

Green Logistics in Last-Mile Delivery: A Focus on Customers' Requirements and Satisfaction

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Abstract

Logistics and green packaging fields have recently witnessed numerous innovations. However, our knowledge about if customers are satisfied with the innovations is limited. This research aims to examine customers' satisfaction with green last-mile delivery innovations. Using a quantitative research method, we developed a questionnaire including 41 items to measure the study variables. Responses were 150 customers who were using innovative green last-mile deliveries. Linear regression analysis was applied to analyze the data. The findings indicate the satisfaction level of the customers highly affects green deliveries demonstrated in their loyalty. When it comes to innovations, customers are still contemplating humanized parcel delivery techniques, even after automated delivery possibilities.

Keywords: Green logistics, transportation, innovation, eco-friendly, sustainability, e-commerce.

Introduction

The last mile logistics is the last part of the supply chain and a crucial one because of customer contact. (Prof. Dr Tobias Bernecker et al., 2014) states that, the logistics industry in Germany employs approximately 2.8 million people and earns over EUR 220 billion in yearly revenue. However, these advantages can impact the environment. The German transportation industry consumes 28.9% of primary energy and is one of the greatest emitters of greenhouse gases. Through this, we get to know, how logistics is important for Germany.

Despite the critical role of logistics service providers (LSPs) in improving the environmental sustainability of supply chains, there is still uncertainty about how LSPs can turn environmental management into a competitive advantage. (D. Bhujbal, N. Shafighi, 2022)

Keeping the period between purchase and delivery, as short as possible, one of the most important aspects determining e-commerce customer happiness is delivery performance. Punctuality during deliveries is always highlighted as one of the most important factors of logistical performance, which also determines consumer satisfaction, with delays frequently resulting in redeliveries, lower perceived quality, and higher costs. Any inefficiency in the delivery service results to be expensive, in terms of finance and image for the customer (Arkadiusz Kawa, 2021). To explain some problems with Last-mile delivery, the following are the major aspects,

1.1 Increasing volume

As stated by (Boysen et al., 2021), Urbanization and e-commerce, are two worldwide megatrends that are driving an ever-increasing need for last-mile delivery services. According to projections, 70 per cent of the world's population, would reside in metropolitan cities by 2050, which naturally gives rise to E-commerce. According to (Statista 2018), E-commerce continued to grow at a global rate of 23.3% in 2018. In Germany, it is estimated that by 2023, 4.4 billion shipments will be required.

1.2 Sustainability

Increasing urban parcel needs to result in a higher number of delivery vans entering city centers, which adds up to congestion, stresses on infrastructure and has serious health, environmental, and safety consequences. Which resulted in the rise of customer awareness and new government legislation. (Boysen et al., 2021)

1.3 Costs

The expense of traditional home delivery by vehicles with a delivery person is high. Traffic congestion and a lack of parking spaces on the narrow streets, as well as customers who are not at home to accept their packages, are major cost drivers. The percentage of first-time delivery failures recorded varies between 12 and 60% depending on the region. (Boysen et al., 2021)

1.4 Time pressure

Most online merchants have made next-day or even same-day deliveries one of their primary service tactics, which puts last-mile deliveries under extreme time constraints. Furthermore, online deliveries fluctuate weekly and throughout the year, for example, due to season changes. This results in, highly variable workloads, necessitating last-mile solutions that can be easily scaled on short notice. (Boysen et al., 2021)

Environmentally responsible behaviors can contribute positively to the quality of life of current and future generations (A. Jahanshahi; et al, 2021). Successful organizations as the most important methods for creating added value for both customers and their related organizations must use these procedural instruments in the best form by recognizing Brand conception, designing and performing effective and efficient strategies, and regarding economic and commerce global trends (S Dejkam, et al; 2018).

Literature review

According to the findings of a multinomial logistic regression study, all consumers are unlikely to participate in economic variables but are quite likely to commit to operational and social aspects. So, the author suggested that the government should provide grants to CEP enterprises to embrace green logistics, such as tax breaks and subsidies, in order to lower the costs of green logistics. Meanwhile, the CEP sector might offer consumers direct and indirect incentives to reuse, recycle, and share materials, as well as to spend time learning about express companies' green logistics, in order to move forward with consumer participation in economic aspects. (Sajid et al., 2021).

