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Last Mile Practices and Their Impact on the Operational Performance of Selected Logistics Companies in Parañaque City

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Abstract: **This research aims to provide directions for various sectors of logistics companies by identifying last-mile practices and analyzing their impact on the operational performance of logistics firms in Parañaque City. The study focuses on last-mile practices and their impact on the operational performance of specific logistics firms in Parañaque City. This study included aspects such as resource utilization, service quality control, lean infrastructure, and environmental impact. The study employed a descriptive and correlational research approach to interpret quantitative data. The researchers used these techniques to determine whether last-mile practices and operational performance were statistically correlated. Purposive and quota sampling methods were used to select 150 participants from 15 participating companies. The participants in the study were the delivery personnel, logistics staff, managers, and supervisors. The findings showed that picking had the highest level of impact in last-mile operations and that there was no significant difference in the impact of last-mile practices on operational performance when grouped according to business profile. Additionally, no significant correlation was found between last-mile practices and operational performance. The study concluded that logistics companies prioritize picking over other last-mile practices. Therefore, it is recommended that they enhance all last-mile practices to improve overall operational performance.**

Keywords: **Last Mile Practices, Logistics Company, Operational Performance.**

I. INTRODUCTION

In the dynamic landscape of business operations, the last mile of the supply chain has emerged as a critical determinant of success, influencing not only customer satisfaction but also the overall operational efficiency of companies. From ensuring timely and accurate deliveries to offering flexible options like same-day service and real-time tracking, this logistic component gained the power to measure a firm's performance.

As the demand for eCommerce in the Philippines continues to rise reaching a market sale of $17 million in 2021 through 73 million active users online in the country [1], the challenges and opportunities associated with last-mile logistics become increasingly pronounced. However, the last-mile delivery sector in the Philippines is still underdeveloped, with a high reliance on informal and traditional delivery procedures [2]. The last mile delivery is part of the supply chain when packages are transported from a logistic center to their final destination. It is also asserted to be the most costly component of the supply chain's overall functioning [3]. Studies suggest that healthy competition between merchants and logistics providers can enhance cost, lead time, and utilization rate metrics [4]. This collaborative approach aims to minimize empty return

trips and optimize resource sharing, ultimately leading to better delivery performance for everyone. Companies have had to invest in optimizing routes, using real-time tracking, and developing practices to possess a competitive advantage and meet customer expectations. A transport company's capacity to deliver goods efficiently and on time is hindered due to the country's archipelagic structure. Businesses must cooperate with multiple logistics suppliers to guarantee that their items are in good shape and delivered on time. The impact of last-mile practices on operational performance is generally positive, with a high level of agreement among participants. The expansion of business operations was supported by the logistics businesses' perceived value and effectiveness in enhancing their operational performance. By embracing optimization strategies and empowering drivers, companies can conquer the challenges of last-mile delivery. This paves the way for a faster, smoother, and ultimately more satisfying delivery experience for everyone involved. Hence, in relation to this, it amplified that effective warehouse management is a multifaceted endeavor. From maximizing space utilization to facilitating efficient inventory retrieval, it encompasses every aspect of the operation, and the sheer volume of orders, coupled with increasing consumer demands for speed and convenience, has necessitated innovation and optimization in the last-mile delivery process.

At the forefront of this digital revolution stand e-commerce giants like Shopee and Lazada, capturing a significant market share in the Philippines. Logistics, the invisible hand behind every delivered package, forms the backbone of the e-commerce supply chain. It ensures your online purchases, from the latest gadget to a cozy sweater, defy distance and obstacles to reach your doorstep. Technological advancements are redefining the landscape of business, with digital transformation playing a pivotal role [5]. This transformation extends to last-mile delivery, a crucial aspect of e-commerce facing pressure from growing customer demands and rising shipment volumes [6]. To address these challenges, innovative solutions are taking flight. The growing demand for expeditious and reliable service from customers has engendered heightened interest in last-mile delivery planning.

