

A Factor Analysis on the Last Mile Delivery Process of 3PL Companies as Partner Couriers of E-Commerce in the National Capital Region, Philippines

**Hans Gabriel T. Garsain, John Andrei P. Peradilla, An Kristen C. So
and Damirson A. Co MSIE, PIE**

Department of Industrial Engineering, Faculty of Engineering
University of Santo Tomas

España Blvd., 1008, Manila, Philippines

hansgabriel.garsain.eng@ust.edu.ph, johnandrei.peradilla.eng@ust.edu.ph,
ankristen.so.eng@ust.edu.ph and daco@ust.edu.ph

Abstract

Third party logistics (3PLs) play a vital role in e-commerce transactions as it makes consumer to consumer and business to consumer transactions more convenient in the Philippines. Nevertheless, delivery issues and challenges persist that lead to frustrations of consumers. For this reason, the study aims to conduct a factor analysis on the last-mile delivery process of 3PL companies as partner couriers of e-commerce companies in the country's National Capital Region (NCR). Employing a self-administered survey questionnaire and structural equation modeling (SEM), the research presses on identifying the relationships among various factors influencing the number of delivery problems. The results of the study indicate that final step failure is the most critical factor in the last-mile delivery process. However, fixed assets, delivery performance, quality service, market share, and long term relationships significantly impact final step failure that leads to the increase of number of delivery problems as well. The findings of the study are recommended to be used to reevaluate last-mile delivery processes to help improve and maintain customer satisfaction.

Keywords

Third party logistics, E-commerce, Delivery Issues, Confirmatory Factor Analysis, Structural Equation Modeling

1. Introduction

The last mile process is considered to be the most expensive and time-consuming in the overall delivery process. Fareye (2022) emphasized that the last mile process is widely regarded as the most critical aspect in supply chain management and argued that 53% of the total shipping costs are accounted for from the last mile process. Furthermore, 61% of logistics companies agree that the last mile delivery process is the most inefficient in the whole chain of operations (SOTI Inc, 2020).

In the Philippines, the third party logistics (3PLs) is a booming industry. It is projected that the revenue from the 3PL industry in the Philippines will reach \$4.39 Billion by 2028 with its annual growth rate of 1.91%. (Statista, 2024). This is influenced by the high demand in e-commerce platforms, wherein logistical support is essential. E-commerce companies are keen on choosing which logistics companies to partner with as it determines the whole ecosystem of the products their users sell and consume. Unfortunately, there are delivery problems or issues that still occur evidently.

Monzon (2023) reported that numerous complaints from e-commerce consumers surged across the Philippines from purchases made throughout the year, but most especially in year end sales. Reaching to an extent that local advocacy

groups call out the Department of Trade and Industry to take action in resolving delivery problems from e-commerce purchases. Customers and sellers feel disappointed and frustrated with the inefficient logistic service e-commerce platforms provide along with its partner couriers. This created an alarming issue in view of the fact that sellers are greatly affected in terms of losing profit and loyal consumers from lack of good customer services from partner 3PLs..

Identifying the factors causing the number of delivery problems encountered by e-commerce users from 3PL service providers is essential. This facilitates the enhancement and optimization of the last-mile delivery process conducted by 3PLs. Improved delivery performance not only benefits them directly but also provides a competitive edge in the market, positioning them favorably.

In accordance with that, the study aims in determining and analyzing the factors affecting the last mile delivery process of 3PLs relative to being partner couriers of e-commerce in the National Capital Region in the Philippines. To be specific, the objectives of this study are the following:

- a. Do a confirmatory factor analysis through a creation of a model to know the relationship of each factor using Structural Equation Modeling (SEM).
- b. Describe the relationships of the identified factors by looking at SEM outputs to be able to recommend strategies to improve the last mile delivery process of 3PLs.
- c. Analyze the model fit through various model fit indices.
- d. Validate the reliability of the created model using Chronbach's Alpha, composite reliability (CR) and average variance extracted to analyze the validity of the model relative to the samples.

2. Literature Review

The article of Munoz-Villamizar et al. (2020) introduces electronic commerce (e-commerce) as an emerging industry in 1997 in which IBM first coined the term "e-commerce" (IBM, n.d., as cited in Munoz-Villamizar et al., 2020). In accordance with that, e-commerce was defined as "the sale of goods and services through the use of technology and telecommunications infrastructure" (Jędrzejczak-Gas et al., 2019 as cited in Munoz-Villamizar et al.). Presently, the ecommerce industry is growing exponentially which may be directly related to the advancement of technology and the internet (Laudon & Traveler, 2016 as cited in Munoz-Villamizar et al., 2020).

The article of the International Trade Administration (ITA) (n.d.), presents data that shows how sales in the e-commerce industry has increased over the years as shown in Figure 1. This shows how the number of sales over the years is seen to increment as the years increase. Relative to the study of Laudon & Traveler, 2016 as cited in Munoz-Villamizar et al., 2020, Figure 1 could also show how over the years, there is an increment on the number of digital people. This underscores how the ecommerce is as an emerging economy which continuously grows up to this day.

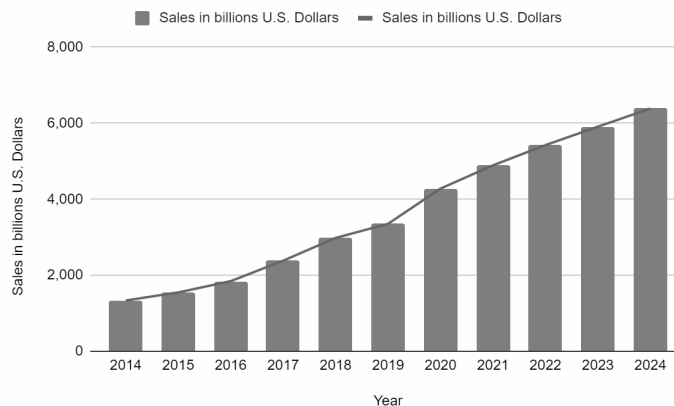


Figure 1. Worldwide B2C Retail Sales in E-Commerce (International Trade Administration, n.d.)

