INTERNATIONAL JOURNAL OF INNOVATIVE COMPUTING
ISSN 2180-4370
Journal Homepage : https://ijic.utm.my/

Design and Implementation of an AI-Integrated Power BI Dashboard for Data-Driven Logistics Management: A Case Study of Ninja Van Pengkalan Chepa

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Submitted: 15/9/2025. Revised edition: 28/11/2025. Accepted: 5/1/2026. Published online: 28/7/2026
DOI: https://doi.org/10.11113/ijic.v16n1-2.696

***Abstract*—The exponential growth of e-commerce has intensified operational demands on courier and logistics services, making real-time performance monitoring and customer insight generation vital for competitiveness. In Malaysia, regional hubs such as Ninja Van Pengkalan Chepa (TrustCo) face recurring challenges, including parcel overload during peak seasons, manual reporting processes, and limited visibility into customer behavior. This study addresses these issues through the novel development of an integrated Power BI dashboard enhanced with AI chatbot capabilities, specifically tailored for regional courier operations, a combination not previously implemented in Malaysia's logistics context. Employing a design and development research approach based on the Software Development Life Cycle (SDLC) framework with Agile principles, operational data from 2022–2025 including parcel volumes, delivery metrics, and customer feedback were analyzed and visualized. The proposed system integrates three innovative modules: (1) Operational Monitoring, for courier performance tracking; (2) Customer Analytics, enabling demographic segmentation and sentiment analysis; and (3) AI Interaction, introducing natural language query processing through a chatbot interface. User Acceptance Testing (UAT) involving logistics professionals validated the system's usability, with 86.7% reporting intuitive navigation, 80% confirming data accessibility, and 93.3% verifying filter accuracy. The AI-powered chatbot demonstrated strong capability in interpreting contextual logistics queries, significantly improving accessibility for non-technical users.**

***Keywords*—Ninja Van, Data visualization, Logistics Dashboard, Customer Segmentation, AI Chatbot, Business Intelligence**

I. INTRODUCTION

The exponential growth of e-commerce has positioned logistics and courier services as critical components of the modern supply chain, with efficient parcel handling becoming a key competitive differentiator [1]. In Malaysia, the courier industry faces significant challenges during peak periods, where high parcel volumes lead to operational bottlenecks, delivery delays, and strained resource allocation [2]. Ninja Van Pengkalan Chepa, as a regional hub serving Kota Bharu, exemplifies these challenges, operating without an integrated system for real-time performance monitoring and customer insight generation.

Current approaches to logistics management in many regional hubs often rely on manual data processing and static reporting, which prove inadequate for dynamic operational decision-making required in fast-paced logistics environments [3]. While business intelligence (BI) dashboards have demonstrated considerable value in large-scale supply chain contexts [4,5], their application in small to medium-sized courier operations remains limited. Previous research has highlighted the potential of data visualization in logistics [6], yet critical gaps persist [7].

This study addresses these limitations by developing an integrated Power BI dashboard with AI chatbot capabilities specifically for Ninja Van Pengkalan Chepa (also referred to as TrustCo in this study). The research aims to: (1) analyze

logistics trends and courier performance using historical delivery data, (2) develop an interactive dashboard for operational monitoring and customer segmentation, and (3) implement an AI chatbot to enhance user interaction and provide instant analytical support. The proposed solution represents a significant advancement over traditional methods by providing real-time insights, demographic analysis, and natural language query capabilities essential for informed decision-making.

II. PROBLEM STATEMENTS

Ninja Van Pengkalan Chepa operates as both a courier service outlet and a pre-distribution hub in Kota Bharu, Kelantan. Since commencing full operations in April 2022, the branch has faced challenges, including parcel overload during festive seasons, inconsistent tracking systems, and limited visibility into customer behavior patterns due to the absence of a centralized monitoring system.

A comparative analysis of existing logistics dashboard systems was conducted to identify functional gaps, the results of which are summarized in Table I. The analysis reveals that while major providers like DHL and FedEx offer robust tracking, they lack integrated features for customer feedback analysis, demographic insights, and AI-powered interaction, capabilities that are particularly valuable for regional hubs serving diverse customer bases. It is important to note that all data used in this study was anonymized and aggregated to ensure customer privacy and confidentiality. Whilst for TrustCo that was developed in this study, the features involved consider all critical elements.

