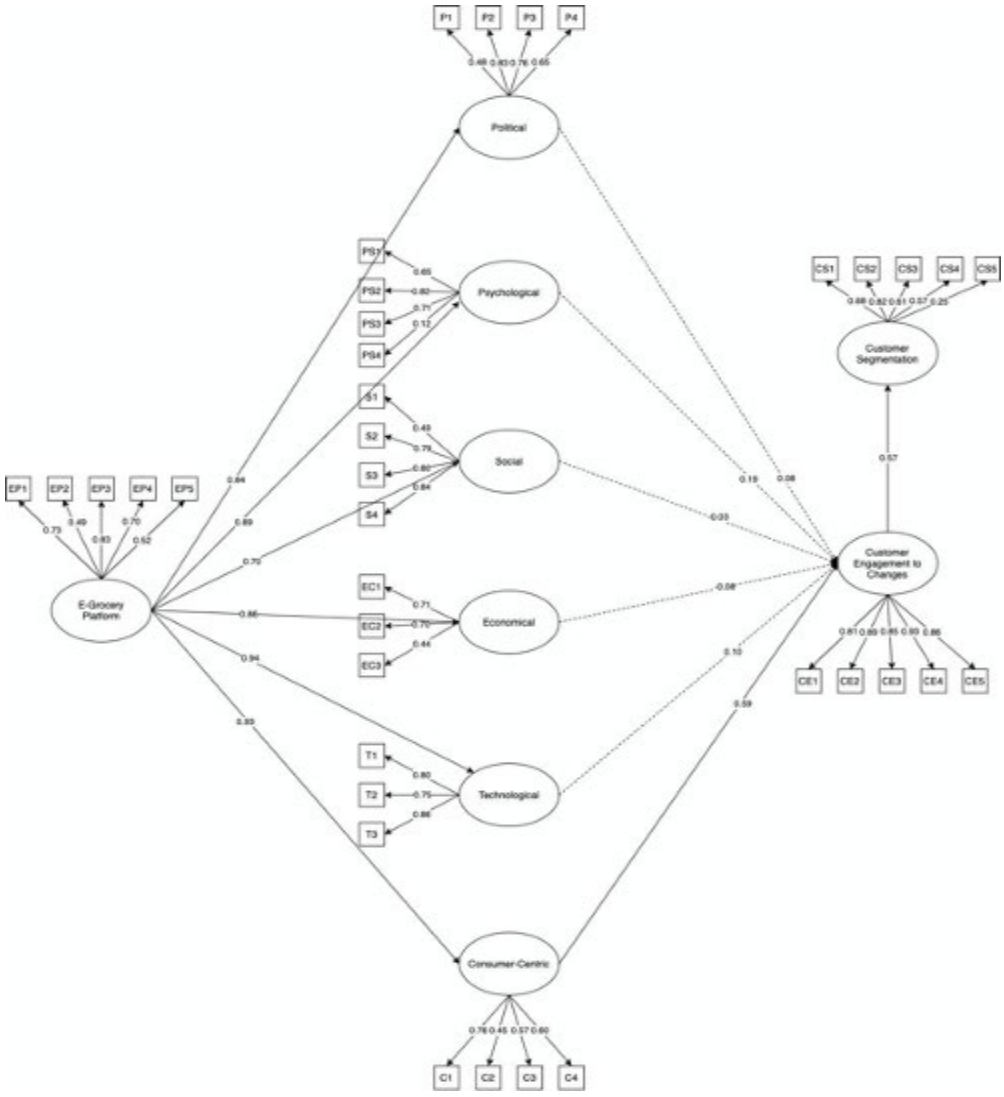

Figure 2. Initial SEM framework

Figure 3 shows the final SEM framework of factors that drives the consumers in highly urbanized cities to possibly go for e-grocery retail stores rather than going to physical stores. Two indicators, one from political factor (P1=0.48) and another one from customer segmentation factor (CS1=0.48), were not removed from the model even if the factor loadings were lower than 0.40 since modification indices were done to improve and have a higher Goodness of Fit Index (GFI) that will fit the suggested minimum cut-off. Moreover, confirmatory factor analysis with factor loadings of 0.4 and above are being considered when looking into pro-environmental action (Ertz et al., 2016) even in 0.50 is the usual cutoff being considered (Truong & McColl, 2011; Hulland, 1999).