In logistics, delays are almost always inevitable, even under organized management. One of the most susceptible aspects of logistics to delays in delivery. Although essential to logistics, the shipping sector faces numerous difficulties. The logistics industry is recognized as the center of all supply chains and is vital to the economy. Even

the greatest logistics firms face increasing challenges as a result of evolving technological advancements, shifting consumer demands, and constantly shifting legal requirements. These difficulties may seriously interrupt the supply chain, which could result in lost sales and clients. (Goddyn, 2022).

Gupta et al. (2019) focused on analyzing the different issues e-commerce users face with regard to delivery of their parcel. The data that Gupta et al. (2019) have collected were from 154 randomly sampled respondents that vary in demographics. Results from the study showed different delivery issues faced by the samples and from there were able to derive 4 factors which influence issues that may be encountered by people using e-commerce applications. In accordance with that, Gupta et al. (2019) summarizes these issues by deriving four factors with respect to the delivery problems encountered by e-commerce users. To be specific, these factors are (1) Final-step failure, (2) Inept delivery person, (3) Product problem, and (4) Payment failure.

Utilizing the selection criteria in Gupta et al. (n.d.), Robas et al. (2022) measured the performance of 3PL service providers by formulating their own rubrics to measure those parameters. They used the factors such as: cost of service, quality of service, flexibility in billing, delivery performance, IT capacity, Long Term Relationships, Product Rating, Market Share and Fixed Asset. From their study, they were able to highlight that cost of service is the most vital factor that online retailers consider when using 3PL services. This generates how heavily competitive it is for 3PL companies in terms of reducing costs in their services to survive the market. The next 3 top ranked factors then concerned the quality service of 3PLs. This is in view of the fact that quality of service is the determining factor that allows 3PLs to acquire loyal customers. Other satisfactory factors include flexibility in billing, delivery performance, IT capacity, long term relationship, service rating, market share, and fixed assets.

Ultimately, sectors like the e-commerce continually increase in which it is vital that support sectors like the 3PLs are able to fully commit in supporting the supply chains of these organizations. The article of Goddyn (2022) helped establish the problems being encountered in logistics wherein these were resultant due to several factors. The article of Gupta et al. (2019) explored different factors relating to issues faced by customers of e-commerce specifically in the logistical part of that chain of operations. They were able to identify several factors such as final-step failure, inept delivery person, product problem and payment failure. At the same time, Robas et al. (2022) measured the performance of 3PL companies using the selection criteria of Gupta et al. (n.d.) wherein they were able to measure parameters such as cost of service, quality of service, flexibility in billing, delivery performance, IT capacity, long term relationships, product rating, market share and fixed asset wherein they were able to highlight that cost of service was the most vital factor.

3. Methods

The research employed a confirmatory factor analysis through the use of structural equation modeling. In accordance with that, the researchers actively collected 257 samples in which stratified random sampling was used to identify the samples needed for the study. The researchers identified 4 stratas which were management of e-commerce, management of 3PL companies, personnel working in inventory hubs/ distribution centers and delivery personnel. The researchers derived the variables from the study of Gupta et al. (2019), Robas et al. (2022) and Daniel (2019). To be specific, the variables used in this study were final step failure (FS), inept delivery person (IP), payment failure (PF), product problem (PP), cost of service (CS), quality of service (QS), long term relationships (LTR), flexibility in billing (FB), delivery performance (DP), IT capacity (IT), performance measurement (PM), fixed asset (FA), market share (MS), incentives (I) and number of delivery problems (NDP). The relationships of these variables can be better understood in Figure 2.

The conceptual framework as shown in Figure 2 shows the different relationships between the identified factors in which it shows how these variables are employed into e-commerce and 3PL businesses' last mile delivery process. With this framework, the researchers are able to better realize every aspect of the last mile delivery process in which they were able to properly look into these important factors that play vital roles in the whole chain of operations of last mile delivery.

