Real-Time Operational Dashboards for Monitoring Supply Chain Activates: Literature Review

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Introduction

In today's digital age, the volume of data gathered by companies has increased exponentially. This is driven by the digitization of operational activities and the utilization of newer technologies such as the Internet of Things (IoT) and Enterprise Resource Planning (ERP) systems (Nabil, et al., 2023). As a result, companies are encouraged to store vast amounts of data that have little to no value unless it is processed and measured effectively. In supply chain management (SCM), the challenge lies in leveraging volumes of data collected from diverse entities including suppliers, warehouses, and logistics to monitor performance or support decision-making (Nabil, et al., 2023). **Real-time Operational Dashboards (RTOD)** address this need by providing live visibility across the entire supply chain, enabling companies to respond swiftly to operational changes, detect potential challenges, and optimize performance (Magnus & Rudra, 2019).

With enhancing supply chain visibility, real-time dashboards contribute to more effective supply chain management (SCM), increasing market competitiveness, reducing costs, and improving customer service (Stefanovic, 2014). In this respect, the literature review aims to answer the following questions:

Q1. What is the important use of Real-time Operational Dashboards and how are they implemented?

Q2. What are the essential metrics that RTODs can offer for more efficient supply chain management practices?

The Role of Real-time Operational Dashboards (RTOD) In Supply Chain Management.

Today, it is estimated that only 31% of the industry uses RTOD, however real-time supply-chain monitoring is becoming increasingly in demand every year (Transporeon, 2022). Due to the complex nature of the industry, growing competition, demanding customers, uncertainty, and the pressure to reduce costs, it has become critical to track, measure, and manage supply chain practices. RTODs serve a pivotal role in this area specifically through data presentation, performance monitoring, and predictive insights (Transporeon, 2022). Therefore, real-time visibility becomes a crucial aspect for stakeholders enabling them to get instant access to order status, inventory levels, and logistics operations (Magnus & Rudra, 2019). For instance, Amazon's utilization of RTODs has enabled them to monitor every stage of their supply chain, from inventory to delivery, ensuring optimal stock levels and reducing delivery times (Chiles & Dau, 2005).

According to various research, including several use cases from industry giants, RTODs excel in three major areas:

a. RTODs Exception management system plays an important role in identifying outliers such as shipment delays or inventory shortages triggering an alert for

immediate corrective actions (Christopher, 2016). Maersk, a global shipping enterprise, deploys RTODs to detect delays in container shipments and reroute cargo in real-time to reduce downtime (Jensen, 2018).

b. Predictive analysis utilizes existing data and historical records to forecast demand, optimize inventory, replenish cycles, and anticipate distortions, ensuring resilient supply chain practices. Walmart's RTOD system, in this case, is deployed for similar reasons (Stefanovic, 2014). Their RTOD model predicts demand surges by analyzing customer buying patterns, allowing the company to stock products efficiently and reduce instances of stockouts during peak shopping periods (Baker, 2019).

c. KPI tracking and reporting aggregate data from various sources is yet another stronghold of RTODs. This includes monitoring critical performance indicators and generating comprehensive reports that support data-driven decision-making (Gunasekaran et al., 2004). Siemens, another leader in industrial manufacturing, uses dashboards to track supplier performance and production efficiency, enabling quick interventions when metrics deviate from predefined targets (Schönsleben, 2016).

RTODs contribution goes beyond efficiency and optimization. Various research suggests an even bigger role of RTODs toward revenue generation and cost savings. An example of this can be seen in General Electric's implementation of RTODs to monitor equipment performance, enabling predictive maintenance that reduced unexpected downtime by 10%, translating into millions in cost savings annually (Smith, 2017).

Similarly, Coca-Cola leveraged RTODs to optimize inventory management across its distribution centers, resulting in a 5% reduction in operational costs and improved product availability, ultimately enhancing sales performance (Jones, 2018).

All in all, these use cases highlight the effective transformation of operations across different organizations as a result of RTODs, respectively, companies have witnessed improvements in delivery efficiency and resilience. Additionally, from a financial aspect, the benefits of RTOD adoption are reflected in profitability as well, which is achieved through real-time insights and operational agility.