(Cárdenas et al., 2017) implies that, even though the last-mile deliveries, which are usually regarded as the costliest element of the journey, still there's very limited information available on the effects of e-commerce on transportation and logistics in society. Despite the urbanization of the country, rural areas have higher e-commerce consumption per capita than metropolitan areas, keeping the same total distance travelled. While metropolitan locations face the majority of the drawbacks associated with last-mile delivery.

(Arkadiusz Kawa, 2021) collected the data using computer-assisted telephone interviews (CATI) and computer-assisted web interviews (CAWI) with 592 number of responses with accurately completed questionnaires received. The association between green logistics, satisfaction and loyalty was proven by the author's empirical study. This means that the more attention online retailers pay to green delivery, the more satisfied and willing customers are to buy from them again. (Arkadiusz Kawa, 2021)

(Hao et al., 2019) Four major elements influencing consumers' willingness to pay are revealed using the 'principal factor analysis method. The environment, green package quality, commodities, and packaging pricing are the decisive factors. Willingness to spend for green packaging using evidence from China is still preliminary, and more research is needed.

Inter-urban and urban mobility must become more sustainable, smart, and healthy, according to the European Commission's Sustainable and Smart Mobility Strategy. Large and mid-sized cities are encouraged to contribute to this transformation by implementing sustainable urban mobility and logistics plans. (Dr. P.A. Plazier, Dr. W.S. Rauws, R. Neef, Dr. P. Buijs, 2022)

Local governments have an important role. They can design regulations and opportunities for efficient municipal logistics transportation in accordance with regional or state legislation. Other stakeholders can be included in the implementation of actions to improve city logistics by city councils. (Dr. P.A. Plazier, Dr. W.S. Rauws, R. Neef, Dr. P. Buijs, 2022)

Offering governmental subsidies and co-funding is one option. In recent years, green projects in Germany have aided several advances in the field of sustainable logistics. In many cases, the programs become CO₂-effective to the point where government assistance is no longer needed. (Prof. Dr Tobias Bernecker et al., 2014)

The German government has a taxation system which varies with the emission level of the CO₂ from a particular vehicle. The vehicles with high CO₂ are taxed far more than the lower ones. (KPMG, 2017)

There's a reward for the purchase of Eco-friendly vehicles. The purchaser is awarded with a premium of EUR 4000 for electric vehicles and EUR 3000 for hybrid vehicles. (KPMG, 2017)

The findings of (Arkadiusz Kawa, 2021) include limitations that can be addressed in future research. Only a few components of green logistics as seen by online retailers were examined. Bigger sample size and study including different stakeholders is suggested.

The research by (Cárdenas et al., 2017) has some limitations. The differences between the distance approximations employed in this paper and the actual distances travelled need to be examined further. When combined with an analysis of delivery alternatives such as smart locker, bike deliveries, off-hour deliveries, or electric vehicles, further insights for managing e-commerce logistics in cities can be gained.

(Hao et al., 2019) explained, Environmental regulations may influence people's 'willingness to pay for green packaging', which promotes additional investigation and follow-up empirical investigations when enough data is available.

As mentioned by (Dr. P.A. Plazier, Dr. W.S. Rauws, R. Neef, Dr. P. Buijs, 2022), Innovations in modes of transportation can be significant, however, they are often driven by technology or changing customer tastes rather than by sustainability considerations. Furthermore, low stakeholder trust, a lack of knowledge, ability, and funds within local government, and severe competition among operators have all been recognized as potential roadblocks to achieving sustainable last-mile logistics.

(Sajid et al., 2021) used an online survey in their study, which is undeniably a more convenient, robust, and cost-effective way of polling people. However, this form of the survey had significant drawbacks, including the inability to reach specific populations, such as the elderly and less educated. Furthermore, the demographics of the respondents could be examined in relation to German consumers' propensity to participate in CEP companies' green logistics.

Research Methodology

1.5 Research type and data collection

A multiple-stage study approach has been used in this research which is inspired by some previous findings and research approaches with the help of (Arkadiusz Kawa, 2021) (Daeheon Choi 1, 2019) and (Sajid MJ, 2021). The Quantitative data collection method has been used. The author has created a new questionnaire based on the previous studies.