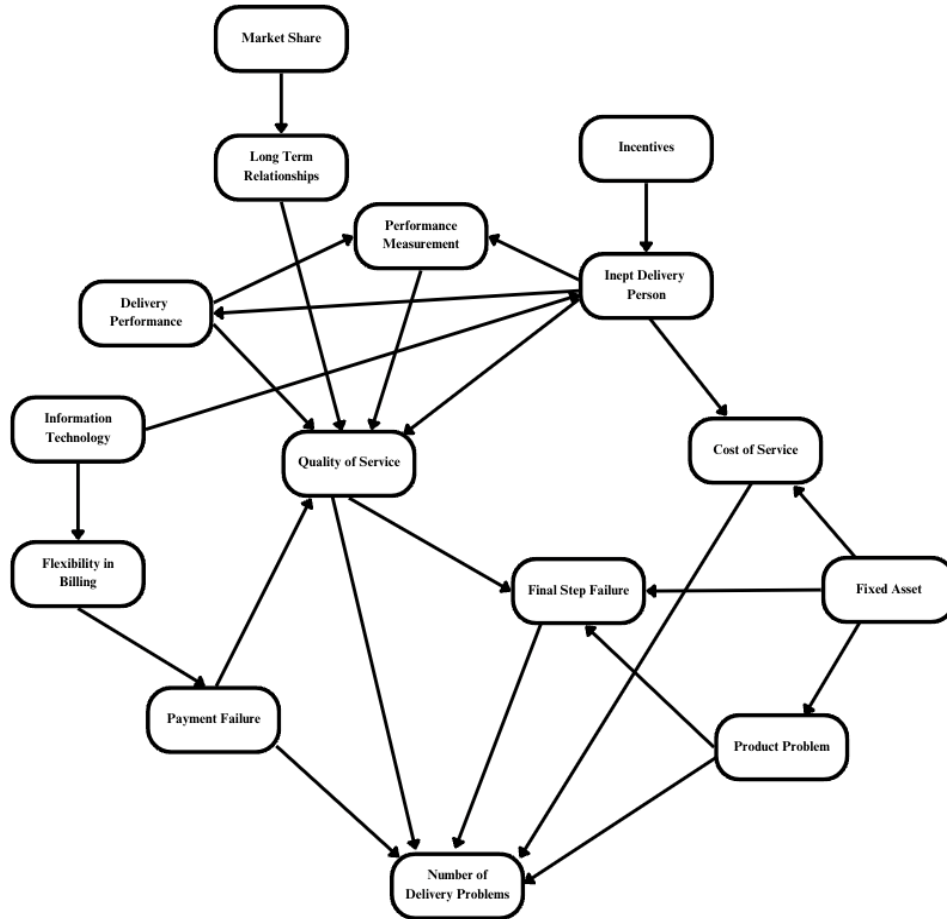


Figure 2. Conceptual Framework

4. Data Collection

The researchers utilized a self-administered survey questionnaire which was designed to analyze the relationships of the identified variables. Integrated in the questionnaire were inquiries regarding the work experience of the respondents as well as the research variables. Prior to data collection, the researchers diffused the number of samples per strata based on the availability of the respondents. At the same time, the researchers printed out copies of their questionnaire along with their consent form. After all the preparation needed, the researchers approached the respondents, one-by-one, to partake in their study, while asking them for their consent. For a more diffused sampling, the researchers went to different parts of the National Capital Region to make sure to limit bias. While answering the survey, the respondents were free to clarify anything related to the questionnaire. The researchers also made sure that their answers will solely guide the respondents, and make sure not to influence the answers of the respondents in order to eradicate biases. Finally, the researchers gave the respondents a token of appreciation as well as giving them their contact information if ever they wanted to pull themselves out of the study, for whatever reason.

After data collection, the researchers analyzed the data with the use of SPSS and SPSS Amos. These were used to analyze the data using structural equation modeling (SEM) which has enabled the researchers to understand the interactions of the variables with each other. It is also important to note that the researchers abided by ethical considerations such as providing consent forms, adherence to safety protocols and confidentiality measures. At the same time, the researchers made sure that the data collected adhered to the assumptions set upon when using structural equation modeling which include multivariate normality, large sample size ($n > 200$), a correct priori model specification, and that the sample is randomly selected.

5. Results and Discussion

5.1 Numerical Results

In data collection, 257 respondents were surveyed across four stratas, specifically, the people working in the management of e-commerce companies, inventory hub/ distribution center, management of 3PL companies, and lastly delivery personnel, who willingly accepted to participate in the research and completed the questionnaire by stratified random sampling (Table 1).

Table 1. Respondent Distribution

Stratas	Number of Respondents	(%)
Management of E-Commerce Companies	3	1.17
Inventory Hub/ Distribution Center	14	5.45
Management of 3PL Companies	6	2.33
Delivery Personnel	234	91.05
Total	257	100.00%
Years of Experience	Number of Respondents	Percentage (%)
Less than a year	81	31.52
A year	52	20.23
More than a year	124	48.25
Total	257	100.00%

5.2 Graphical Results

Figure 3 shows the final Structural Equation Model (SEM) for the variables influencing the factors influencing delivery problems in e-commerce and 3PL companies. The analysis reveals strong loading values, mostly above 0.5, indicating robust measurement features for the variables assessed. These values signify significant relationships between indicators and their respective constructs. Notably, indicators such as final step, inept delivery person, payment failure, and others consistently exhibit strong loading values across multiple items. This strengthens the validity and reliability of the measurement model, reinforcing the study's credibility in identifying factors influencing delivery problems in e-commerce and 3PL companies.

