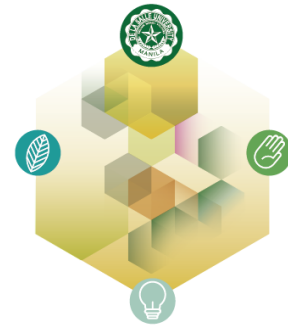


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Fostering a Humane and Green Future: Pathways to Inclusive Societies and Sustainable Development



Development of Diagnostic Analytics to Maximize Customer Profitability in AC Logistics

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Abstract: AC Logistics Philippines helps customers establish a successful supply chain by tracking and controlling their shipments through its network. The company collaborates with numerous industries to create innovative, value-added solutions. The convergence of technology has transformed logistics competitiveness, requiring flexibility. Thus, the company's tight partnerships with major airlines enable the most reliable and cost-effective air cargo solutions. The purpose of this project is to develop diagnostic analytics to maximize customer profitability for AC Logistics in order to provide solutions to the company's problems, which include understanding what and why trends are occurring, aggregating data managed by different resources, and addressing errors in calculations by having set measures and calculated fields within the tool. The proponent used the CRISP-DM model which is flexible and iterative. The results of the diagnostic analytics showed insights regarding which customers are profitable and the shipment commodity that generated the most profit. This has to lead the company to identify which customers to invest in. In addition, it has led to insights to handle operations during peak periods. The capstone project showed that customer profitability data, when properly used with descriptive and diagnostic analytics, provides insights that help the organization succeed financially. To enhance customer profitability, future studies should examine external variables such as flight, pandemic restrictions, seasonality, and inflation.

Key Words: data analytics; air logistics; descriptive analytics; diagnostic analytics; seasonality

1. INTRODUCTION

The aviation industry has grown steadily over the past couple of years, primarily due to the increasing demand for cargo and tourism; however, the COVID-19 pandemic disrupted the supply and

demand chain of the travel market (Dube et al., 2021).

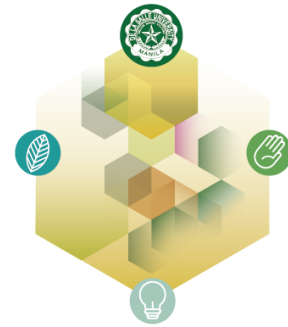
Profitability will depend on continuous cost control as the industry returns to more typical production levels and high fuel prices persist for some time. Walsh stated that the suppliers, including airports and air navigation service providers, must be

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as cost-conscious as their customers to assist the industry's revival (IATA, 2022). Cargo revenues will contribute to \$191 billion of industry revenues. It is a modest decrease from the \$204 billion recorded in 2021 but more than double the \$100 billion recorded in 2019. In 2022, the industry is projected to transport a record-breaking 68 million tons of cargo.

Despite the high air transportation cost, retailers believe delivering shipments secured is still a better deal. In September 2021, the cost of sending a kilogram of goods using air was 12.5 times more than the cost of sending the same amount using ocean freight. The International Air Transport Association noted that air cargo's speed helps minimize the effects of supply chain constraints. Congestion at US ports and the closures of factories in the country are causing some companies to consider accepting higher freight rates (Garland, 2021). Backlogs at global shipping ports and local lockdown measures in countries such as Vietnam, where the Delta-variant is surging, are forcing retail executives to expedite shipments originally slated for ocean cargo. Those alternative modes of transport come at a higher cost, exacerbating inflationary pressures that finance executives are confronting elsewhere in their business. Rates for air cargo has increased as airlines continue to operate fewer international passenger flights than before the pandemic, according to Clive Data Services, an Amsterdam-based tracking firm. Logistics companies use passenger flights to ship some of their clients' goods (Broughton, 2021). With shippers seeking to speed freight through clogged U.S. ports to meet holiday deadlines, peak season is expected to trigger another busy period for air carriers. Some businesses, however, have already planned to secure the timely delivery of their items, whether by chartering ships or simply sending merchandise sooner if they have the room. As a result, commerce and manufacturing activities are hurt by supply chain challenges, but air cargo benefits from its speed, which helps satisfy peak season demand and will allow it to continue to outpace global goods trade (Garland, 2021). Most airports that receive mainline cargo flights from DHL, FedEx, or UPS will observe changes in the operational pattern - aircraft that would ordinarily linger for the entire day may instead conduct two flights; a route may be served by a larger aircraft; a route may be operated by a wet-lease partner (Benson, 2021). AC Logistics Philippines must be aware of airline rates and seasonality to be profitable in the airfreight industry.