TABLE I. COMPARATIVE ANALYSIS OF EXISTING LOGISTICS DASHBOARD SYSTEM

Feature	TrustCo (This study)	DHL	FedEx
Open Access	YES	YES	YES
Courier Focused	YES	YES	YES
Customer Feedback	YES	NO	NO
Customer Review	YES	NO	NO
Chatbot Q&A	YES	NO	NO
Gender Insights	YES	NO	NO
Location Insights	YES	YES	YES

This research makes three primary contributions to both theory and practice in logistics management. First, it demonstrates the practical design and application of a comprehensive BI dashboard tailored for the specific needs of Ninja Van regional courier services, a segment often overlooked in prior literature. Second, it advances current logistics analytics by incorporating customer feedback and review mechanisms, enabling real-time insights into service quality and satisfaction that current available like DHL and FedEx systems currently lack. Third, it introduces AI-driven features, including a chatbot Q&A interface and demographic insights (gender and location analytics), which enhance user engagement and facilitate data-driven decision-making for diverse customer bases.

The developed framework provides a scalable model for the digital transformation of small to medium-sized logistics operations, demonstrating how accessible BI tools can be leveraged to bridge the gap between raw operational data and actionable business intelligence.

III. METHODOLOGY

A. Research Design and Framework

This study employed a design and development research approach, utilizing the Software Development Life Cycle (SDLC) framework with Agile principles to create an integrated dashboard for courier performance monitoring. The iterative nature of Agile methodology facilitated continuous refinement based on stakeholder feedback, ensuring the final product aligned with operational needs at Ninja Van Pengkalan Chepa [9]. The development process encompassed five primary phases: planning, analysis, design, implementation, and testing. Fig. 1 illustrates the research framework and workflow from initial dashboard development to final improvements based on user acceptance testing.

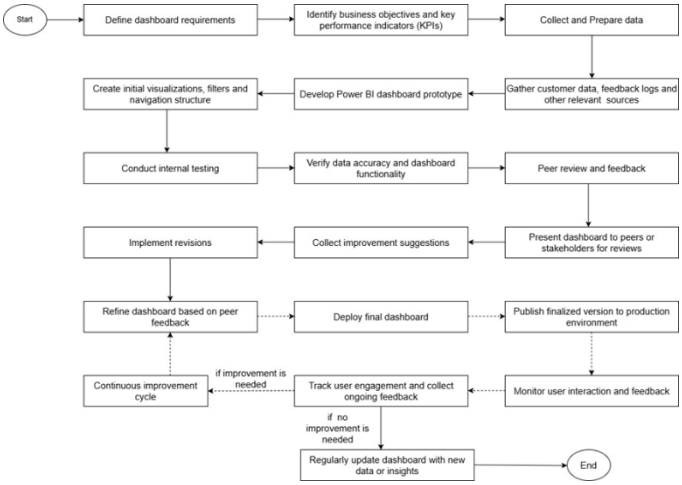

Fig. 1. Research Framework Adopted in This Study

B. Data Collection and Preparation

Operational data spanning from 2022 to 2025 was collected from Ninja Van Pengkalan Chepa, comprising parcel volumes, customer demographics, delivery performance metrics, and customer feedback. The dataset included information from multiple courier services operating at the hub: Ninja Van, Shopee Express, and Flash Express.

Data preparation involved significant cleaning and transformation processes using Power Query in Microsoft Power BI. Key steps included the generation of unique identifiers to establish relationships between customer and parcel data. Standardization of gender labels and geographic references, and consolidation of multiple monthly Flash Express files into a unified dataset. It also removes duplicate entries and irrelevant columns to optimize processing efficiency.

The entity relationship diagram (Fig. 2) illustrates the structured data model developed to support the dashboard's analytical capabilities.