The author has considered a Dependent variable and four independent variables. Through which a total of 41 questions with respect to the variables will be formed. This data collection method will help to collect the required primary data.

To find out the relationship between the independent and dependent variables the Linear regression method has been used. Through this, we will get to know if the research variables that we have selected make a great

impact on the dependent variable. The study is limited or specifically made for the German population due to the involvement of the study of the government policies.

1.6 Research framework

Considering the previous researcher's study gap, the author has designed a research framework. As we can see in Figure 1 it is mentioned all the Variables.

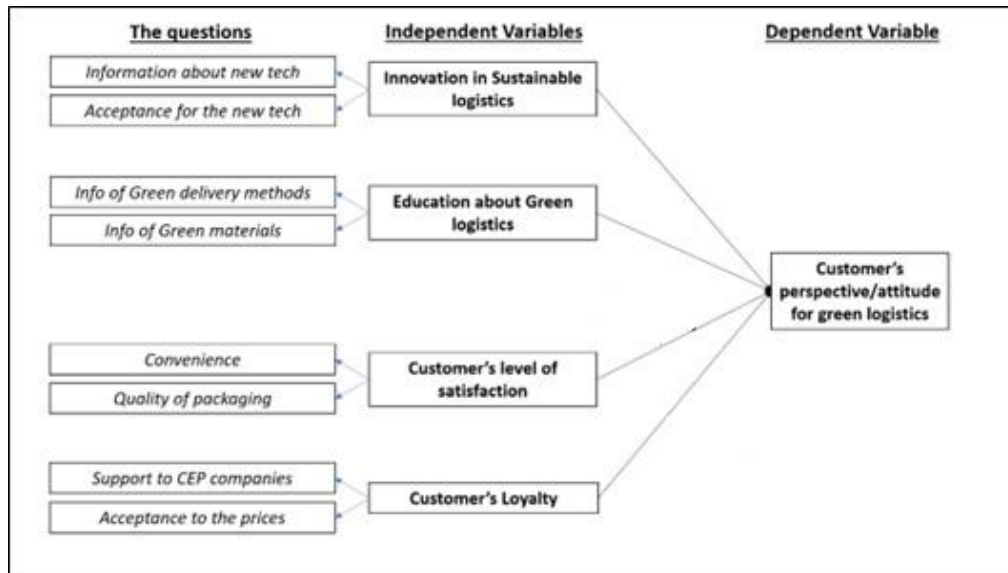


Figure 1 Research Framework (Author)

1.6.1 Dependent Variables

As we can see in diagram 1, The dependent variable is Green's last-mile logistics and the customer's perspective about it. This variable will be manipulated according to the response of the customers to the independent variables. The major research questions are formed under the Dependent variables.

1.6.2 Independent Variables

The author has designed these variables according to the previous research and after identifying some research gaps. To fill up these research gaps the independent variables have been modified with the hope that they will answer some important questions.

1.6.2.1 Innovation in sustainable logistics

The innovation of logistics is a part of our lifestyle along with the advancement of the e-commerce. Some innovations have been listed in the Literature review and the survey conducted by the author has mentioned all of them with the help of questions, through which we get to know if the people think that the particular innovation is suitable for their lifestyle or not. Also, that will give us an idea of which innovation should be developed further and which should not.

1.6.2.2 Education about green logistics

If a subject enthusiast has very little knowledge about green delivery, then the normal person has even lesser information about the same. So, we can get an insight into how much information a normal person has about the green delivery. It includes the questions about green packaging material, green delivery methods, recycling methods and government policies regarding green logistics.

1.6.2.3 Customer's level of satisfaction

By considering all the positive effects of green logistics on the environment we believe it is widely accepted, however it comes with some disadvantages. Through this, we would know if the customer is happy with his purchase or not. Because people might be used to the conventional methods but if they want to change to

become greener, then they have to sacrifice something, and through this variable, we would know the customer's level of satisfaction.