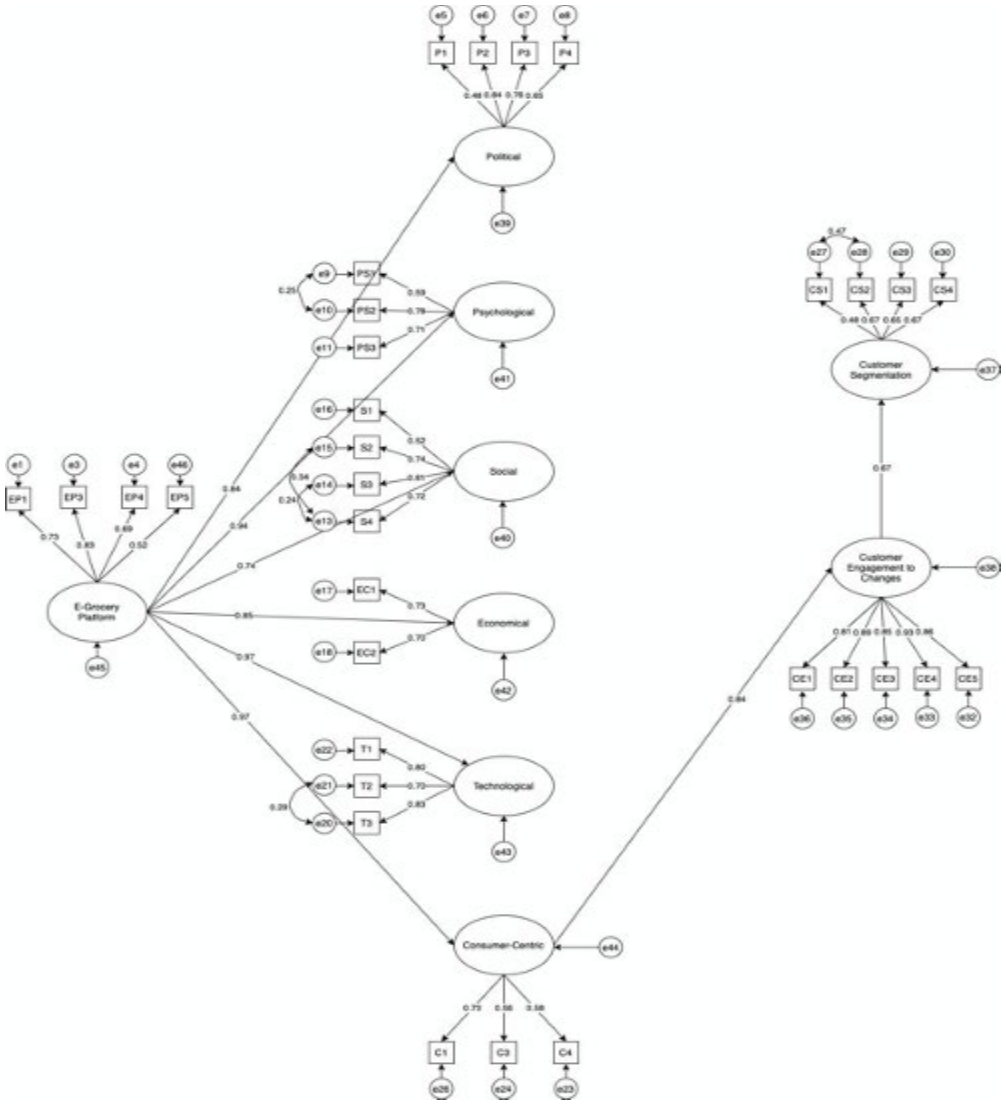

Figure 3. Final SEM framework

Table 4 shows a good result of RMSEA from the final model with a value of 0.068 which surpasses Hair (2014) recommended cut-off of 0.070. As well as with Goodness of Fit Index (GFI) since the value was above 0.80 as the recommended minimum cut-off (Gefen et al., 2000), while the value for Adjusted Goodness of Fit Index (AGFI) is 0.798 which is below 0.80, but both GFI and AGFI are considered a marginal fit when the AGFI result will be between 0.80-0.90 as Ferdinand (2014) and Wijanto (2008) mentioned. For Incremental Fit Index (IFI), Tucker-Lewis Index

(TLI), and Comparative Fit Index (CFI), all recommended minimum cut-offs will be considered to be a marginal fit or acceptable model when it provides a value ranging from 0.80-0.90 as Ferdinand (2014) and Wijanto (2008) mentioned.

Table 4. Final Parameter Estimates and Goodness of Fit

Goodness of Fit Measures of the SEM	Parameter Estimates	Minimum Cut-off	Supporting References
Incremental Fit Index (IFI)	0.895	0.80 ≤ IFI ≤ 0.90	Ferdinand (2014) Wijanto (2008)
Tucker Lewis Index (TLI)	0.884	0.80 ≤ TLI ≤ 0.90	Ferdinand (2014) Wijanto (2008)
Comparative Fit Index (CFI)	0.895	0.80 ≤ CFI ≤ 0.90	Ferdinand (2014) Wijanto (2008)
Goodness of Fit Index (GFI)	0.828	> 0.80	Gefen et al. (2000)
Adjusted Goodness of Fit Index (AGFI)	0.798	0.80 ≤ AGFI ≤ 0.90	Ferdinand (2014) Wijanto (2008)
Root Mean Square Error of Approximation (RMSEA)	0.068	< 0.07	Hair (2014)