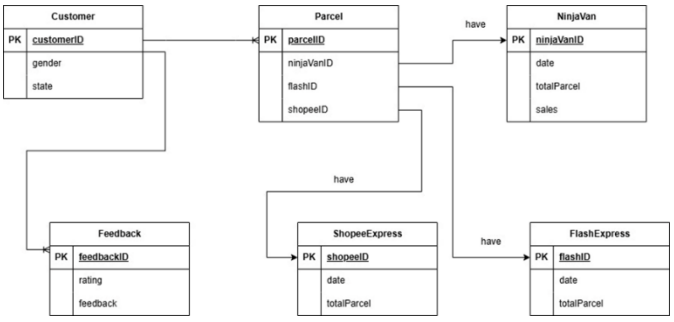

Fig. 2. Entity Relationship Diagram for the Courier Monitoring System

C. Dashboard Development Process

1) Platform Selection and Architecture

Microsoft Power BI was selected as the primary development platform due to its robust data visualization capabilities, seamless integration with the Microsoft ecosystem, interactive filtering options, and its cost-effectiveness for small to medium-sized enterprises compared to other BI tools like Tableau. The dashboard architecture was designed around three interconnected modules: Operational Monitoring, Customer Analytics, and AI Interaction.

The use case diagram in Fig. 3 illustrates the interactions between the user and the TrustCo dashboard, outlining key functions such as viewing parcel data, analyzing sales trends, and accessing customer demographics.

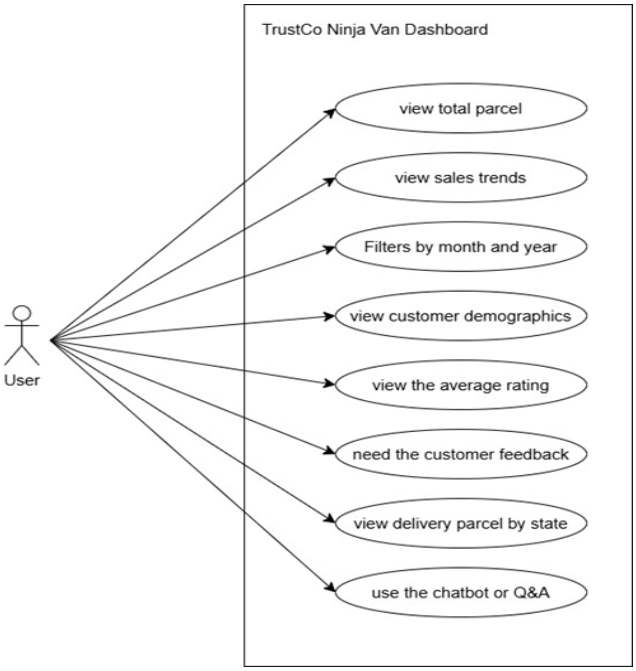

Fig. 3. Use case diagram of the *TrustCo Ninja Van Dashboard*

The user is represented by the stick figure on the left, while the various functions of the dashboard are represented by ovals on the right. Each line connecting the user to a function shows an action or feature that the user can access or perform. Through this dashboard, the user can view total parcels, analyze sales trends, and filter data by month or year to gain insights into business performance over time. Additionally, the user can view customer demographics, check the average rating, and collect customer feedback, which supports performance evaluation and service improvement. The dashboard also allows users to view delivery parcels by state, providing geographical insights into logistics operations. Finally, users can interact with a chatbot or Q&A feature for assistance or clarification, enhancing user experience and accessibility. Overall, this use case diagram represents the key functionalities that the dashboard offers to support data-driven decision-making and customer engagement.

2) Visualization Design and Implementation

The development process followed a user-centered design approach, with initial prototypes validated through stakeholder feedback sessions. The final dashboard interface comprised three main views: a Main Dashboard for key performance indicators, a Customer Analytics Page for demographic segmentation, and a Chatbot Interface for natural language queries. The Q&A functionality leveraged Power BI's built-in natural language processing engine to interpret user queries and generate appropriate visualizations dynamically.

D. Validation and Testing Approach

System validation employed a multi-stage testing strategy encompassing functional verification, data accuracy assessment, and User Acceptance Testing (UAT). Functional testing confirmed all interactive elements, including time-based filters, navigation controls, and visualization updates, which performed as intended across different usage scenarios.

The UAT involved more than 30 participants from Ninja Van Pengkalan Chepa and other logistics organizations, who evaluated the system using the System Usability Scale (SUS). Participants completed structured tasks across all dashboard modules and provided feedback on interface intuitiveness, information accessibility, and overall user experience. The testing protocol assessed navigation efficiency, filter responsiveness, chatbot query interpretation, and data presentation clarity.