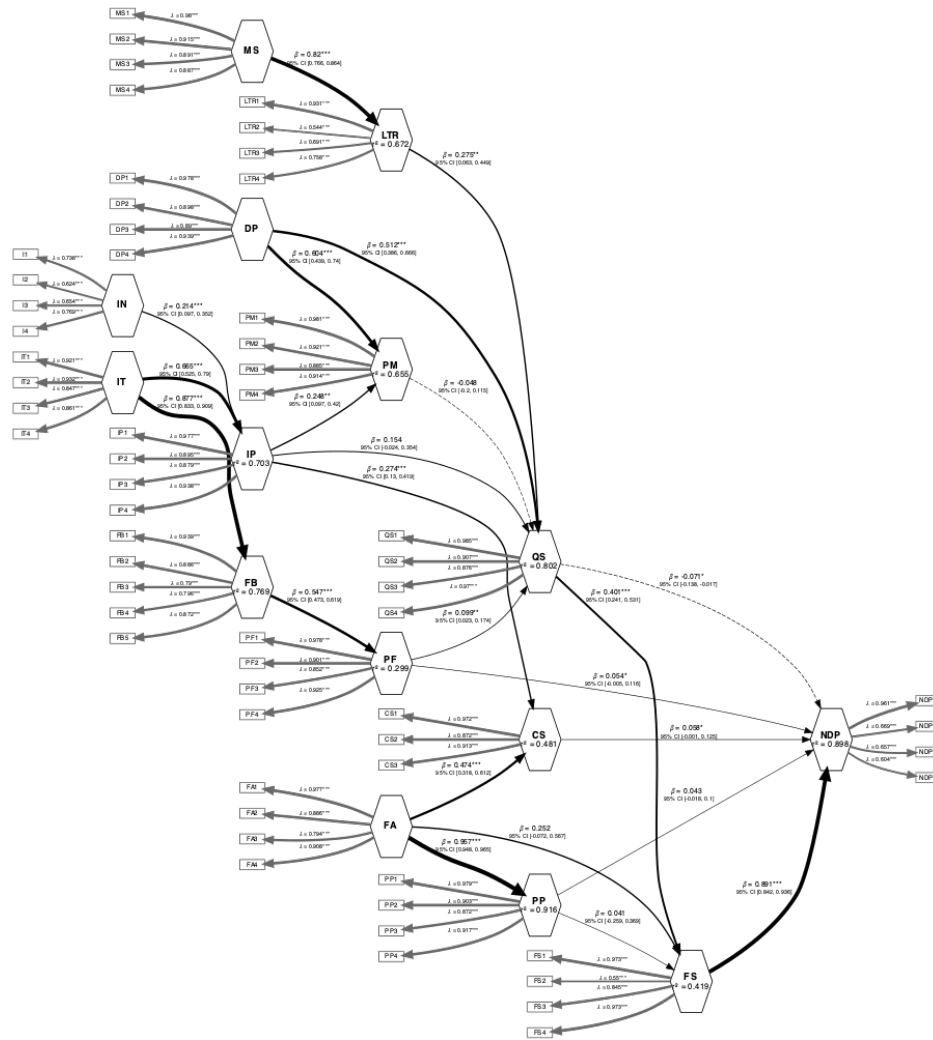


Figure 3. Final SEM Model

The final structural equation model is thoroughly investigated in the study utilizing a range of fit indices, as indicated in Table 2. The model fit is assessed with a specific criteria, a strong fit is typically indicated by a minimum value of 0.9. The Goodness of Fit Index (GFI) is 0.998, the Comparative Fit Index (CFI) is 0.999, the Normed Fit Index (NFI) is 0.992, the Tucker-Lewis Index (TLI) is 0.999. The number values are higher than the suggested cutoff point of 0.9 indicating a strong model fit. The number values are higher than the suggested cutoff point of 0.80, indicating a strong model fit. Furthermore, the model fits the data effectively. The Root Mean Square Error of Approximation (RMSEA) is 0.005, which is less than the 0.05 cutoff.

Table 2. Model Fit Indices

Goodness of Fit Measure	Parameter Estimate	Minimum Cutoff	Suggested By
Root Mean Square Error of Approximation (RMSEA)	0.005 (good)	<0.05 = good 0.05 - 0.08 = acceptable 0.08 - 0.1 = marginal > 0.1 = poor	Fabrigar et al. (1999) as cited in Kim et al. (2016)
Goodness of Fit Measure	Parameter Estimate	Minimum Cutoff	Suggested By

Goodness of Fit Index (GFI)	0.998 (good)	$\geq 0.9 = \text{good}$	Mulaik et al. (1989) as cited in Kim et al. (2016)
Comparative Fit Index (CFI)	0.999 (good)	$\geq 0.9 = \text{good}$	Bentler, P. (1990) as cited in Kim et al. (2016)
Normed Fit Index (NFI)	0.992 (good)	$\geq 0.9 = \text{good}$	Bentler, P. (1990) as cited in Kim et al. (2016)
Tucker-Lewis Index (TLI)	0.999 (good)	$\geq 0.9 = \text{good}$	Bentler, P. (1990) as cited in Kim et al. (2016)

Table 3 presents findings from a factor analysis, specifically highlighting the factor loadings for various indicators. Each row lists a specific indicator or variable that was measured in the study. These indicators represent different aspects or components of the overall construct being studied, such as "FS" (Final Step), "IP" (Inept Delivery Person), "PF" (Payment Failure), "CS" (Customer Satisfaction), "QS" (Quality of Service), and "LTR" (Long Term Relationships). Factor loading represents the strength and direction of the relationship between the indicator and the underlying factor. Higher loading values indicate a stronger association between the indicator and the factor it represents. For instance, a loading of 0.973 for "FS1 -> FS" suggests a strong relationship between the indicator and the "FS" factor. Overall, table 3 provides valuable insights into the associations between different indicators and their underlying factors, supported in the interpretation of the study's findings.

Table 3. Indicators Statistical Analysis

Indicator	Factor Loading	95% Confidence		P Value
		<i>Lower</i>	<i>Upper</i>	
FS1 -> FS	0.973	0.967	0.979	0.000
FS2 -> FS	0.550	0.427	0.665	0.000
FS3 -> FS	0.845	0.786	0.891	0.000
FS4 -> FS	0.973	0.967	0.979	0.000
IP1 -> IP	0.977	0.972	0.982	0.000
IP2 -> IP	0.895	0.858	0.923	0.000
IP3 -> IP	0.879	0.836	0.911	0.000
IP4 -> IP	0.938	0.915	0.956	0.000
PF1 -> PF	0.978	0.972	0.982	0.000
PF2->PF	0.901	0.862	0.931	0.000
PF3 -> PF	0.852	0.791	0.898	0.000
PF4 -> PF	0.925	0.877	0.955	0.000
CS1 -> CS	0.972	0.966	0.977	0.000
CS2 -> CS	0.872	0.820	0.913	0.000
CS3 -> CS	0.913	0.884	0.938	0.000