Table 5 shows the direct, indirect, and total effects among the selected latent variables. The result of the SEM framework indicates that consumer-centric had a significant effect on customer engagement to changes (β=0.843, p=0.001) while there is significant indirect effect by e-grocery platform (β=0.190, p=0.295). On the other hand, the e-grocery platform gave the highest direct effect on the result towards consumer-centric (β=0.971, p=0.001), followed by technological (β=0.970, p=0.001), psychological (β=0.941, p=0.001), economical (β=0.848, p=0.001), political (β=0.841, p=0.001), and social (β=0.742, p=0.001). Meanwhile, it was found that customer engagement to changes had a significant direct effect on customer segmentation (β=0.675, p=0.001) while the e-grocery platform (β=0.553, p=0.001) and consumer-centric (β=0.569, p=0.001 had a significant indirect effect on customer segmentation.

Table 5. Direct, Indirect, and Total Effects of the Final SEM framework

Model Path	Direct effect	p-value	Indirect effect	p-value	Total effect	p-value
EP → C	0.971	0.001	-	-	0.971	0.001
EP → P	0.841	0.001	-	-	0.841	0.001
EP → PS	0.941	0.001	-	-	0.941	0.001
EP → S	0.742	0.001	-	-	0.742	0.001
EP → EC	0.848	0.001	-	-	0.848	0.001
EP → T	0.970	0.001	-	-	0.970	0.001
EP → CE	-		0.819	0.001	0.819	0.001

C → CE	0.843	0.001	-	-	0.843	0.001
CE → CS	0.675	0.001	-	-	0.675	0.001
EP → CS	-		0.553	0.001	0.553	0.001
C → CS	-		0.569	0.001	0.569	0.001