Data analytics is the technique of analyzing

data to answer questions, recognize trends, and gain insights. Data analyses help organizations analyze data from many perspectives and generate visuals illuminating data trends. Algorithms are a more sophisticated data analytics ability, with an in-depth understanding of coding and statistical modeling to reap the benefits of data-driven decision-making (Cote, 2021).

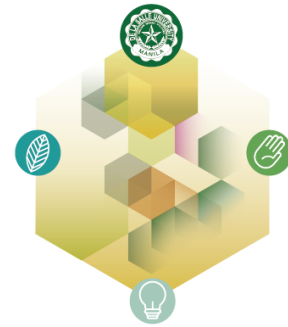
Air freight logistics has enabled the global transport of cargo, hence fostering economic expansion (Abdullah et al., 2016). The expansion of the aviation business has complicated air freight operations, including the problem of revenue management in aviation logistics (Huang & Lu, 2015). Air freight logistics plays a significant part in continental inter-hub, inter-airline, and intermodal competitiveness (Heinitz et al., 2013). For instance, service companies such as freight forwarders are the primary consumers of combination airlines (Reis & Silva, 2016). In Wu and Yang's study, the main objective is to construct a hybrid data mining model to extract critical information from a vast volume of unstructured data on aviation logistics and develop strategies for managing air cargo logistics. This study provides a hybrid data mining technique for investigating air cargo logistics insights. (Wu & Yang, 2018).

Developing diagnostic analytics based on customer profitability is significant to the success of AC Logistics Philippines as it helps identify why a specific demographic or a customer group exhibits positive profit or negative profit. Customer profitability also helps in planning for the future by analyzing historical data and understanding why something has transpired. This information can help executives develop strategies and initiatives to meet their customers' expectations and gain profit.

AC Logistics is not able to understand what is happening and why it occurred, find it difficult to aggregate data that is managed by different resources, and encounter mistakes in the calculation. The objective of this capstone project is to develop diagnostic analytics to maximize customer profitability for AC Logistics in order to address these problems. The study focused on the company's internal data.

2. METHODOLOGY

Cross-Industry Standard Process for Data Mining (CRISP-DM) is the methodology used in this study. It describes the normal phases of a project, the



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tasks associated with each phase, and the links between these tasks. The life cycle model is comprised of six phases, with arrows representing the most significant and common dependencies between them. The order of the phases is not rigid. In truth, majority of initiatives cycle between phases as necessary (IBM, 2021).

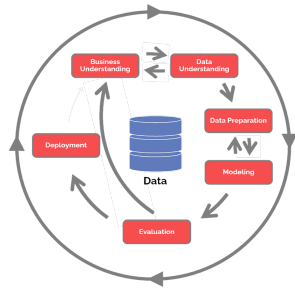


Fig. 1 CRISP-DM Methodology

2.1 Business Understanding Phase

The Business Understanding phase is a step-by-step process that involves identifying the project's objectives and requirements. Aside from defining the goals, this phase also involves establishing a business success criterion. In this phase, the current situation is established to determine the scope of the work must be considered as well as the various risks and opportunities involved in the project (Data Science Process Alliance, n.d.). AC Logistics wants to understand why their top 5 customers are trending during a specific period in the year 2021. This is for the client to know the variables that contributed to this occurrence and their correlation. The steps included identifying high and low-performing customers; visualizing and sharing reports with other stakeholders; discover the reasons why customers are trending during a specific period; and drill through the data to identify the cause of trends.

2.2 Data Understanding Phase

The Understanding phase focuses on identifying and collecting data sets that can be used to improve the project. If necessary, it includes loading of the data into the analysis tool. After collecting the data, it can be explored to know the properties and identify relationships among the various data sets (Data Science Process Alliance, n.d.). AC Logistics Philippines utilizes the data from the invoice team per customer based on all the transaction records in the system, the airline rate per kilo derived from airline rates which considers holidays, the cost of the company to ship the cargo, the weight of the cargo, and

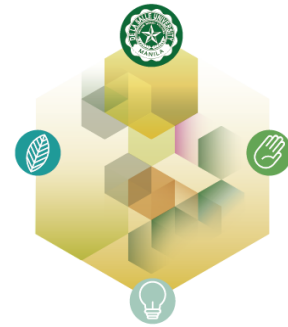
the number of airline flights in accordance with the pandemic guidelines. The data provided was given through an extract from the system, in csv and .xlsx format.

