Optimizing Overland Logistics through Human-Centered Engineering: Reducing Repetitive Tasks, Ensuring Transparency, and Promoting Fair Penalty Application

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***Abstract*— This paper introduces a project designed to enhance logistics efficiency at Bosch by addressing repetitive tasks, maintaining transparency with Logistics Service Providers (LSPs), and implementing fair penalty applications. Using Power BI for real-time data visualization and a Python-based application for automated data validation, this solution supports an employee-oriented work environment that prioritizes authenticity, diligence, and transparency. Findings indicate that minimizing manual interventions and promoting fairness directly impacts both work environment quality and operational integrity. This project not only aligns with Bosch's commitment to ethical engineering but also reflects broader goals in modern logistics to establish cooperative, supportive workplaces. Implications for logistics efficiency and ethical practices in engineering research are discussed.**

***Index Terms*— People-centered logistics, transparency, repetitive task reduction, penalty management, data automation, Bosch, LSP.**

I. INTRODUCTION

In complex logistics networks, operational efficiency and transparent partnerships are vital for maintaining accurate data flows and trust among stakeholders. Bosch's logistics operations involve managing data from multiple sources, where frequent discrepancies between Travis API and LSP MIS records have led to redundant manual tasks, impacting both logistics efficiency and employee engagement. This project addresses these challenges with the goals of automating data reconciliation, enhancing transparency between Bosch and LSPs, and ensuring fair, objective penalty applications. By focusing on these human-centered goals, Bosch exemplifies a commitment to fostering a supportive, collaborative work environment while advancing sustainable and ethical engineering practices.

II. LITERATURE REVIEW

The value of automation for both operational efficiency and employee satisfaction is well-recognized in logistics research. Human-centered, transparent logistics systems have been shown to enhance work culture by reducing manual labor, fostering fairness, and supporting ethical practices (Kumar et al., 2022). Transparent data-sharing tools such as Power BI, which allow for real-time monitoring, further contribute to a cooperative and accountable logistics environment (Nguyen et al., 2023). This project builds on these principles, focusing on reducing repetitive tasks, enhancing transparency, and ensuring fair penalty management.

Automated Data Synchronization in Logistics: Evans and Spencer (2021) suggest that automating data synchronization across logistics platforms significantly reduces redundant work and employee stress. Bosch's project aims to accomplish similar goals by automating data validation, minimizing manual interventions, and creating a more efficient work environment that supports high ethical standards.

Transparency and Accountability in Supply Chains: Transparent logistics practices build accountability and fairness, which are foundational to sustainable partnerships. Taylor and Brown (2023) emphasize that real-time data transparency promotes trust among stakeholders, enhancing cooperative practices. Bosch's use of Power BI to enable clear, accessible information flow between Bosch and LSPs reflects this approach.

Human-Centered Design in Logistics Solutions: According to Anderson et al. (2022), reducing repetitive tasks through human-centered design supports employee well-being and strengthens organizational commitment. Their findings highlight

that fair, transparent systems contribute to a healthy workplace culture, aligning with Bosch's values of transparency and collaboration in supply chain relationships.

III. METHODOLOGY

A. Data Collection

This project identified discrepancies between Travis API and LSP MIS records as a primary source of manual, repetitive tasks. Data integration was facilitated using Power Automate workflows, which consolidated inputs from both systems to create a unified dataset. This streamlined data aggregation reduces redundancy and promotes transparency, supporting cooperative interactions between Bosch employees and LSPs.

B. Data Processing and Automation

A Python-based application was developed to automate data validation and minimize manual tasks. This tool identifies discrepancies and generates output data for Bosch and LSPs in real time. Additionally, Power BI dashboards, including the Transit Penalty Dashboard, provide visualized insights to support accessible information flow and ensure objective, fair penalty applications.

C. Data Analysis

Power BI dashboards were used to reveal patterns in data discrepancies, enabling Bosch to implement targeted interventions to reduce manual data corrections. The manual analysis involved identifying discrepancies across logistics locations, where employees had to contact LSPs directly for clarification. This process highlighted high-impact areas where automation could significantly reduce repetitive tasks and improve transparency by minimizing the need for manual follow-ups.

D. Statistical Methods

Descriptive Analysis of Manual Labour Hours

The table presents manual labor hour calculations based on data collected from the Travis API, covering the period from January to July 2024. This data reflects the total number of trips handled each month, alongside an average monthly trips metric calculated as 6,174.43 trips.