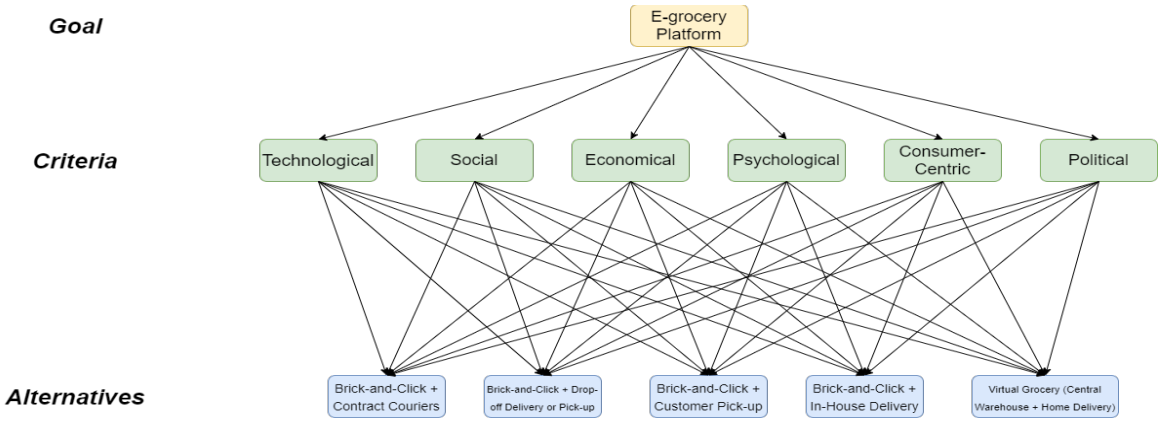

Figure 4. Decision Hierarchy for E-grocery Platform Strategy

Figure 4 illustrates the decision hierarchy of the E-grocery platform strategy which is divided into 3 levels, namely the Level 0, 1, and 2. Level 0 is the goal of the analysis which is to determine the best E-Grocery Platform Strategy. Level 1 is the multi criteria that consist of several factors which are identified from the SEM Framework that are significant factors to the E-Grocery Latent. Lastly, level 2 is the alternative choices which are the e-grocery platform strategies identified. It is used to identify the significant variable that is the best strategy to be recommended in an e-grocery platform.

Table 6. Strategy Value

Variable	Strategy	Political	Psychological	Technical	Economical	Social	Consumer -centric
X1	Brick-and-Click + Contract Couriers	5	3	5	3	3	3
X2	Brick-and-Click Grocery + Drop-off Delivery or Pick-up	5	5	5	3	3	3
X3	Brick-and-Click + Customer Pick-up	3	3	5	3	3	3
X4	Brick-and-Click + In-House Delivery	3	3	1	5	3	3
X5	Virtual Grocery (Central Warehouse + Home Delivery)	3	5	5	5	5	3

The values in Table 6 were obtained in respect to the rubrics in Table 2. Where the checklist was referenced to the list of factors with its Statement References in the Questionnaire. The values of the strategies were obtained if it satisfies the description of the rubrics guided by the results of the survey. This was prepared in preparation for the computation of the alternative results.

Table. 7. Weighted Criteria

Variable	Criteria	Weights
W1	Political	0.1582
W2	Psychological	0.1770
W3	Technical	0.1394
W4	Economical	0.1601
W5	Social	0.1827
W6	Consumer-Centric	0.1827

To be able to calculate for the alternative results, the criteria is weighted. These values were obtained by making a comparison matrix of the criterias. It is important to identify if the consistency ratio (CR) is less than 0.1 to be able to tell it has acceptable values. This means that the data indicates consistent judgment. It was calculated that it had obtained a consistency ratio of -0.0001 which satisfies the condition. After identifying that the values are consistent, the computation of alternatives are next in order to compute for the level of importance.