2.3 Data Preparation Stage

This step is usually followed by the selection of the data sets that will be used for analysis. It also reviews the reasons why these data sets should be included or excluded. Most of the time, the clean data task is the most critical part of the data preparation process as it involves identifying and removing erroneous values. There are also instances that new attributes are then added to the data sets to make them more useful. This phase also includes converting data sets to their proper data format (Data Science Process Alliance, n.d.). All the data collected from AC Logistics Philippines underwent data cleaning, construction of data if applicable, and formatting. The proponent together with AC Logistics have selected the data sets in alignment with the customer profitability report. Redundant fields such as Branch, BU, and center were excluded from the customer table. Data such as the Estimated Time of Arrival (ETA) were removed as it was deemed not essential to the relationship between flight count and pandemic restrictions.

Specifically, the profit data was cleaned and transformed by unpivoting the original data. This transformation effectively highlighted the total sum of profits per year, facilitating easier aggregation. Additionally, the proponent converted the data sets into the appropriate format using Data Analysis Expressions (DAX). This enabled the creation of essential measures and tables, including a date hierarchy, total profits, growth rate per customer, total expenses, total headcount, and total orders for the years 2019 to 2021. To organize the data effectively, the proponent established various tables and columns. These included the Map Table, Performance Table, Calendar Table, and Industry Lookup, each incorporating specific attributes and columns relevant to the analysis. As part of the data transformation process, the proponent created lookup tables such as Customer Lookup, Calendar Lookup, Rates Lookup, Flights, Industry Lookup, Holiday Sales Lookup, Performance Group, Pandemic Restriction Lookup, PH Map Lookup, Profit Data, Expense Data, FTE Data, Branch Lookup, and

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Inflation Rate. These tables were prepared by importing the relevant data, performing necessary transformations, and establishing relationships with other tables where applicable. Adhering to this comprehensive data preparation approach, the proponent ensured the quality and reliability of the data, thereby setting a solid foundation for subsequent analysis and deriving valuable insights for AC Logistics Philippines.

While descriptive analytics was used as a prerequisite to diagnostic analytics, there are evident indications of employing aspects of root cause analysis to identify profitable and non-profitable customers. The data preparation phase ensures data quality by cleaning and formatting the AC Logistics Philippines dataset, integrating data from multiple sources, and incorporating a calendar table for date-based analysis. Data modelling establishes relationships between tables, visually illustrating the connections between specific columns. Descriptive analytics is applied through various visualizations, including those for change over time, ranking, KPIs, part-to-whole comparisons, matrix charts, spatial visualizations and diagnostic analytics for drill-through analysis, and root cause analysis.

2.4 Modelling Phase

This phase involves building and assessing analysis techniques. The CRISP-DM guide suggests that assessing and building analysis until finding one that fits their needs. Doing so would help them find an optimal analysis model that shows the historical analysis (Hotz, 2018). The analytics modelling was done using Power BI which has a graphical user interface and a built-in data pipelining framework, allowing users to build, and run interactive models that utilizes low code development. In the case of AC Logistics Philippines, the proponent utilizes the visual vocabulary suggested by the Financial Times to enhance the effectiveness of their data visualizations. By adhering to these principles, the proponent ensures that the visualizations accurately convey the intended messages and insights to the stakeholders.

The use of short or long-term moving averages and extended series in the "Change v Time" visualization helps emphasize changes in the data, providing a comprehensive view of trends over different time periods. The "Ranking" technique using a standard bar chart allows for quick and easy understanding of the relative positions of values. The "KPI" visualization enables the evaluation of key performance metrics against defined goals, aiding in

assessing overall performance.

Similarly, the "Part to Whole" visualization using pie charts or doughnut charts effectively showcases the breakdown of data into its component elements, facilitating easy comparison of segment sizes. The "Matrix Chart" technique, inspired by the Financial Times' recommendation, assists in navigating and comprehending complex data by organizing it across multiple dimensions.

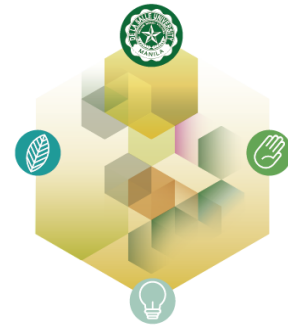
Furthermore, the "Spatial" visualization, employing choropleth maps, helps geographically represent data based on latitude and longitude, enhancing understanding of regional variations. The use of scatter plots or line columns for "Correlation" analysis enables the identification of relationships between variables, fostering insights into potential connections and patterns. Lastly, the "Drill Through/Root Cause Analysis" technique utilizing the Power BI decomposition tree visual allows for exploring data across different dimensions, aiding in identifying underlying causes and investigating further. The Financial Times' visual vocabulary, the proponent ensures that the data visualizations are designed with clarity, coherence, and adherence to best practices. This improves the effectiveness of the visualizations in communicating insights, facilitating better understanding, and supporting decision-making processes for AC Logistics Philippines.