QS1 -> QS	0.985	0.982	0.988	0.000
QS2 -> QS	0.907	0.871	0.938	0.000
QS3 -> QS	0.876	0.829	0.909	0.000
QS4 -> QS	0.970	0.956	0.980	0.000
LTR1 -> LTR	0.931	0.910	0.947	0.000
LTR2 -> LTR	0.544	0.364	0.689	0.000
LTR3 -> LTR	0.691	0.591	0.782	0.000
LTR4 -> LTR	0.758	0.643	0.839	0.000
NDP1 -> NDP	0.961	0.956	0.967	0.000
NDP2 -> NDP	0.669	0.550	0.766	0.000
NDP3 -> NDP	0.657	0.546	0.750	0.000
NDP4 -> NDP	0.604	0.462	0.731	0.000
FB1 -> FB	0.939	0.919	0.956	0.000
FB2 -> FB	0.886	0.853	0.915	0.000
FB3 -> FB	0.790	0.716	0.851	0.000
FB4 -> FB	0.796	0.716	0.857	0.000
FB5 -> FB	0.872	0.817	0.912	0.000
PP1 -> PP	0.979	0.975	0.983	0.000
PP2 -> PP	0.903	0.860	0.935	0.000
PP3 -> PP	0.872	0.816	0.913	0.000
PP4 -> PP	0.917	0.877	0.948	0.000
DP1 -> DP	0.978	0.969	0.985	0.000
DP2 -> DP	0.898	0.848	0.935	0.000
DP3 -> DP	0.890	0.840	0.931	0.000
DP4 -> DP	0.939	0.916	0.959	0.000
IT1 -> IT	0.921	0.896	0.943	0.000
IT2 -> IT	0.932	0.906	0.951	0.000
IT3 -> IT	0.847	0.794	0.889	0.000
IT4 -> IT	0.861	0.807	0.897	0.000
PM1 -> PM	0.981	0.977	0.985	0.000
PM2 -> PM	0.921	0.885	0.949	0.000
PM3 -> PM	0.885	0.839	0.919	0.000
PM4 -> PM	0.914	0.864	0.956	0.000
FA1 -> FA	0.977	0.974	0.980	0.000
FA2 -> FA	0.886	0.841	0.926	0.000
FA3 -> FA	0.794	0.716	0.865	0.000
FA4 -> FA	0.908	0.856	0.949	0.000
MS1 -> MS	0.980	0.976	0.984	0.000
MS2 -> MS	0.915	0.880	0.942	0.000

MS3 -> MS	0.891	0.839	0.930	0.000
MS4 -> MS	0.887	0.829	0.935	0.000
I1 -> IN	0.738	0.618	0.830	0.000
I2 -> IN	0.624	0.483	0.740	0.000
I3 -> IN	0.654	0.533	0.758	0.000
I4 -> IN	0.769	0.671	0.850	0.000

Table 4 presents path coefficients, effect sizes (f^2), and significance levels for key relationships in the model. For instance, Market Share (MS) significantly influences Long Term Relationships (LTR), with a strong positive effect (coefficient = 0.820) and substantial effect size ($f^2 = 2.046$). Similarly, Delivery Performance (DP) strongly impacts Performance Measurement (PM), indicating the importance of delivery performance in overall assessment. Additionally, Quality of Service (QS) positively affects Final Step Failure (FS), suggesting that higher service quality leads to fewer final step failures. Overall, these findings highlight the significant role of various factors in influencing outcomes, with effect sizes indicating the magnitude of these effects according to Cohen's guidelines.

Table 4. Direct and Indirect Effects

Path Coefficients	Path	f^2	95% Confidence		P Value
			Lower	Upper	
MS -> LTR	0.820	2.046	0.766	0.864	0.000
IN -> IP	0.214	0.067	0.097	0.352	0.001
LTR -> QS	0.275	0.099	0.063	0.449	0.003
DP -> PM	0.604	0.433	0.439	0.740	0.000
DP -> QS	0.512	0.355	0.386	0.666	0.000
PM -> QS	-0.048	0.003	-0.200	0.115	0.720
IP -> PM	0.248	0.073	0.097	0.420	0.001
IP -> QS	0.154	0.036	-0.024	0.354	0.054
IP -> CS	0.274	0.075	0.130	0.419	0.000
IT -> IP	0.665	0.649	0.525	0.790	0.000
IT -> FB	0.877	3.327	0.833	0.909	0.000
QS -> FS	0.401	0.120	0.241	0.531	0.000
QS -> NDP	-0.071	0.016	-0.138	-0.017	0.986
CS -> NDP	0.058	0.012	-0.001	0.125	0.039
FB -> PF	0.547	0.426	0.473	0.619	0.000
PF -> QS	0.099	0.033	0.023	0.174	0.008
PF -> NDP	0.054	0.014	-0.005	0.116	0.042
FA -> CS	0.474	0.221	0.318	0.612	0.000
FA -> FS	0.252	0.009	-0.072	0.567	0.060
FA -> PP	0.957	10.944	0.948	0.965	0.000
PP -> FS	0.041	0.000	-0.259	0.369	0.402
PP -> NDP	0.043	0.006	-0.018	0.100	0.079

Figure 4 shows the path of coefficients, which the researchers use as a foundation to comprehend the direct and indirect impacts of one variable on another.