1.6.2.4 Customer loyalty

This variable is probably the most important because the customer might try the green delivery once or twice but become a habit for it will be a big concern, because green delivery is yet more efficient than the conventional ones. Through this variable, we get an insight, if whether the customer is willing to become a frequent buyer of the green products and green delivery methods. This is also a major driver of the main research questions and hence the overall dependent variable.

1.7 Questionnaire formation

The questionnaire was formed by the author, with a thought in mind for the non-professional people. That means the question was designed to be easy to understand and simple to answer.

1.7.1 Demographic questions

In this section of the survey, information like Gender, age, occupation, location, online shopping frequency and income limit have been asked. Through this, the type of the person can be identified. In this section single-select and multi-select, multiple-choice questions are used. These are developed with the help of (Sajid MJ, 2021)

1.7.2 (DV) Customer's perspective/ attitude for green logistics

This section is the dependent variable and the questions asked in this section are the major ones, which are taken from (Daeheon Choi 1, 2019). They will help us to understand the answers to the research questions. Also, it is essential data for the data analysis with the other independent variables.

In this section, straightforward information has been taken out like if people want the logistics companies to accept the green delivery methods, what kind of information people have about eco-friendly shipment, and if they are satisfied with the last green delivery they have experienced. The following studies have focused on this variable; Kuppusamy and Gharleghi (2014, and 2015).

1.7.3 (IV1) Innovation in Sustainable logistics

This is the first independent variable according to the questionnaire and it is also formed with the level of agreement questions (Sajid MJ, 2021). Here the author has asked what kind of currently used innovations are people using and if they want to see some improvement in the reduction of the packaging material waste.

1.7.4 (IV2) Education about green logistics

We cannot assume if all people know the green logistics and why it concerns them. People have less knowledge about the green system. Some basic questions have been formed.

1.7.5 (IV3) Customer satisfaction

The section tries to know if the customer is satisfied with the last green purchase. The questions are formed in such a way that through them we may know all the sides of customer satisfaction. The most important thing with these questions starts with the pricing. Also, some opinion about satisfaction with the packaging, delivery timing and customer service has been asked.

1.7.6 (IV4) Customer loyalty

In these questions, the author wanted to know if the customer will be considering buying the green product next time or keep buying from now onwards. Also, the answers to the questions will imply that, if the consumers support the CEP companies to upgrade them with the green methods. These questions are derived from the questionnaire proposed by (Arkadiusz Kawa, 2021).

1.8 Sampling Method

For the research, it is clear that the quantitative method of data collection has been used. For this, the survey questionnaire was distributed among the consumers. Before the distribution, it was given a pilot test with a couple of subject experts and one consumer. The questionnaire was modified with their important opinions. After the final questionnaire design, it was formed with the help of Google forms. Which is better in terms of data collection for its ease of work.

There's no specific group of people has been focused, on because from a business point of perspective the parcel receiving person could be anyone, which makes it difficult to keep a customer in a certain category. Hence, the 'simple random sampling method has been used, however, there's one group which could be concentrated on as follows.

A URL link was formed through a google account and it was distributed with the help of social media and the University platform. Social media was considered as WhatsApp groups, Instagram and LinkedIn. Also, the University student platform was used to distribute it amongst the students, which are a definite part of the German population.

1.8.1 Target group and location

The researcher has segregated the age groups into 16 to 21, 22 to 30, 31 to 40, and 41 and above. It is assumed that the age group from 16 to 30 would be of more response than the next elder ones. Because we cannot deny that when it comes to online purchases the most responsible population could be the youth or most probably the students. The most important reason to target the youth is that they are the future of the planet and considering their opinion about the green logistics is far more important. The current generation might not have the access to the fuel within the next few decades, so getting their attention to this subject feels essential to the author.

The study is specifically focused on Germany. There are several reasons to keep it that way. As it is provided in some kinds of literature, Germany can be considered a booming industry for green logistics due to people's response and government support.

Results and Data Analysis

Two weeks of response collection resulted in 150 participants. Most of the respondents were obtained from Instagram. As per the responses following data has been analyzed with the help of Regression analysis and correlation analysis.

1.9 Demographic analysis

1.9.1 Gender

In the total 150 responses, there are a whopping 71.9% of male participants as compared to females. The female participants are just 28.1%, which shows a gap of 43.8%. This also means that the Male population is more into using the internet and specifically social media.