The emphasis on exploring metrics such as total profits, growth rates, and expenses suggests an investigation into customer profitability. By leveraging visualizations and data modelling, AC Logistics identified profitable and non-profitable customers, providing insights into the underlying factors influencing customer profitability. While it uses descriptive analytics, however, to further analyse why it occurred suggested the utilization of root cause analysis or drill through techniques to understand why such customers are profitable at AC Logistics.

2.5 Evaluation Phase

The Evaluation phase focuses on the business understanding phase and deriving insights that are actionable based on historical data (Hotz, 2018). Aside from conducting focus group discussion, diagnostic analytics was done to show the why trends have transpired considering the omitted variables.

A Focus Group Discussion (FGD) was conducted with the following participants: general manager as the domain expert and major stakeholder; the operations manager, marketing specialist and the



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3. RESULTS AND DISCUSSION

With the results of the FGD and the availability of the data, the proponent has highlighted the importance of analyzing the profit trends, profit margins, profit KPIs, and YoY analysis. The proponent has utilized a data presentation strategy to uncover the insights that demonstrate the increase during every fourth quarter, the top five clients, and the industry to which they belong.

The project showed that YoY comparison, profit growth, target profit per customer, segmentation, industry, or commodity helps to understand customer profitability trends. The initial data shows that the industry to significant to customer performance. The proponent has implemented an FTE analysis that shows the efficiency of handling cargo per month which helped the company plan for future allocation and decision-making for workforce allocation. Additionally, the analytics has uncovered the effects of COVID19 pandemic on the number of flights. The system also shows the quarter-to-quarter analysis, which is vital for accounting for the peak period of profits. The proponent has included a visualization of the diagnosis tree that lets the company drill through the visualization.

The company's performance can now be seen at a glance, as opposed to the typical three to four days waiting period. It was easy to identify the industry that contribute most to the company's profit, in their case, these are the electronics/appliance and high-tech semiconductor industries. Customers are segmented for more focused marketing by doing a customer-by-customer detail analyses that enabled the company to determine which customers to invest in for the future.

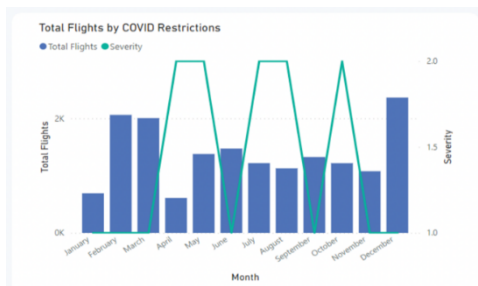


Fig. 5 Flight Count Against the Severity of the Restriction

Using proposition charts, the company was able to rapidly identify the most profitable company and determine which quarter makes the most profit, allowing them to prepare their operations and sales teams for the influx of goods during peak periods. If inflation continues to rise, the sector could see severe repercussions as the price of the typical aviation fuel is positively correlated to selling rates. This has allowed AC Logistics to monitor and track inflation, which has a direct impact on overall financial performance.

4. CONCLUSIONS

The organization had difficulties with calculations since they manually aggregated spreadsheets, input formulas, and stored them locally on their workstations. This has rendered the business incapable of gaining insights and acting on decisions. The capstone project demonstrated that customer profitability data, when utilized with descriptive and diagnostic analytics, reveals insights that are crucial for the company's profitability, thereby highlighting the significance of developing descriptive analytics and a diagnostic tree to drill through data. To maximize client profitability, future research should explore additional external variables such as, but not limited to, flights, pandemic restrictions, and inflation. Through descriptive and diagnostic analytics, the organization was able to go into the components and determine why a particular trend had occurred. AC Logistics should utilize the dashboard to acquire additional information and take action based on the data.

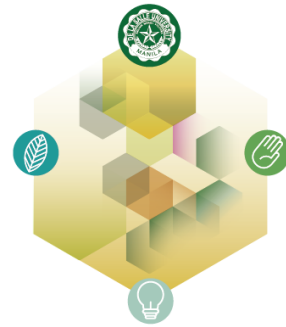
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