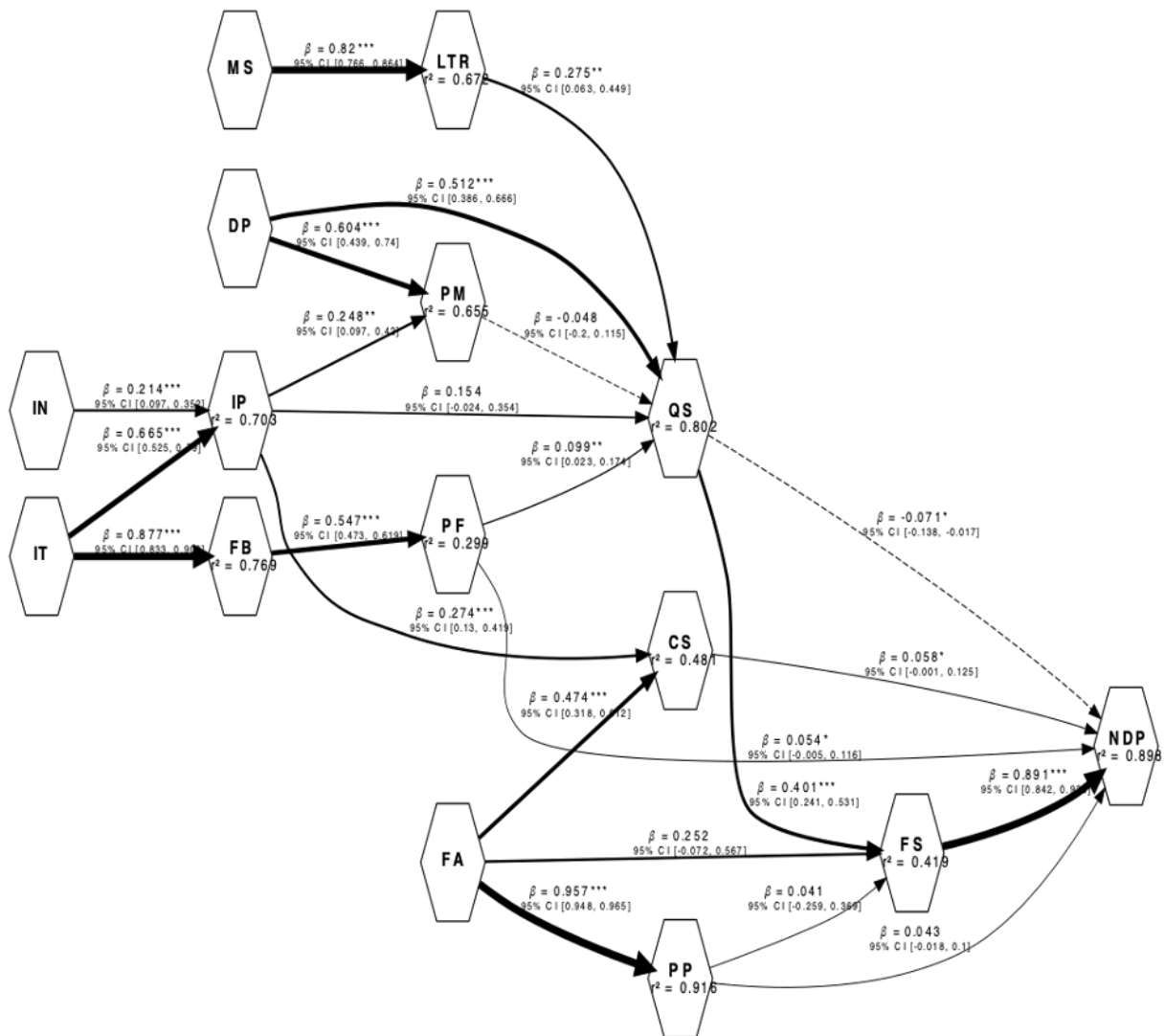


Figure 4. Final SEM Model, Latent Variables Only

In summary, the result show that Market Share (MS), Long Term Relationship (LTR), Delivery Performance (DP), Quality of Service (QS), Fixed Assets (FA), and Final Step Failure (FS) have the relative impact in the Number of Delivery Problems (NDP) among all of the variables. This can be seen from the values of their respective path coefficients that connect them to one another. From the path analysis of Market Share (MS), improving this factor can lead to better Long Term Relationships (LTR) and Quality of Service (QS) which reflect the improvement in Final Step Failure (FS). This can also be applied to the path analysis of Delivery Performance as it significantly impacts Quality of Service (QS) and Final Step Failure (FS) as well. For the path analysis of Fixed Assets (FA), managing them effectively can reduce Final Step Failure (FS). Needless to say, these variables work hand in hand to minimize the number of delivery problems. Lastly, it can be seen that the model is a good fit based on the results of the model fit indices. This is further supported by the reliability testing as seen in the validation section.

5.3 Proposed Improvements

The study shows that market share, long-term relationships, delivery performance, quality service, and fixed assets are the main underlying contributors that are interrelated with the most critical factor in the last-mile delivery process, which is final step failure.

As for long term relationships, this implies that the e-commerce companies and the 3PL companies must focus and prioritize efforts towards building a stronger partnership. Both companies must have aligned goals and objectives to create a common purpose for the service being provided. The two way contract must always be revisited for both companies making them liable for the goods that are being delivered. It specifies the responsibility and accountability of both parties in the last mile delivery process.

As for fixed assets and final step failure, 3PL companies could invest in innovations towards the protection of the goods being brought by delivery personnel. Results have shown that improvements on how delivery personnel handle goods being delivered helps minimize final step failure. 3PLs could look at innovations on the goods compartment attached on motorcycles which are the present compartments of logistic services here in the Philippines to limit damages while goods are in transit. At the same time, e-commerce could revisit their policies towards handling goods by 3PLs as well as the compliances of the stores as providers of the goods.