Thus, it is substantial to determine the practices utilized by selected logistics companies in Parañaque City, in terms of their preparation for distribution, parcel tracking and monitoring, and last-mile delivery, and how each aspect impacts their operational performance, and this research also aimed to identify the impact level of last-mile practices on their operational performance. This paper is intended to benefit company managers, supervisors, and logistics personnel identify the best last-mile practices and areas for improvement. These insights could serve as benchmarks for enhancing competitiveness and meeting customer expectations.

Furthermore, the result of this study substantiates an extensive matrix intended to classify and identify efficient last-mile practices, highlighting opportunities for logistics companies to enhance their operations. This study is deemed beneficial among logistics companies and delivery personnel as it will respectively abet understanding the practices, challenges, inequalities, and critical components of logistics for riders to improve their logistics management effectiveness and efficiency; thus, enabling companies to determine areas for improvement. The Department of Trade and Industry may utilize the findings on organizational performance in discerning logistics' importance. Further, researchers shall have fostered an understanding of the logistics companies' operational performance located in Paranaque City, while this can serve as a reference for future researchers.

II. OBJECTIVES OF THE STUDY

The research study focused on determining the impact of last-mile practices on the operational performance of the selected logistics companies in Parañaque City. Specifically, this determined the business profile of selected logistics companies in terms of the number of employees, form of ownership; and years of operation, including the socio-demographic profile of the participants in terms of age, sex, educational attainment, job position, and length of service within the company. The study also explored the last-mile practices implemented by selected logistics companies, as perceived by the participants in terms of last-mile back-end fulfillment, including picking, and last-mile delivery, covering delivery mode, delivery time, delivery area, and returns; also, the impact of last-mile practices on the operational performance of selected logistics companies in relation to resource utilization, service quality assurance, lean infrastructure, and environmental impact. More so, the researchers determined whether there is a significant difference in the impact of last-mile practices on operational performance when grouped according to their business profile, and whether there is a significant relationship between the last-mile practices and the operational performance as perceived by the participants to substantially create a matrix of improvement for the logistics companies based on the findings of the study.

III. METHODOLOGY

The study integrated the use of quantitative research method and design as it aimed to investigate the extent of last-mile practices utilized by companies and their impact on the operational performance of selected logistics companies in Parañaque City. The participants' socioeconomic profile was also described by the researchers, including their age, sex, highest educational attainment, job position, and years of experience. This research interpreted quantitative data through descriptive and correlational research design to determine if last-mile practices and operational performance were statistically correlated.

A. Participants and Sampling Technique

The participants in the study were delivery personnel, logistic staff, managers, and supervisors who were knowledgeable and actively engaged in the operations of back-end fulfilment and last-mile delivery, wherein these were chosen through purposive and quota sampling techniques as there are 220 logistics companies in Paranaque City, with an average of 70 workers per establishment and through Raosoft, the population size was determined at 15,400; thus, the sample size has been set at 150 participants among the 15 participating companies, wherein inclusion criteria is limited to regular employees and third-party logistics personnel hired by the company.

B. Instrument

There are two data-gathering tools used, wherein the first one targets logistics staff and delivery personnel, and the second one is intended for managers and supervisors. Each questionnaire is partitioned into three, which include close-ended questions. These questionnaires were verified and validated by three validators and an external psychometrician. The first questionnaire's three parts include; the business profile, socio-economic profile, and last-mile delivery practices, particular on picking, delivery mode, delivery time, delivery area, and returns. Meanwhile, the second questionnaire's three parts include; business profile, socio-economic profile, and last-mile practices on the company's operational performance in terms of resource utilization, service quality assurance, lean infrastructure, and environmental impact. A four-point scale was used for part three of the two separate research instruments, measuring the level of implementation of last-mile delivery practices and their impact on last-mile delivery performance.

