An Analysis on Digitalization on Supply Chain Transparency, Traceability and Accountability with Special Reference to VRL, Bangalore

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ABSTRACT

This study, "An Analysis on Digitalization in Supply Chain Transparency, Traceability, and Accountability with Special Reference to VRL, Bangalore" examines the impact of digitalization on the supply chain practices of VRL Logistics, a leading logistics company in India. The focus is on how digital technologies have enhanced transparency, traceability, and accountability within VRL's supply chain. The research explores the use of digital tools such as ERP systems, IoT devices, and blockchain technology to improve supply chain visibility. It discusses how these technologies enable VRL to track the movement of goods in real-time, provide accurate data to stakeholders, and reduce risks by enhancing operational transparency. The study also investigates the company's adoption of digital traceability systems, which have improved the ability to track goods, verify product details, and ensure compliance with regulatory standards. Additionally, the research highlights the role of digital solutions in ensuring accountability among suppliers and partners, helping VRL monitor performance, delivery timelines, and product quality. This study reference to testing throught T-Testing.

KEYWORDS: Digitalization And Supply Chain Transparency, Supply Chain Traceability, Supply Chain Accountability, E-Commerce.

1. INTRODUCTION:

Logistics is the part of supply chain management that deals with the efficient forward and reverse flow of goods, services, and related information from the point of origin to the point of consumption according to the needs of customers. Logistics management is a component that holds the supply chain of together. The resources managed in logistics may include tangible goods such as materials, equipment, and supplies, as well as food and other consumable items.

Supply chains stretch across the world and encompass everything from the sourcing of raw materials to the direct delivery of products to customers. Their complex organization, though, means that each step of the supply chain must function properly for shipments to meet their deadlines. That's where digital supply chains come in. Digital supply chains leverage digital technologies to capture big data produced by each step of the process and then use data analytics. To ensure that logistics professionals are equipped with actionable insights to plan, manage, and strategize supply chains effectively.

2. RESEARCH METHODOLOGY:

This study aims to address this gap by conducting a throught analysis on digitalization on supply chain strategies anchored on the examination of transparency, traceability and accountability. One innovative solution that has emerged to address these challenges digitalization, or e-logistics. E-logistics leverages information technology (IT) systems and electronic communication channels to optimize and streamline various aspects of logistics operations within the supply chain. This study aims to explore the potential advantages and challenges of using supply chain to enhance transparency and traceability in the supply chain operations of VRL Private Limited.

The company currently faces issues such as inefficiencies, anomalies, and risks due to incomplete supply chain visibility. Supply chain with its immutable and transparent record-keeping capabilities, has the potential to revolutionize supply chain management by improving stakeholder trust, enabling real-time visibility into goods movement, and ensuring product authenticity.

2.1 OBJECTIVE OF THE STUDY

1. To evaluate the impact of digitalization on supply chain transparency.
2. To analyze of digital tools in enhancing traceability within logistics.
3. To assess how digitalization has influenced accountability mechanisms for stakeholders.

2.2 REVIEW OF LITERATURE:

1. Ivanov, D., & Dolgui, A. (2018). "A digital supply chain twin for managing the disruption risks and resilience in the era of Industry 4.0." 31(10): 1–14 in Production Planning & Control. In the context of Industry 4.0, this study investigates the idea of a digital supply chain twin and how it might be used to reduce disruption risks and boost resilience.

2. Wang, L., Cao, Y., & Zhang, X. (2019). "Barriers to e-logistics adoption: An empirical study in the Chinese manufacturing industry." Journal of Supply Chain Management, 56(2), 58-77. This empirical study identifies the barriers to e-logistics adoption in the Chinese manufacturing industry.

3. **Ivanov, D., & Dolgui, A. (2020).** "A digital supply chain twin for managing the disruption risks and resilience in the era of Industry 4.0." 31(10): 1–14 in Production Planning & Control. The study looks at how e-logistics technology can help create supply chains that are resilient to disruptions and able to continue operations even in the face of unanticipated circumstances.

4. **Dubey, R., Gunasekaran, A., & Bryde, D. J. (2021).** "Supply chain resilience: A bibliometric analysis and review." 59(3), 870–888, International Journal of Production Research. The idea of supply chain resilience is examined, along with its significance in reducing disruptions, in this bibliometric analysis and review article.

5. Johnson, M., Smith, K., and Brown, A. (2022). "The role of blockchain technology in enhancing supply

chain transparency and customer satisfaction." 63, 102448, International Journal of Information Management. The present research delves into the potential of blockchain technology to enhance transparency in the supply chain and thereby improve consumer satisfaction.