IV. Result and Discussion

A. Dashboard and Implementation and Key Features

The implemented TrustCo dashboard provides a comprehensive, data-driven overview of logistics and sales activities. The main interface, shown in Fig. 4, is organized to present key performance indicators (KPIs) and trends clearly. Key metrics are summarized in Table II.

TABLE II. Key performance indicators from the TrustCo dashboard

Metric	Value
Total Sales	RM 400,022.16
Total Shopee Express Parcels	856,607
Total Ninja Van Parcels	399,412
Total Flash Express Parcels	10,364

The dashboard includes filter options for Month and Year, allowing users to customize their view based on specific time periods. A line chart visualizes total sales per year, showing a notable upward trend from 2022 to 2024, indicating strong sales growth. A separate bar chart compares the average total parcels per month across the three courier services, enabling the identification of seasonal trends and performance fluctuations.

Fig. 4. Main Dashboard Interface Showing Key Performance Indicators.

B. Customer Segmentation and Demographic Insights

The customer analytics module reveals significant patterns in service utilization across demographic segments. An initial sample of 35 customer responses, while limited and intended for prototype validation, shows a gender distribution of 44.07% male, 28.76% female, and 27.17% business/company users, indicating a diverse customer base composition. Geographic analysis through an interactive map visualization identifies Kelantan, Selangor, and Johor as the highest-volume states for parcel deliveries.

Customer feedback analysis through word cloud visualization (Fig. 5) highlights predominant service evaluation themes. Terms such as "delivery," "good," "service," and "fast" appear most frequently. The average customer rating of 4.3 stars out of 5 demonstrates generally positive service perception, while specific feedback comments provide actionable insights into service improvement initiatives.

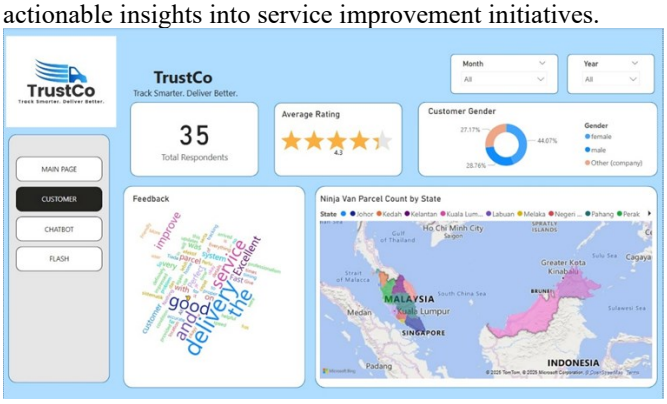

Fig. 5. Customer Analytics Page Showing Demographic Distribution and Feedback Analysis

C. AI Chatbot Implementation and User Interaction

The integrated Q&A chatbot, powered by Power BI's native NLP engine, successfully enables natural language query processing. This allows users to access specific insights without navigating complex visualization interfaces. As shown in Fig. 6, queries such as "total ninja van on March 2024" return the precise result of 22,701 packages. The chatbot can also handle more complex requests like "show female customers in Johor," generating appropriate filtered visualizations.

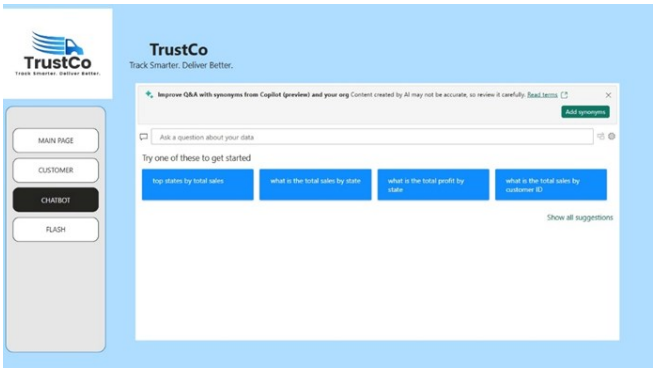

Fig. 6. Example Of the AI Chatbot Interface Processing a User Query

The chatbot demonstrates strong capability in interpreting contextual logistics terminology. However, its performance is contingent on the clarity of the user's question; ambiguous or incorrectly phrased queries may lead to irrelevant visualizations, indicating a reliance on the user's familiarity with the dataset's structure. This functionality significantly enhances dashboard accessibility, particularly for operational staff without data analysis expertise, demonstrating the practical application of NLP in specialized business domains.