Below are the two respective four-point scales used in measuring the level of implementation of last-mile practices, and the level of impact on last-mile delivery performance:

TABLE I: FOUR-POINT SCALE ON THE IMPLEMENTATION OF LAST MILE PRACTICES

Rating Scale	Mean Range	Response Option	Verbal Interpretation
4	3.26 – 4.00	Fully Implemented	The last mile practices are fully implemented in their company to the extent that they are implemented effectively in their company.
3	2.51 – 3.25	Moderately Implemented	The last mile practices are moderately implemented in their company to the extent that they are moderately effective in their company
2	1.76 – 2.50	Limited Implementation	The last mile practices have controlled implementation in their company to the extent that they are minimally effective in their company.
1	1.00 – 1.75	Not Implemented At All	The last mile practices are not implemented at all in their company to the extent that they are not effectively implemented in their company.

TABLE II: FOUR-POINT SCALE ON THE IMPACT ON LAST-MILE DELIVERY PERFORMANCE

Rating Scale	Mean Range	Response Option	Verbal Interpretation
4	3.26 – 4.00	Strongly Agree	High Impact
3	2.51 – 3.25	Agree	Moderate Impact
2	1.76 – 2.50	Disagree	Low Impact
1	1.00 – 1.75	Strongly Agree	No Impact

C. Data Collection Procedure and Analysis

Upon the validation and reliability testing, approval from the company's top management was secured; afterward, the survey questionnaires were distributed to chosen logistics companies, and monitoring of the completed survey questionnaires according to sample size was done to proceed with the tabulation and analysis, wherein the statistical tools used were frequency distribution, percentage, one-way analysis of variance (ANOVA), weighted mean, and Pearson correlation coefficient.

D. Ethical Consideration

The researchers observed the implementation of ethical considerations in line with local laws and regulations, observing legal and ethical guidelines, which specifically included acquiring informed consent among the participants, and ensuring that data were subjected to confidentiality and transparency.

IV. RESULTS AND DISCUSSION

The study found that the majority of the companies (f=6, P=40%) have 51 to 100 employees; followed by one to 50 employees (f=5, P=33.33%), then 101 to 500 employees (f=3, P=20%), and last with 501 to 1,000 employees (f=1, P=6.67%). On the other hand, the majority of the companies are corporations (f=12, P=80%), cooperatives (f=2, P=13.33%), and a partnership (f=1, P6.67%) as forms of ownership among the logistics companies. Meanwhile, most have been operating for more than 10 years (f=7, P=46.67%), followed by six to 10 years running (f=4, P=26.67%), and tied with three to five years of tenure. On the socioeconomic profile, most of the participants are aged 27-35 years old (f=56, P=37.33%), then 36 to 44 years old (f=46, P=30.67%), 18 to 26 years old (f=26, P=17.33%), and lastly, 45 years old and above (f=22, P=14.67%), while majority of which are male (f=104, P=69.33%), compared to female (f=46, P30.67%). On educational attainment, the majority are holders of bachelor's degrees (f=87, P=58%), followed by high school graduates (f=29, P=19.33%), then with vocational degrees (f=19, P=12.67%), and finally, with master's degree (f=15, P=10%). Among these participants, most of them hold the logistics staff position (f=44, P=29.33%), then supervisor (f=40, P=26.67%), management or department head (f=35, P=23.33%), and delivery personnel (f=31, P=20.67%). Most of them are tenured for two to five years (f=71, P=47.33%), then six to ten years (f=36, P=24%), followed by six months to one year (f=33, P=22%), and lastly, ten years and above in service (f=10, P=6.67%).