1.9.2 Age

Here, the most responsive age group was 22-30 with an incredibly 81%. There are 124 responses recorded from this group out of the total 150. The age group from 22 to 30 is most prominent in the case of online shopping. Also, they have been considered as a group of people with a steady income and most updated in new technology.

1.9.3 Education

The maximum number of respondents have a Master's degree, which is 56.3% and 30.5% have a Graduate degree followed by undergraduates with 9.9%. Only 5% of the responders have a Doctorate. From this, we can say that most of the population is young and highly educated.

1.9.4 Occupation

Most of the people are doing a full-time job somewhere, which counts 43.8% followed by full-time students and part-time jobbers with 21.6% and 13.7% respectively. Hence, we can state that most of the participant crowd either has a job or they are a student.

1.9.5 Earning

This might be the most important information because the income may decide the level of expenses of a person. The maximum number of participants fall under the income range of 450-1500. The income range of 0-450 and 1500-6000 Euro holds the same share of 17% followed by 2500-6000. As these are the lowest to the medium income holder.

1.9.6 Location

The location might help to decide the needs of the people, because every kind of location type may decide the level of assistance or the type of delivery method required. Most of the population was situated in a city with a percentage of 61.8%. Then the remaining population refers to Town and Suburban areas with 26.3% and 9.9% respectively.

1.9.7 Online shopping frequency

This data could be more important for an eCommerce business, because, we get to know the online shopping frequency of the people. AS we can see, most the people are ordering Once or twice a month from online shopping with 60.8%. the second next population goes with once or twice in a year with 25.5%. People who order twice a week are 11.1% and everyday shoppers are pretty less at 2.6%.

1.9.8 Parcel delivery preference

The author has asked people their parcel receiving preferences with multi-select options and the results are in figures 4-8. After all, creating many options, people tend to choose direct home delivery with 82.9%. The second rank cracked by delivery in time slots with 38.8%. The least preference is self-pickup anywhere. There are 3 types to pick up the parcels and all of them are least preferred by the customers.

1.10 Linear Regression analysis

As the name indicates the author has used the linear regression analysis. For the analysis MS Excel software has been used.

For the Regression analysis the selection of X and Y axis data needs to be done. Here Y is the Dependent and X is the independent variable. In this case there's first column of DV has been selected as Y axis and other 4 columns are selected as X axis. After this selection the data analysis in the software has been carried out, which resulted in the following data.

1.10.1 Regression Output

We can see in the following table 1 about the achieved regression statistics. Here, we can focus on the 2 important values such as R Square and Observations.

Table 1 Regression Statistics

| Regression Statistics | |
|------------------------------|-------------|
| Multiple R | 0.824842341 |
| R Square | 0.680364888 |
| Adjusted R Square | 0.671547368 |
| Standard Error | 0.295300729 |
| Observations | 150 |

R-square means the independent variables can explain 0.6803 or 68.03% of the behaviour of the dependent variable.

Table 2 ANOVA Table

| ANOVA | | | | | |
|------------|-----|-------------|-------------|-------------|----------------|
| | df | SS | MS | F | Significance F |
| Regression | 4 | 26.91438451 | 6.728596128 | 77.16056923 | 6.15526E-35 |
| Residual | 145 | 12.64436549 | 0.087202521 | | |
| Total | 149 | 39.55875 | | | |

The table 2 is called as ANOVA table and we are focusing on the column 'F' and Column 'Significance F'. This represents the area in the F-statistics, also they tell us if this is a good model or not. According to the ANOVA table, the Significance F is 6.15526E-35 which is way too smaller to show on a graph. This means our regression is good as well as we have a good equation.