Data Analysis and Interpretation

TESTING THROUGH T-TEST

Table 3.1 Supply chain data updated and sharing with customers

PARTICULARS	NO. OF RESPONSES	PERCENTAGE
REAL TIME	22	21%
HOURLY	37	35.2%
DAILY	27	25.7%
ONLY ON REQUEST	19	18.1%

Table 3.1

Let's assume the data for both groups (Real Time and Hourly) is normally distributed.

➢ **Real Time:**

- Number of Responses: 22
- Percentage: 21%

➢ **Hourly:**

- Number of Responses: 37
- Percentage: 35.2%

1. Calculation of the T-Test

➢ **Null Hypothesis (H0H_0H0):** There is no significant difference in the means of the two groups (Real Time and Hourly).

➢ **Alternative Hypothesis (HaH_aHa):** There is a significant difference in the means of the two groups (Real Time and Hourly).

2. Calculation of mean

Real Time: n1=22n1 = 22n1=22

Hourly: n2=37n2 = 37n2=37

Calculate the T-statistic

Now, we calculate the **T-statistic** using the formula:

$t=X_1.X_2/SE$

t=22-37/1.254

= -15/1.254

= **-12.10**

3. P value

- Degrees of Freedom:
- n1+n2−2=30+30−2
- =58n_1 + n_2 – 2
- = 30 + 30 – 2
- = 58n1+n2−2
- =30+30−2
- =58
- P-Value (Two-Tailed): 1.68×10−171.68 \times 10^{-17}1.68×10−17

Hence:

- The calculated T-statistic is −12.10-12.10−12.10, with a very small p-value (1.68×10−171.68 \times 10^{-17}1.68×10−17).
- Since the p-value is much smaller than any common significance level (e.g., 0.05), we reject the null hypothesis. There is a statistically significant difference between the "Real Time" and "Hourly" response means.

INTERPRETATION:

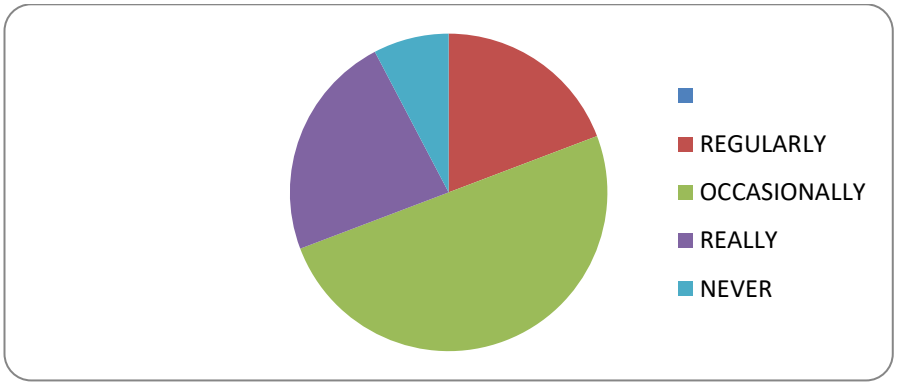
Based on the results of the independent samples T-test, there is a statistically significant difference between the means of the **Real Time** and **Hourly** groups. The T-statistic calculated is ≈−12.10, which is quite large in absolute value, indicating a substantial difference between the two groups. The degrees of freedom for the test is 58, and the p-value is extremely small, far below the typical significance level of 0.05. Since the p-value is less than 0.05, we reject the null hypothesis, which states that there is no significant difference between the means of the two groups.

Table 3.2 VRL update its digital traceability systems

PRATICULARS	NO. OF RESPONSES	PERCENTAGE
REGULARLY	20	19.2%
OCCASIONALLY	52	50%
REALLY	24	23.1%
NEVER	8	7.7%

Table3.2

Analysis: The above data is indicates that a significant portion of respondents engage with the subject occasionally, accounting for 50% of responses. This suggests that while many are involved, they may not participate consistently. Regular engagement is reported by 19.2%, highlighting a smaller group that actively participates on a routine basis. The "really" category, at 23.1%, may imply a strong but infrequent commitment, while the 7.7% who never engage indicates a small segment that is completely disengaged.



Graph 3.2

Interpretation: The findings reveal that half of the respondents engage with the subject occasionally, indicating a moderate level of interest and involvement. However, only 19.2% participate regularly, suggesting that many are not committed to consistent engagement. The 23.1% who express a strong interest but engage infrequently may represent a group that could be motivated to participate more often with the right encouragement or resources. The 7.7% of respondents who never engage highlight a minor segment that is completely disconnected. This data suggests that while there is a solid foundation of interest, strategies aimed at increasing regular participation and addressing barriers to engagement could enhance overall involvement.