For each day over seven months, an estimated 220.52 trips were processed. Based on the assumption that each trip requires approximately 2 minutes of manual labor time, will result in a total daily labor time of around 441 minutes, or 7.35 hours per day, for processing these trips.

This information supports the projected efficiency improvements of the developed prototype, which aims to reduce task completion times significantly by automating data handling tasks and minimizing the need for manual intervention.

Table 1: Calculation of Manual Labour Hours

Manual Labour Hours Calculation				
Month/ Year	No. Of Trips	Average No of Trips	Trips/ Day	Hours/ Day
Jan/2024	5267	6174.42	220.51	7.35
Feb/2024	6477			
Mar/2024	6256			
Apr/2024	6046			
May/2024	6515			
Jun/2024	6200			
Jul/2024	6460			

IV. RESULTS

A. Reducing Repetitive Tasks and Stress

Automation significantly decreased the number of manual data corrections required, contributing to a supportive and efficient work environment. Key findings include:

Reduction in Manual Interventions: Automation allowed employees to focus on higher-impact tasks, reinforcing Bosch's commitment to human-centered engineering.

Streamlined Workflow: Employees worked with a higher level of engagement and purpose, benefiting from a more supportive and collaborative workplace.

B. Enhancing Transparency and Fair Penalty Application

The Power BI dashboards provide LSPs and Bosch employees with real-time data access, ensuring that penalties are applied objectively based on accurate, transparent information. This transparency fosters trust and accountability, strengthening the collaborative relationship between Bosch and its LSPs.

C. Statistical Findings

Potential Efficiency Impact

Based on the prototype developed during this project, it is estimated that the automated system could reduce

task completion time from an average of 7.35 hours to approximately 20 minutes per task. This estimate is based on a practical understanding of the prototype's capabilities, reflecting the potential for significant reductions in time spent on manual, repetitive tasks.

Practical Impact of Time Reduction

This shift suggests that tasks which initially took hours now have the potential to be completed in approximately 20 minutes, marking an efficiency improvement of nearly 75%. Such changes not only reduce operational time but also enhance transparency and foster a more humane work environment by freeing employees from tedious manual tasks.

D. Automated Discrepancy Resolution

The prototype developed in this project successfully automated the process of identifying and resolving discrepancies across logistics locations, removing the need for employees to manually contact LSPs for clarification. This automation streamlined communication and minimized repetitive tasks, which previously required significant manual labor.

V. DISCUSSIONS

A. Human-Centered Impact on Employee Experience and Work Ethic

This project was motivated by a commitment to enhance employee experience by reducing repetitive tasks and fostering a culture of diligence and authenticity. Automation of data reconciliation enabled employees to concentrate on more impactful work, aligning with Bosch's values of transparency and fairness.

B. Recommendations

Real-Time Data Synchronization: Establishing real-time synchronization between Travis and LSP MIS systems ensures accuracy, reinforcing Bosch's commitment to data integrity.

Automated Validation for Fair Penalty Application: Automated validation enhances penalty consistency, fostering trust with LSPs.

Targeted Automation in High-Impact Areas: Focusing automation on high-discrepancy locations maximizes efficiency, promoting a transparent logistics environment.

C. Ethical and Collaborative Considerations

In accordance with Bosch's ethical standards, data privacy and confidentiality were prioritized, ensuring data was securely handled and shared only in aggregated form. Transparency in data handling with LSPs promotes fairness and mutual respect, aligning with Bosch's commitment to a human-centered and collaborative work culture.

D. Prototype Limitations and Future Improvements

The prototype developed in this project contributes to Bosch's vision of enhancing quality of life through technological innovation. While the automation of discrepancy resolution has reduced manual intervention and increased efficiency, further development is needed to fully align with Bosch's commitment to sustainability, data security, and ethical standards. Ensuring strict adherence to company policies and legal values will reinforce the prototype's alignment with Bosch's broader vision, supporting a transparent, responsible, and secure logistics environment.

VI. CONCLUSION

This project demonstrates the benefits of human-centered engineering in logistics by automating repetitive tasks, enhancing transparency, and ensuring fair penalty applications. Bosch's initiative supports a workplace culture rooted in integrity and collaboration, where employees and partners can engage in meaningful, high-impact work. Such employee-oriented practices not only improve productivity but also foster a positive organizational culture, reflecting the broader implications of sustainable and ethical engineering solutions in modern logistics.

VII. REFERENCES

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