Furthermore, delivery performance works hand in hand with quality service as it encompasses customer experiences, higher satisfaction levels, and ultimately, increased customer retention and loyalty. It is also recommended to further improve delivery performance in speed and reliability of delivery by implementing continuous improvement. Acquiring customer feedback can help identify areas of improvement and elevate the optimization of delivery performances for the benefit of users of e-commerce platforms.

Given the results, there are many things that need to be considered and further studied. The researchers are hopeful that the information gained from this study will be useful for future research. In accordance with that, the researchers recommend future researchers to investigate further the aspects of the delivery process beyond the aspect of last mile delivery process. Future research could also study and dive deeper into the effectiveness of tactics implemented by both parties that have already worked with regards to solving these delivery problems. Furthermore, new technologies could help the ecommerce industry to have more opportunities for innovation and improvements. This could help develop customer satisfaction and operational efficiency.

Furthermore, it is recommended that future studies consider demographics covered beyond the National Capital Region as this gives a better amount of variability. By including additional locations, a bigger sample size can be obtained, which could lead to a more thorough investigation of the factors mentioned. Penultimately, the researchers recommend future research to adopt more factors, from other studies, to have a better grasp on the factors that can be related towards delivery failure. The researchers suggest that future researchers look into the study of Goddyn (2022) wherein they listed different variables such as the weather, holidays, etc. to analyze the relationship of these variables towards delivery failure. Finally, it is also recommended that future studies employ other analytical methods such as analytic hierarchy process (AHP) to analyze factors relating to the last mile delivery process.

5.4 Validation

In the research frameworks, reliability assessment is based on a number of indicators such as average variance extracted (AVE), composite reliability and whether Cronbach's Alpha is not less than 0.6 or 0.7 to maintain consistency and reliability within constructs. Table 5 shows that the Market Share (MS), Delivery Performance (DP), Performance Measurement (PM), Quality of Service (QS) and Cost of Service (CS) exhibit highest levels of reliability in these measures with Cronbach's alpha values above 0.9 and composites reliabilities exceeding 0.95. In addition, these structures have AVE values more than 0.8 implying that they are able to explain huge amounts of variances compared to measurement errors. This clearly shows how strong the core constructs are in this particular research framework.

Table 5. Construct Validity of the Model

Constructs	Cronbach's Alpha	Composite Reliability	Average Variance Extracted
Market Share (MS)	0.938	0.956	0.845
Incentives (IN)	0.646	0.791	0.488
Long Term Relationships (LTR)	0.716	0.827	0.554
Delivery Performance (DP)	0.945	0.961	0.859
Performance Measurement (PM)	0.944	0.960	0.857
Inept Delivery Person (IP)	0.941	0.958	0.852
IT Capacity (IT)	0.913	0.939	0.794
Quality of Service (QS)	0.952	0.965	0.875
Cost of Service (CS)	0.908	0.943	0.846
Flexibility in Billing (FB)	0.909	0.933	0.737
Payment Failure (PF)	0.934	0.954	0.837
Final Step Failure (FS)	0.862	0.911	0.727
Fixed Asset (FA)	0.914	0.940	0.798
Product Problems (PP)	0.938	0.956	0.844
Number of Delivery Problems (NDP)	0.698	0.820	0.542

6. Conclusion

The study delves into the intricate factors influencing delivery issues in e-commerce and third-party logistics (3PL) companies. Through a comprehensive analysis employing structural equation modeling, the objective of the study was achieved by examining various relationships within the delivery process

The e-commerce and logistics industry faces significant challenges related to delivery problems. Key factors such as Delivery Performance, Long Term Relationships, Market Share and quality of service, which in turn influences final step failures and ultimately impacts the number of delivery problems. Although there are also factors like Incentives, inept delivery people, and IT capacity that show some influence, their impact is relatively smaller. The effect size suggests that the impact of the said factors might be comparatively not affecting than other relationships in the model. Integrating path analysis and reliability estimation provides a strong foundation for understanding these complex relationships, offering valuable insights for future research and decision-making in addressing delivery challenges. Moving forward, further exploration and practical application of these findings are essential for making meaningful advancements in the field.

To further understand the relationship between each factor, the path analysis of the study shows the relationship in various factors that affects the number of delivery problems. It reveals important relationships, like Market Share positively influencing Long Term Relationships and Delivery Performance impacting the quality of service. Moreover, the analysis highlights the connections between quality of service, fixed assets, and final step failures that lead to the number of delivery problems. The study's reliability tests, including Cronbach Alpha and composite reliability, confirm the robustness of key constructs like Market Share, Delivery Performance, and Quality of Service, adding credibility to the findings.