D. User Acceptance Testing and System Validation

Comprehensive UAT with logistics professionals yielded strongly positive feedback. System Usability Scale (SUS) assessments indicated high satisfaction levels:

- Ease of Navigation: 86.7% of users found the interface intuitive.
- Information Accessibility: 80% reported quickly locating required operational insights.
- Filter Effectiveness: 93.3% confirmed that time-based filters accurately updated visualizations.
- Chatbot Utility: 73.3% found that the natural language queries enhanced their analytical capability.

The implemented system directly addresses the research objectives and the gaps identified in Table I. Unlike the dashboards of major providers like DHL and FedEx, the TrustCo system uniquely integrates operational monitoring with customer analytics and AI-driven interaction. However, it is important to note that certain operational and system-specific data from DHL and FedEx are not publicly accessible, which poses challenges for researchers attempting to conduct a comprehensive benchmarking analysis.

In terms of AI elements, the approach enables management to make proactive decisions regarding workforce allocation and promotional targeting based on empirical data, such as correlating the 4.3 average customer rating with specific service periods and demographic segments. Chatbot functionality represents a key innovative contribution, democratizing data access beyond technically skilled personnel. This aligns with

emerging trends in BI, emphasizing accessibility [7] and directly addressing the contextual challenges of regional logistics operations.

For scalability, the system architecture can accommodate increasing data volumes; however, its current limit lies in the reliance on manually imported data sets rather than a live connection to a central database, which would be necessary for enterprise-wide, real-time deployment. Future iterations should focus on this integration to enhance the system's scalability and real-time capabilities, potentially incorporating predictive analytics and IoT tracking for a more proactive logistics management approach.

V. Conclusion and Future Work

This research successfully developed and validated an integrated logistics dashboard with AI chatbot capabilities for Ninja Van Pengkalan Chepa. The study achieved its three primary objectives by analyzing logistics performance trends, developing an interactive Power BI dashboard, and implementing a natural language chatbot. User Acceptance Testing (UAT) confirmed that the system significantly enhances usability and supports data-driven decision-making.

A. Limitation and Future Work

However, this study also has several limitations. The customer insight analysis is based on a limited initial sample, and the data integration process is not yet fully automated. Moreover, while the chatbot effectively facilitates user interaction, it relies on Power BI's built-in Q&A engine and may encounter difficulties handling complex or ambiguous queries. Additionally, when benchmarking against major logistics providers such as DHL and FedEx, certain operational data were not publicly accessible, which constrained the depth of comparative evaluation.

Future work will therefore focus on several key areas. First, expanding data coverage to include all Ninja Van branches across Malaysia to enable national-level performance benchmarking. Second, implementing real-time data integration and automated reporting to move beyond static dataset imports. Third, enhancing AI capabilities through predictive analytics to forecast delivery demands and customer behavior patterns. Finally, a broader rollout and longitudinal study will be conducted to evaluate the long-term impact on operational efficiency and service optimization.

Acknowledgment

The authors would like to thank the Faculty of Data Science and Computing, Universiti Malaysia Kelantan, and NinjaVan Pengkalan Chepa for providing the data with sufficient technical support.

Conflict of Interest Statement

The authors declare no conflict of interest.

Authors' Contributions

Nur Diyanah carried out the research, wrote, and revised the article. Hasyiya Karimah conceptualised the central research idea, provided the theoretical framework, and supervised the research progress. Nurul Izzah led the review and revisions and approved the article for submission. Fairuz Ayuni contributed to the final manuscript and presented the paper.

References

[1] Banerjee, K., Das, S., & Nath, S. (2024). Data visualization approach for business strategy recommendation using a Power BI dashboard. *International Journal of Research in Management*.

[2] Baskoro, F., Andrahsmara, R. A., Darnoto, B. R. P., & Tofan, Y. A. (2021). A systematic comparison of software requirements classification. *IPTEK: The Journal for Technology and Science*.