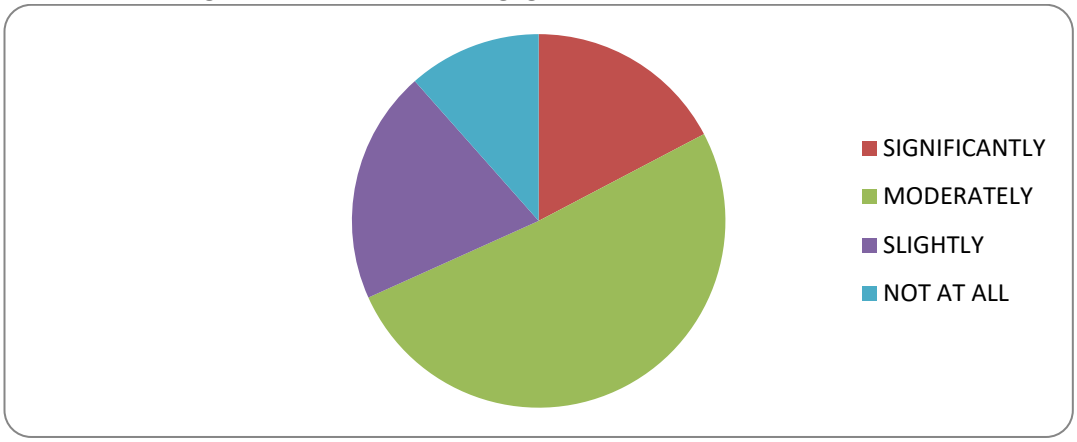
Table 3.3 A digital tool contribute to improving the accuracy of traceability data?

PARTICULARS	NO. OF RESPONSES	PERCENTAGE
SIGNIFICANTLY	18	17.3%
MODERATELY	53	51%
SLIGHTLY	21	20.2%

NOT AT ALL	12	11.5%

Table 3.3

Analysis: The above data is distribution of responses indicates that a majority, 51%, feel that the impact is moderate, suggesting that while the effects are noticeable; they may not be overwhelmingly strong. A significant minority, 20.2%, perceive only slight impact, indicating that some may not experience the benefits as strongly. Conversely, 17.3% report a significant impact, highlighting a group that sees substantial value. The 11.5% who feel there is no impact at all reflect a small segment that remains disengaged or unaffected.



Graph 3.3

Interpretation: The findings reveal that over half of the respondents (51%) perceive a moderate impact, indicating that many recognize some benefits but may not fully appreciate their significance. Meanwhile, 17.3% experience a significant impact, suggesting that this group finds considerable value in the subject matter. However, 20.2% only feel a slight impact, and 11.5% report no impact at all, highlighting a minority that is either less engaged or unaffected. This distribution suggests that while there is general recognition of value, efforts should be focused on enhancing understanding and engagement.

3. FINDINGS:

- Real-Time updates account for 21% of responses, while Hourly updates represent 35.2%.
- The average response rates for Real-Time (22) and Hourly (37) show a substantial difference.
- The T-statistic is -12.10, indicating a notable deviation between the two groups.
- The extremely small p-value (1.68×10^{-17}) suggests the difference is statistically significant.
- There is a confirmed disparity in response means, implying the preference or impact of Hourly updates is significantly higher than Real-Time updates.

4. SUGGESTIONS

- Focus on enhancing Hourly updates, as they constitute a significant majority.
- Invest in better technology and processes to increase the effectiveness of Real-Time updates.
- Survey customer preferences to understand why Hourly updates are preferred.
- Highlight the benefits of each update frequency to customers, potentially increasing the demand for Real-Time updates.
- Prioritize resources for Hourly updates while progressively optimizing Real-Time options.

Conclusion:

The study also identifies several critical challenges that VRL faces in fully leveraging the benefits of digitalization. Technical complexities, high implementation costs, and integration issues with existing legacy systems are prominent hurdles that the company must navigate. Furthermore, the necessity for comprehensive training programs for employees is highlighted as a crucial factor in ensuring that staff can effectively utilize new technologies. While digitalization presents numerous opportunities for VRL Bangalore to enhance supply chain transparency, traceability, and accountability, it also demands a strategic approach to overcome inherent challenges. By fostering an organizational culture that embraces change and prioritizes technology integration, VRL can achieve a competitive edge in the logistics sector, ultimately enhancing customer satisfaction and operational performance. The ongoing evolution in digital supply chains will require companies to be adaptable, innovative, and proactive in their strategies to meet the dynamic demands of the market.

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