References

- Batarlienė, N., & Jarašūnienė, A. “3PL” Service Improvement Opportunities in Transport Companies. *Procedia Engineering*, vol. 187, pp. 67–76. Available: <https://doi.org/10.1016/j.proeng.2017.04.351>, 2017.
- CNN Philippines. *PNP files charges against J&T Express over multiple violations, orders shutdown of Muntinlupa hub*. Available: <https://www.cnnphilippines.com/news/2020/7/20/>, 2020.
- Cohen J., *Statistical Power Analysis for the Behavioral Sciences*. New York, NY: Routledge Academic. 1988
- Collier, J. E. *Applied Structural Equation Modeling using AMOS_ Basic to Advanced Techniques-Routledge* (2020). New York; Routledge. 2020.
- Dang, D. D., Ha, D. L., Tran, V. B., Nguyen, V. T., Nguyen, T. L. H., Dang, T. H., & Le, T. T. H., Factors affecting logistics capabilities for logistics service providers: a case study in Vietnam. *Journal of Asian Finance, Economics and Business*, vol. 8, no. 5, pp. 81–89. Available: <https://doi.org/10.13106/jafeb.2021.vol8.no5.008>, 2021.
- German, J., Asuncion, M. K., & Pacheco, L. Increasing Productivity and Efficiency for Third Party Logistics Service. *Proceedings of the International Conference on Industrial Engineering and Operations Management*. Available: <http://ieomsociety.org/ieom2019/papers/772.pdf>, 2019.
- Gupta, P. K., Singh, S., Ranjan, R., Kharayat, G., Raman, S., & Balaji, V. *Analysis of Delivery Issues that Customers Face upon E-Commerce Shopping*. *International Journal of Management Studies*. Available: <https://doi.org/10.18843/ijms/v6si3/03>, 2019.
- Heydari, J. & Bakhshi, A. *Contracts between an e-retailer and a third party logistics provider to expand home delivery capacity*. Available: <https://doi.org/10.1016/j.cie.2021.107763>, 2022.
- Holmgren, J. Using Cost-Benefit Analysis to Evaluate City Logistics Initiatives: An Application to Freight Consolidation in Small- and Mid-Sized Urban Areas. *Using Cost-Benefit Analysis to Evaluate City Logistics Initiatives: An Application to Freight Consolidation in Small- and Mid-Sized Urban Areas*, 271–290. Available: <https://doi.org/10.1002/9781119425526.ch17>, 2018.
- International Trade Administratio., *eCommerce Sales and Size Forecast*. Available: <https://www.trade.gov/e-commerce-sales-size-forecast>, n.d.-a.
- Kim, H., Ku, B., Kim, J. Y., & Park, Y. Confirmatory and exploratory factor analysis for validating the phlegm Pattern questionnaire for healthy subjects. *Evidence-based Complementary and Alternative Medicine*, 2016, 1–8. Available: <https://doi.org/10.1155/2016/2696019>, 2016.
- Kmiecik, M. Innovation Management in Third-Party Logistics. *Scientific Papers of Silesian University of Technology, Organization and Management Series No. 168*. Available: <https://doi.org/10.29119/1641-3466.2023.168.16>, 2023.
- McCREA, B. 3PL TRENDS: Keeping up with the E-Commerce Boom. *Logistics Management: Transportation Best Practices/Trends*.vol 61, No. 10, pp.26-29, 2022.
- Monzon, A. *Shopee probes delays in parcel deliveries as complaints mount | Inquirer Business*. INQUIRER.net. Available: <https://business.inquirer.net/382252/shopee-probes-delays>, 2023.
- Mondal, C. & Giri, B. *Analyzing strategies in a green e-commerce supply chain with return policy and exchange offer*. Available: <https://doi.org/10.1016/j.cie.2022.108492>, 2022.
- Muñoz-Villamizar, A., Velázquez-Martínez, J. C., Haro, P., Ferrer, A. S., & Mariño, R., The environmental impact of fast shipping ecommerce in inbound logistics operations: *A case study in Mexico*. *Journal of Cleaner Production*, 283, 125400. Available: <https://doi.org/10.1016/j.jclepro.2020.125400>, 2021.
- Pallant, J.. *SPSS Survival Manual: A Step by Step Guide to Data Analysis Using IBM SPSS* (7th ed.). Routledge. Available: <https://doi.org/10.4324/9781003117452>, 2020.
- Papadopoulou, C., *An Overview of Third Party Logistics Industry*. *Massachusetts Institute of Technology*. Available: <https://web.mit.edu/supplychain/www/sp-iscml/>, n.d.-a.
- Premkumar, P., Gopinath, S., & Mateen, A. Trends in third party logistics – the past, the present & the future. *International Journal of Logistics*, vol. 24, no. 6, pp. 551–580. Available: <https://doi.org/10.1080/13675567.2020.1782863>, 2021.
- Robas, K. P., Valimento, J. C., & German, J. Performance Measurement of 3PL Service Providers for Online Retailers in the Philippines. *International Conference on Industrial Engineering and Operations Management*. Available: <https://ieomsociety.org/proceedings/2022istanbul/583.pdf>, 2022.
- Service quality of e-Commerce logistics services. *The Journal of Contemporary Issues in Business and Government*. Available: <https://doi.org/10.47750/cibg.2020.26.02.094>, 2020.
- Shi, Y., Osewe, M., Li, Q., Han, L., & Liu, A. Global challenges and research gaps for third-party logistics: literature review. *International Journal of Logistics Economics and Globalisation*, vol. 8. no. 1, p. 46. Available: <https://doi.org/10.1504/ijleg.2019.100209>, 2019.

Biographies

Hans Gabriel T. Garsain is a fourth year student taking up his bachelor's degree in Industrial Engineering from the University of Santo Tomas. Currently, he is also taking up his specialization in Service Engineering.

John Andrei P. Peradilla is a fourth year student taking up his bachelor's degree in Industrial Engineering from the University of Santo Tomas. Currently, he is also taking up his specialization in Service Engineering.

An Kristen C. So is a fourth year student taking up her bachelor's degree in Industrial Engineering from the University of Santo Tomas. Currently, she is also taking up her specialization in Quality Engineering.

Damirson A. Co, MSIE, PIE is an adjunct professor in the Department of Industrial Engineering at the University of Santo Tomas. He earned his Bachelor of Science degree in Industrial Engineering from the University of Santo Tomas and a Master of Science degree in Industrial Engineering Major in Production Systems in the University of the Philippines in Diliman, Quezon City, Philippines.