Table III: DESCRIPTIVE STATISTICS OUTPUT ON THE OVERALL LEVEL OF IMPLEMENTATION OF LAST MILE PRACTICES

Indicator	Mean	Interpretation
Picking	3.39	Fully Implemented
Delivery Mode	3.29	Fully Implemented
Delivery Time	3.21	Moderately Implemented
Delivery Area	3.35	Fully Implemented
Returns	3.42	Fully Implemented
OVERALL	**3.33**	**Fully Implemented**

Table 3 shows that "Delivery Time" has the lowest mean of 3.21, corresponding to a moderately implemented level. It indicates that logistics companies are more focused on the other variables of last mile practices. Further, having a robust, interconnected last mile infrastructure that can provide accurate, real-time data from all resources and systems is essential for enhancing interfaces and delivery performance with external carriers [7]. However, "Returns" has the highest mean of 3.42, corresponding to full implementation level. This implies that the aspect of handling returns in the last mile process is fully implemented in the operations of the logistics companies surveyed. Return management is a crucial component of return procedures that promote customer happiness, making it an essential component of any e-commerce fulfilment operation. It is easier for new customers to sample products from companies that offer generous client returns policies because they can purchase the things and return them if they are not satisfied. For the customer, this helps to reduce some of the risks.

The overall mean of the level of implementation of last mile practices is 3.33, which corresponds to a fully implemented level. The findings imply that a large portion of the participants believe that practices on picking, delivery mode, delivery time, delivery area, and returns are highly practiced in their company. This suggests that logistics companies are effectively executing last mile strategies across various aspects of their operations.

Table IV: DESCRIPTIVE STATISTICS OUTPUT ON THE OVERALL IMPACT OF LAST MILE PRACTICES ON OPERATIONAL PERFORMANCE

Indicator	Mean	Remarks	Interpretation
Resource Utilization	3.27	Strongly Agree	High Impact
Service Quality Assurance	3.23	Agree	Moderate Impact
Lean Infrastructure	3.21	Agree	Moderate Impact
Environmental Impact	3.22	Agree	Moderate Impact
OVERALL	**3.23**	**Agree**	**Moderate Impact**

Table 4 reflects the findings revealed that Lean Infrastructure has the lowest mean gaining a 3.21. This interprets that Lean Infrastructure only has a moderate impact on the operational performance of logistics companies. IT systems must be embraced and integrated into society for them to be used effectively [8]. The technology might not be completely utilized if these procedures are poorly handled, which would have a moderate impact on operational performance. However, Resource Utilization gained the highest mean of 3.27 that corresponds to "strongly agree". This indicates that the utilization of resources has a high impact on the operational performance of logistics companies. Through resource utilization, logistics companies have the ability to efficiently allocate resources such as transportation, personnel, and equipment to meet consumer demands and enhance operational performance [9]. The overall mean of the impact of last mile practices on operational performance is 3.23 which corresponds to a "strongly agree". This implies that the majority of the participants assumed that there is a high positive impact through the implementation of last-mile practices.

Table V: DIFFERENCE BETWEEN PARTICIPANTS' NUMBER OF EMPLOYEES AND THE IMPACT OF LAST MILE PRACTICES ON OPERATIONAL PERFORMANCE

Factors	Impact of Last-Mile Practices on Operational Performance	Sig-Value	Interpretation	Result
Number of Employees	Resource Utilization	0.604	Not Significant	Accept Ho1
	Service Quality Assurance	0.869	Not Significant	Accept Ho1
	Lean Infrastructure	0.041	Significant	Reject Ho1
	Environmental Impact	0.895	Not Significant	Accept Ho1
Form of Ownership	Resource Utilization	0.331	Not Significant	Accept Ho1
	Service Quality Assurance	0.636	Not Significant	Accept Ho1
	Lean Infrastructure	0.995	Not Significant	Accept Ho1
	Environmental Impact	0.933	Not Significant	Accept Ho1
Years of Operation	Resource Utilization	0.696	Not Significant	Accept Ho1
	Service Quality Assurance	0.657	Not Significant	Accept Ho1
	Lean Infrastructure	0.354	Not Significant	Accept Ho1
	Environmental Impact	0.464	Not Significant	Accept Ho1

Criteria: sig-value > .05 Not Significant(Accept Null Hypothesis) sig-value < .05 Significant (Reject Null Hypothesis)