[3] Biedert, R., & Roth-Berghofer, T. R. (2008). Designing a context-sensitive dashboard for an adaptive knowledge worker assistant. *Semantic Scholar*.

[4] Fazaeli, S., Khodaveisi, T., Vakilzadeh, A. K., Yousefi, M., Ariafar, A., Shokoohizadeh, M., & Mohammad-Pour, S. (2021). Development, implementation, and user evaluation of COVID-19 dashboard in a third-level hospital in Iran.

[5] Jintana, J., Sopadang, A., & Ramingwong, S. (2021). Idea selection of new service for courier business: The opportunity of data analytics. *International Journal of Engineering Business Management*.

[6] Kallel, M. B. E., Bouajaja, S., & Elloumi, A. (2024). Developing a sales dashboard with Power BI: A case study in a pharmaceutical company. *Decision Making Advances*.

[7] Kamaruddin, S. A. B., Hashim, H. B., Mohamad, E. J. B., Mohamad, N. H. B., & Mamat, H. B. (2023). Effective visualization electrification system via PSCADA event log in railway industry.

[8] Khalid, A. S., Hassan, N. H., Razak, N. A., & Baharuden, A. F. (2020). Business intelligence dashboard for driver performance in fleet management. In *Proceedings of the 2020 11th International Conference on E-Education, E-Business, E-Management, and E-Learning*.

[9] Khayashi, F., Jamasb, B., Akbari, R., & Shamsinejadbabaki, P. (2022). Deep learning methods for software requirement classification: A performance study on the PURE dataset.

[10] Khilari, D., Singh, C., & Mane, M. (2022). Business intelligence tool-Power BI for performance management. *SSRN Electronic Journal*.

[11] Kobi, J. (2024). Developing dashboard analytics and visualization tools for effective performance management and continuous process improvement. *International Journal of Innovative Science and Research Technology (IJISRT)*.

[12] Mahendrawathi, E., Pranantha, D., & Utomo, J. D. (2010). Development of dashboard for hospital logistics management. In *2010 IEEE Conference on Open Systems (ICOS 2010)*.

[13] Nabil, D. H., Rahman, M. H., Chowdhury, A. H., & Menezes, B. C. (2023). Managing supply chain performance using a real-time Microsoft Power BI dashboard by action design research (ADR) method. *Cogent Engineering*.

[14] Nova, S. H., Widodo, A. P., & Warsito, B. (2022). Analisis metode agile pada pengembangan sistem informasi berbasis website: Systematic literature review. *Techno Com, 21*(1).

[15] Panghal, R. (2024). The role of data visualization in decision making: Case of D-Mart. *International Journal for Multidisciplinary Research, 6*(3).

[16] Riya, Singh, G., Singh, J., & Singh, P. (2022). Preliminary analysis of data visualization based Uber technology using R: A review. In *2022 International Conference on Augmented Intelligence and Sustainable Systems (ICAISS)* (pp. 721–725).

[17] Schreiber, A., Von Kurnatowski, L., Meinecke, A., & De Boer, C. (2021). An interactive dashboard for visualizing the provenance of software development processes. In *IEEE Working Conference on Software Visualization* (pp. 100–104).

[18] Silva, D., Pereira, P., & Amaro, A. (2020). Logistic performance & dashboards: A flexible Power BI solution.

[19] Sindhu, K., Jain, K. A., Sandhya, S., & Nasreen, D. A. (2020). Comparative study and review of principles for dashboard design.

[20] Singh, K. (2021). Agile methodology for product development: A conceptual study. *International Journal of Recent Technology and Engineering (IJRTE), 10*(1), 209–215.

[21] Sohail, F., Zia, S. S., Qureshi, R., Naseem, M., & Haider, H. (2021). Impact of agile methodology on software development life cycle. *Pakistan Journal of Engineering and Technology, 4*(2), 153–158.

[22] Tsai, W., Liu, C., Lin, H., Hsu, C., Ma, Y., Chen, C., Huang, C., & Chen, C. (2022). Design and implementation of a comprehensive AI dashboard for real-time prediction of adverse prognosis of ED patients. *Healthcare, 10*(8), 1498. https://doi.org/10.3390/healthcare10081498