Table 3 Actual Co-efficient

| | Coefficients | Standard Error | t Stat | P-value |
|------------------|--------------|----------------|-------------|-------------|
| Intercept | 0.099097392 | 0.112781367 | 0.878668122 | 0.381034975 |
| IV1 Innovation | 0.118829954 | 0.04405425 | 2.697355052 | 0.007817844 |
| IV2 Education | 0.31885039 | 0.04513903 | 7.063740431 | 6.25994E-11 |
| IV3 Satisfaction | 0.211366368 | 0.037261678 | 5.672486532 | 7.38133E-08 |
| IV4 Loyalty | 0.233552349 | 0.048817231 | 4.78421949 | 4.18088E-06 |

* Note: the dependent variable is: Customer's perspective/ attitude for green logistics

Lastly, we are looking at the Coefficients in table 3, which represents the actual data of our model. The table describes the linear model which will graph a best fit line through our data. If we look at the Coefficients of the IV's, all the IVs have a positive value, which shows the direct relation between the Dependent variable and Independent Variables. an increase in the values of IVs would increase the value of the DV. Simply, when the level of innovation, education, satisfaction, and loyalty improves, then the Customer's perspective/ attitude for green logistics will improve.

Conclusion

The results that we have acquired with inputs from the German consumer make it clear what are they looking for. Indeed, we have a data collection from the normal consumer, however being the younger generation, they are the most tech-savvy and highly educated smart people with a vision for their and the planet's future.

The current methods of green delivery are widely accepted by the consumer; however, the satisfaction level is questionable due to convenience and time requirement limitations. Also, the major reason for their limited satisfaction is the price of the green delivery. Indeed, they are willing to pay more to make it green, however, the prices are poorly in the competition with the conventional methods.

After examining and analyzing the level of information of the end consumer, we got to know that they have very limited education about green logistics and more importantly about the government policies. The customer has preferred the drone delivery more than the delivery through robotic droids (with a minor gap), however according to the previous research, the droids are safer and more efficient than the drones. Also, even though the European government has one of the best policies regarding the green last-mile delivery across the globe, the consumer is still asking to make the same policies which already exist. The reason for this is that, the information about the support from the government in the form of tax concession and subsidies to the businesses are not easily accessible to the general public, hence they lack the information.

To overcome the education aspect, the author has a few suggestions for the government as well as the green businesses, which are backed by the survey results and consumer recommendations. The current government should publicize and make easily accessible their policies regarding the support of green businesses, so the

young entrepreneurs would be more interested and clearer with their vision. Along with the policies, education about green logistics should be given at the school level to make an awareness among the future customers.

Even though there are strict rules about the use and recycling of plastic packaging material, there are lesser taxes for manufacturing it. Plastic recycling does not make an effective difference if there's no control to manufacture it (Nicasio, 2021). The government is recommended to apply heavy taxes for the manufacturing which will make it less usable and also it will motivate the consumer to use less plastic.

1.11 Managerial implication

The awareness about the green logistics from the government may not be faster, however, the green logistics businesses can do more about it. As a business, making publicity with the green aspect makes us look more effective due to the effect on the customer's mind. From the marketing point of view, providing a leaflet with the information about the sustainable delivery (e.g., Thanking them for choosing the green delivery and green product). Also, they can provide information on their website about the transportation method, so the customer will be more interested in orders and recommendations.

The green products can be sold cheaper than in the current situation due to tax benefits, so the stereotype of paying more for the green purchase will be broken. That will also make great competition in the current market of duplicate and harmful products.

If the packaging requirement of the product is a cardboard box, then recycling the box would make it greener. For the same, the recycling instruction for the box can be provided on the website as well as on the box itself. An incentive for the consumer can be provided to return the box to the pickup points as a Pfand.

If the last mile logistics business is dependent on conventional vehicles, then they can consider switching their vehicles to cargo electric vehicles. The price, maintenance, and tax benefits make it more realistic as well as sustainable.

1.12 Limitations and Future scope

The study with the survey indeed comes with a good descriptive manner, however, there are some limitations which can be a good way for the further study.

In this study the respondents mostly are young and working generation, however, Germany has more old people than young ones, so getting their opinion is also an important task which was not addressed in the current research. Also, as per the author's reach to the participants was limited to the people from the city centre and town area, hence the research can be further examined with the inputs from the Suburb and village locations, as all of them represent different needs according to their convenience.

The study was conducted with some current and feasible innovations applied in Germany, however, if there are new improvements in the same field or innovations in the delivery equipment, then the study can be further improvised. Also, the research was limited to Germany only and this can be further expanded to all of Europe or any other country.

The study was conducted in a particular period and with the current speed of innovation in the logistics sector, the study can be carried out again in a different timeline.

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