Table 5 illustrates that the calculated significance value for Resource Utilization, Service Quality, and Environmental Impact is below the.05. level of significance. As a result, the null hypothesis is approved. The last mile's performance does not seem to be much impacted by the quantity of staff. The sig value for Lean infrastructure, however, is 0.041. Hence, the

null hypothesis is disproved. When participants are categorized based on the number of employees, it seems that there is a substantial variation in the effect of last mile activities on operational performance. It suggests that big businesses can afford to invest more in enabling lean infrastructure, but small businesses have less money to devote to technology growth. Big businesses will be able to innovate and implement lean infrastructure in line with emerging trends and technology [10]. A corporation with a tiny workforce is less flexible and innovative.

Meanwhile, the computed significance values reveal a consistent pattern across various metrics. Specifically, the significance value for Resource Utilization stands at 0.331, for Service Quality Assurance it is 0.636, for Lean Infrastructure it is 0.995, and for Environmental Impact it is 0.933. Consequently, the null hypothesis is upheld across all these domains. These results collectively suggest that there is no significant differences between the impact of last mile practices on operational performance when participants are grouped according to form of ownership. The likely effect of the ownership structure on operational performance is weak and static [11]. While it is recognized that owners' interference in business operations can be a potential issue, its overall impact on operational performance is generally minimal and often overstated. Evidence suggests that there is little to no significant difference in operational performance between different forms of ownership, such as sole proprietorship, partnership, corporation, and cooperative.

On the other hand, the computed significance values revealed a consistent pattern across various metrics. Specifically, the significance value for Resource Utilization stands at 0.696, for Service Quality Assurance it is 0.657, for Lean Infrastructure it is 0.354, and for Environmental Impact it is 0.464. Consequently, the null hypothesis is upheld across all these domains. These results collectively suggested that there is no significant difference between the impact of last mile practices on operational performance when participants are grouped according to years of operations. The adoption of innovative technologies, effective procedures, and customer-focused strategies are more strongly associated with last mile performance rather than the number of years a company has been in operation [12]. Thus, there is no significant difference in the effect of last mile practices on operational performance when participants are categorized based on years of operation.

Table 6: RELATIONSHIP BETWEEN LAST MILE PRACTICES AND OPERATIONAL PERFORMANCE

	Sig-Value	Operational Performance	Last Mile Practices
Operational Performance	0.443	1.000	0.090
Last Mile Practices	0.443	0.090	1.000

Criteria: 0.00-no correlation/negligible correlation

±0.01-±0.25-very low correlation

±0.26-±0.50 -moderately low correlation

±0.51-±0.75-high correlation

±0.76-±0.99-very high correlation

±1.00- perfect correlation

Table 6 exhibited the correlation between Last Mile Practices and Operational Performance. The Pearson correlation coefficient, a measure of the strength and variables of the linear relationship between these variables, is 0.090 for both pairs. This indicated a very weak positive correlation between last mile practices and operational performance. In addition, the significance value, which measures the probability of observing such a correlation in the absence of a true relationship in the population, is 0.443 for both pairs.

To further explain these results, last mile practices and operational performance don't show a clear linear correlation with one another. Given the high significance value, it is more likely that the weak correlation was the result of random chance than of a real underlying relationship. This does not, however, eliminate the possibility that these variables have a nonlinear connection. To obtain a more thorough knowledge of the data when dealing with non-linear relationships, alternate techniques and modifications should be considered [13]. Further studies must be conducted to explore these non-linear dynamics comprehensively.