Table 8. Computation of Alternatives

Alternatives	Formula	Weights
Brick-and-Click + Contract Couriers	X1 = (5*W1) + (3*W2) + (5*W3) + (3*W4) + (3*W5) + (3*W6)	3.5955
Brick-and-Click + Drop-off Delivery or Pick-up	X2 = (5*W1) + (5*W2) + (5*W3) + (3*W4) + (3*W5) + (3*W6)	3.9495
Brick-and-Click + Customer Pick-up	X3 = (3*W1) + (3*W2) + (5*W3) + (3*W4) + (3*W5) + (3*W6)	3.2791
Brick-and-Click + In-House Delivery	X4 = (3*W1) + (3*W2) + (1*W3) + (5*W4) + (3*W5) + (3*W6)	3.0417
Virtual Grocery (Central Warehouse + Home Delivery)	X5 = (3*W1) + (5*W2) + (5*W3) + (5*W4) + (5*W5) + (3*W6)	**4.3187**

The calculation of the alternative results uses the strategy values and weighted criteria. And the computation shows that the Virtual Grocery is ranked the highest with a value of 4.3187 which will be chosen as the best recommended strategy. Both consumers and retailers could benefit since one courier only will be assigned to deliver the purchased products from the online platform. By that means, there will be no collaboration from different courier service and logistics companies that could give no assurance of handling the purchased products extra carefully. Since the purchased products will be delivered by the same courrier, the business can have more time focusing on the quality of the products and can notice right away if there is a problem. Interestingly, it can reduce the delivery fees and assure the consumers about the potential harm and certainty of the products which surely benefits the consumers and the retailers unnoticeably. A centralized distribution model can lead to better delivery performance, better customer service and less inventory carrying and transportation cost (Fröderberg, 2016).

4. Conclusion

The researchers evaluated the significant factors that could possibly drive consumers in highly urbanized cities in the Philippines to go for e-grocery retail stores. To be followed by developing and recommending a platform strategy that best serves the mutual interests of consumers and retailers. Using the Structural Equation Modeling (SEM), the significant factors driving consumers in highly urbanized cities to go for e-grocery retail stores were all determined with statistical results. From there on, Analytical Hierarchy Process (AHP) criteria weights are calculated and the

alternative values were identified. With that, comparing the alternatives to the respective criteria, the best alternative was produced as the basis for the recommended scheme and its benefits.

Filipino grocery patrons value price, brand image, past online shopping experience, and utilitarian aspects when using e-grocery platforms. With the results of the SEM-AHP technique, retailers should focus on creating virtual groceries that focus more on consumer-centricity in their platform to be able to provide a positive influence for consumers to shift to e-grocery. By focusing on providing the best experience for their customers as their core in order to make a positive and long-term relationship. And to focus on the Virtual Grocery (Central Warehouse + Home Delivery) since it will be able to help consumers realize that doing their grocery can be efficient and safe while making it more productive and have less cost for retailers.

References

Higgins, M., & Benaroya, H. (2020). Utilizing the analytical hierarchy process to determine the optimal lunar habitat configuration. *Acta Astronautica*, 173, 145-154.

Goepel, K. D. (2019). Comparison of judgment scales of the analytical hierarchy process — a new approach. *International Journal of Information Technology &amp*; Decision Making, 18(02), 445-463.

Bilsel, R.U., Büyüközkan, G., Ruan, D., 2006. A fuzzy preference-ranking model for a quality evaluation of hospital Web sites. *Int. J. Intell. Syst*. 21, 1181–1197.

Gbongli, K. A two-staged SEM-AHP technique for understanding and prioritizing mobile financial services perspectives adoption. *Eur. J. Bus. Manag*. 2017, 9, 107–120.

Vargas, R. V. (2010). Using the analytic hierarchy process (ahp) to select and prioritize projects in a portfolio. Paper presented at PMI® *Global Congress 2010*.

Hulin, C., Netemeyer, R., and Cudeck, R. (2001). Can a Reliability Coefficient Be Too High? *Journal of Consumer Psychology*, Vol. 10, Nr. 1, 55-58.

Hair JF. *Multivariate Data Analysis: A global Perspective.* Upper Saddle River: Pearson; 2010

Fu, H., Chen, Y., & Wang, G. (2020). Using a fuzzy analytic hierarchy process to formulate an effectual tea assessment system. *Sustainability*, 12(15), 6131.

Gefen, D., Straub, D., & Boudreau, M. (2000). Structural equation modeling and regression: Guidelines for research practice. *Communications of the Association for Information Systems*, 4. doi:10.17705/1cais.00407.