Table 7: PROPOSED MATRIX TO FURTHER IMPROVE THE QUALITY OF LAST MILE OPERATIONS OF LOGISTICS COMPANIES

Action Plan	Objectives	Activities	Persons Responsible	Expected Result
1. Leveraging Technological Solutions by enhancing Operations with GPS Tracking and Company Apps				
Integrate GPS tracking data with customer facing platforms to provide real-time updates.	• To improve customer satisfaction and efficiency in operations. • Evaluate whether integrating GPS monitoring data with currently in use customer-facing systems is technically feasible and compatible.	• Launch chatbot for customer support queries. • Conduct training sessions to familiarize staff with new tools and protocols. • Ask feedback from the clients.	IT Department Customer Service Manager	Higher customer satisfaction due to timely deliveries and real-time tracking information
2. Enhance Premium Delivery Services				
Implement a real-time tracking and communication system within the logistics operations.	• To provide transparency in the delivery process. • To allow customers to monitor their shipments and increase customer satisfaction.	• Deploy advanced real-time tracking systems. • Set up automated notifications for customers. • Train staff on using new communication tools.	IT Department Customer Service Team Logistics Coordinator	Increased customer satisfaction, reduced customer inquiries, and improved delivery accuracy and reliability
3. Delivering Packages Beyond the Standard Workday				
Implement a shifting schedule to employees.	• To accommodate operations after hours. • To increase customer options on choosing dates for delivery.	• Notify employees of the shifting schedule that the company will implement. • Communicate with employees about what incentives they will get. • Monitor performance of both shifts to ensure quality.	Human Resource Department Operations Department	Higher customer satisfaction and eliminating bottlenecks in the operations that will hamper business continuity.
4. In compliance with special delivery instructions.				
Equip employees with the necessary systems and technology to monitor and maintain high-quality service	• To enable employees to track and assess. • To monitor and analyze service quality and	• Make sure all necessary software is updated to properly handle the recording and transmission of special instructions.	IT Department Logistics Staff and Delivery Riders Operations Department	Higher customer satisfaction due to fewer errors in handling delivery instructions can reduce the costs associated with

and delivery instructions	delivery instructions, identify areas for improvement, and implement targeted interventions.	• Implement delivery personnel with mobile devices that have systems to receive and update in real-time. • Monitor whether special delivery instructions are being followed appropriately and do audits and spot checks.		corrections, returns, or customer complaints.
5. Implement mandatory customer feedback collection in all last mile operations.				
Enhancing last mile operations through mandatory customer feedback collection	• To locate bottlenecks on the delivery process and guarantee on-time deliveries. • To improve service quality and satisfy client expectations, get information on customer experiences. • Develop key performance indicators (KPIs) to monitor and assess last mile operational performance.	• Determine the instrument that will be used for customer feedback. Surveys, open-ended forms within delivery applications, SMS replies or even a phone call may be used. • Create a system that will effectively collect and store the feedback data. • Focus on important indicators like customer satisfaction levels and rates of on-time deliveries • Use it as basis for strategy development.	Operations Department Customer Service Department IT Department	Higher levels of overall customer satisfaction as a result of more dependable, prompt, and customized services that take into account with the adjustments made in response to feedback from customers.

Table 7 presents the matrix of recommendations for the improvement of the performance of the logistics companies involving last-mile practices and operational performance. The matrix focused on leveraging technological solutions, siding on innovation pertinent to the advent of technology, and amplifying the use of GPS tracking and company applications. This also includes the enhancement of provided services by rendering premium delivery services. The researchers also proposed the delivery of packages beyond the standard workday to better meet the needs of the clients. It would also be beneficial for both ends, the company and the client if special delivery instructions are adhered to as it will improve customer satisfaction which can be reflected through feedback.

V. CONCLUSIONS

1. The logistics industry consists of both small and medium-sized companies, with medium-sized firms being the most common. Most businesses are structured as corporations, followed by cooperatives and partnerships. Many companies have been operating for over ten years, while a significant number are newer, with three to ten years of experience.

2. The logistics workforce is mostly composed of millennials, followed by gen x and gen z, with many employees in their late twenties to mid-thirties. The industry has a gender imbalance, with more males than females. Most participants hold a bachelor's degree, making it a common qualification. Logistic staff make up the largest group of participants, reflecting a variety of roles. Many have moderate experience with their companies, indicating stable employment and opportunities for growth. Overall, the sector is young, male-dominated, well-educated, and moderately experienced.

3. Logistics companies in Parañaque City prioritize efficient last-mile operations. They focus on well-organized picking schedules and careful vehicle selection to minimize delays, rather than relying heavily on advanced technologies like GPS tracking. Monitoring delivery personnel is a key practice to prevent damage, losses, and delays. Companies are also adopting real-time routing to improve delivery times, though specialized delivery options and handling special instructions need improvement. Return management is well-established, with strict inventory documentation. Overall, these companies excel in organization, vehicle selection, personnel monitoring, and returns but have room to enhance service quality further.

4. Effective last-mile practices improve logistics operations in Parañaque City, enhancing resource use, service quality, lean infrastructure, and environmental impact. Companies agree these practices boost performance, especially through personalized customer interactions. However, areas like cost reduction and customer retention using modern technology need improvement. Lean infrastructure benefits from efficient last-mile operations, though further refinements could strengthen its impact. Environmental benefits are moderate, with high compliance to regulations but room for better emissions reduction. Overall, last-mile practices positively influence logistics performance, but targeted improvements can further enhance efficiency and sustainability.

5. The findings indicate that business profile differences (size, ownership, or years of operation) do not significantly affect the impact of last-mile practices on operational performance. This suggests that regardless of company characteristics, last-mile strategies contribute similarly to logistics efficiency.

6. The lack of a significant correlation between last-mile practices and operational performance implies that other factors beyond last-mile strategies may influence overall efficiency.

VI. RECOMMENDATIONS

1. Logistics Companies may benefit from this study's company profile to provide precise data, useful recommendations, and clearer comparisons with other classifications of companies. The researchers recommend that future studies focus on one specific form of business ownership—whether sole proprietorship, partnership, corporation, or cooperative.

2. Logistic companies may use the data about the socio-economic profile of the participants as valuable insights for tailored workforce management, enabling companies to create age-appropriate training programs, promote diversity and inclusion, optimize role assignments, and design effective retention strategies based on the specific needs of their workforce.

3. To address the limited utilization of technology, the researchers propose two potential solutions: integrating GPS tracking systems and developing AI-based mobile and desktop applications that allow customers to monitor their deliveries in real-time. These technological advancements can enhance shipment tracking, optimize route planning, and improve customer communication. By gradually adopting these innovations, logistics companies can strengthen their operations and maintain a competitive edge. While full implementation may require time and resources, taking steps toward technological integration is essential for long-term success in the logistics industry.

4. The low compliance of a few logistics companies with environmental policies led us to recommend them to invest in sustainability practices like having an electric charging port for electric vehicles and electric forklifts. This recommendation came from the companies surveyed since 11 out of 15 companies (73%) use electric vehicles in their operations. Furthermore, researchers highly recommend logistics companies to use Euro 5 standard delivery vehicles to reduce harmful emissions.

5. Larger companies should prioritize investments in lean infrastructure to enhance efficiency and performance. Since ownership type and years of operation do not significantly impact last-mile practices, companies should focus on improving core operational metrics. This includes using data analytics to address process inefficiencies and implementing measures like optimizing delivery routes and adjusting staffing levels based on demand trends. Integrating special instructions into existing systems can further streamline operations.

6. Since business profile differences (size, ownership, or years of operation) do not significantly impact last-mile practices, companies should focus on refining their last-mile strategies to enhance logistics efficiency. Standardized best practices, data-driven decision-making, and continuous monitoring can help optimize delivery performance regardless of company characteristics.

7. Given the lack of a significant correlation between last-mile practices and operational performance, companies should adopt a holistic approach to efficiency improvements. This includes investing in technology-driven solutions, enhancing

workforce training programs, fostering stronger supply chain collaboration, and implementing a rewards system to reward employee performance. Recognizing and rewarding effectively can boost motivation, encourage best practices, and contribute to overall operational success.

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