Hisham, Nasrullah & Baharudin, Ahmad & Karkonasasi, Kamal. (2016). Implementation of e-Grocery Portal in Malaysia. *International Journal of Applied Engineering Research*. 11. 8421-8426.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes IN covariance STRUCTURE analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1-55.

Guo, X., Ling, K. C., & Liu, M. (2012). Evaluating Factors Influencing Consumer Satisfaction towards Online Shopping in China. *Asian Social Science*, 8(13).

Mulaik S. A., James L. R., Van Alstine J., Bennett N., Lind S., Stilwell C. D. Evaluation of goodness-of-fit indices for structural equation models. *Psychological Bulletin*. 1989;105(3):430–445.

Fröderberg, A. (2016, October 04). *Cutting logistics costs with a centralized distribution model for Abb's distribution of LV products in Asia Pacific*. Retrieved April 28, 2021, from http://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1028633

Goepel, K. D. (2019). Comparison of judgment scales of the analytical hierarchy process — a new approach. *International Journal of Information Technology & Decision Making*, 18(02), 445-463. doi:10.1142/s0219622019500044

Bilsel, R.U., Büyüközkan, G., Ruan, D., 2006. A fuzzy preference-ranking model for a quality evaluation of hospital Web sites. *Int. J. Intell. Syst.* 21, 1181–1197. doi:10.1002/int.20177

Vargas, R. V. (2010). Using the analytic hierarchy process (ahp) to select and prioritize projects in a portfolio. *Paper presented at PMI® Global Congress 2010*—North America, Washington, DC. Newtown Square, PA: Project Management Institute

Ferrette, C. (2000). *E-commerce and international political economics: The legal and political ramifications of the internet on world economies*. Retrieved from https://nsuworks.nova.edu/ilsajournal/vol7/iss1/2.

Syed, A. A., & Khan, A. (2017, September). (PDF) A study on E-tailing: Factors influencing the online Indian Consumers. *Journal of Education and Research*, ISSN 2349-8838.

Cetină, I., Munthiu, M., & Rădulescu, V. (2012). Psychological and social factors that influence online consumer behavior. *Procedia - Social and Behavioral Sciences*, 62, 184-188.

Fornell, C. (1992). A National Customer Satisfaction Barometer: The Swedish Experience. *Journal of Marketing*, 56(1), 6–21.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39.

Singh, R., & Rosengren, S. (2020). Why do online grocery shoppers switch? An empirical investigation of drivers of switching in online grocery. *Journal of Retailing and Consumer Services*, 53, 101962.

Molinillo, S., Aguilar-Illescas, R., Anaya-Sánchez, R., & Liébana-Cabanillas, F. (2021). Social commerce website design, perceived value and loyalty behavior intentions: The moderating roles of gender, age and frequency of use. *Journal of Retailing and Consumer Services*, 102404.

Vasic, N., Kilibarda, M., & Kaurin, T. (2019). The Influence of Online Shopping Determinants on Customer Satisfaction in the Serbian Market. *Journal of Theoretical and Applied Electronic Commerce Research*, 14(2).

Martín, J., Pagliara, F. and Román, C., 2019. *The Research Topics on E-Grocery: Trends and Existing Gaps. Sustainability*, 11(2), p.321.

Hisham, Nasrullah & Baharudin, Ahmad & Karkonasasi, Kamal. (2016). Implementation of e-Grocery Portal in Malaysia. *International Journal of Applied Engineering Research*. 11. 8421-8426.

Shankar, V., Kalyanam, K., Setia, P., Golmohammadi, A., Tirunillai, S., Douglass, T., Hennessey, J., Bull, J. and Waddoups, R., 2021. How Technology is Changing Retail. *Journal of Retailing*, 97(1), pp.13-27.

Gupta, Bhavna & Hooda, Apeksha. (2011). Retailing to e tailing: Evolution to Revolution; *International Journal of Retailing and Marketing*. 1. 61-75.

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