Implementation & Deployment of RTOD

Successful RTOD deployment and Implementation depends on selecting customized tools and advanced technology to manage data collection, integration, analysis, and visualization (Nabil, et al., 2023). However, the implementation across supply chain entities presents several technical and organizational challenges (Transporeon, 2022). From a technical standpoint, integrating RTODs with existing Warehouse Management Systems (WMS) and Transportation Management Systems (TMS) requires overcoming data silos, ensuring compatibility with legacy systems, and maintaining data accuracy across platforms (Ben-Daya et al., 2019). In warehouses, dashboards must seamlessly track inventory movements and optimize storage allocation in real-time, yet discrepancies in data entry and hardware limitations can affect accuracy (Eckerson, 2011). Similarly, in logistics, real-time tracking of vehicle routes and delivery statuses is essential for on-time

performance, but integration with diverse transport networks especially third-party logistics providers adds several complexities (Christopher, 2016).

Successful implementation of RTODs also depends heavily on the collaboration of specialized roles within the organization, each bringing a unique perspective. Supply chain analysts focus on interpreting dashboard insights to refine processes and mitigate risks (Eckerson, 2011). IT specialists manage the technical integration, ensuring smooth data flow between disparate systems. Data scientists enhance predictive capabilities by developing algorithms to foresee disruptions and optimize inventory management (Min, 2010). Operations managers use the dashboards for day-to-day monitoring and decision-making, while executive leadership oversees strategic alignment and champions digital transformation initiatives (Waller & Fawcett, 2013).

Despite these efforts, resistance to change and insufficient training often slow adoption, requiring organizations to cultivate a data-driven culture to fully leverage RTOD benefits. However, implementing the right tools alongside the coordination between all these roles ensures that dashboards function as reliable decision-support systems, enhancing overall supply chain performance.

Essential Supply Chain Management Metrics for An Effective RTOD

RTODs effectiveness can be determined by the selection of Key Performance Indicators (KPIs) that reflect supply chain performance (Nabil, et al., 2023). This has shown remarkable benefits in improving efficiency through real-world applications of key metrics throughout multiple industry leaders. For instance, Amazon uses order fulfillment

rate and on-time delivery performance as its main KPIs to track and optimize its delivery operations (Chiles & Dau, 2005). The close monitoring of these metrics has allowed Amazon to reduce average delivery times and improve customer satisfaction, particularly during high-demand periods like Black Friday (Chiles & Dau, 2005). Similarly, FedEx leverages supply chain cycle time metrics to streamline shipping routes and improve package processing efficiency. Real-time updates help managers identify delays and implement immediate corrective actions, ultimately reducing transit times and enhancing service reliability (Reis, 2016).

Operational performance metrics also play a vital role in refining inventory management and production processes. Companies like Toyota use inventory turnover ratio to minimize excess stock and reduce holding costs (Kleijnen & Smits, 2002). The application of RTODs in their just-in-time (JIT) system enables real-time monitoring of parts delivery, ensuring that inventory aligns with production schedules (Kleijnen & Smits, 2002). This reduces wastage while improving responsiveness to market changes (Waller & Fawcett, 2013).

Risk and resilience metrics further highlight the contrasting perspectives on their significance. Unilever in this instance uses lead time variability metrics to mitigate risks associated with supplier delays, enabling them to reroute shipments in real time during disruptions like the COVID-19 pandemic. This approach ensured product availability across global markets despite supply chain turbulence (Ben-Daya et al., 2019). However, other research assumes that focusing heavily on disruption recovery metrics may divert attention from long-term strategic improvements and reinforce reactive rather than proactive management approaches (Bai et al., 2020).

That said, one of the key challenges in implementing RTODs is selecting the right KPIs. Choosing appropriate KPIs requires a deep understanding of organizational goals, industry standards, and supply chain processes. For example, while Amazon prioritizes order fulfilment rate and delivery times to enhance customer satisfaction, other companies might focus on supplier performance metrics to ensure procurement efficiency (Chiles & Dau, 2005).

Generally, misaligned KPIs can lead to misguided decision-making, where companies chase metrics that don't directly impact performance or align with strategic objectives (Chae , 2009). Hence, some organizations argue that overemphasis on turnover metrics, for example, could lead to understocking and missed sales opportunities, especially in industries where the supply chain is highly unpredictable (Christopher, 2016). Additionally, the dynamic nature of supply chains means that KPIs need regular reassessment to remain relevant in evolving market conditions (Chae , 2009). These differing viewpoints underscore the necessity of balancing efficiency, operational performance, and resilience when selecting key metrics for RTODs.

Challenges of RTOD

The literature reveals multiple perspectives on the challenges and values of implementing RTODs in supply chain management. On one hand, (Ben-Daya et al., 2019), argue that, unlike traditional dashboards and data processing methods, RTOD can significantly enhance responsiveness and transparency by providing real-time insights into operations, allowing companies to optimize workflows and address service

disruptions promptly. In this respect, Amazon's use case which aims to reduce delivery times through real-time monitoring and dynamic route optimization using RTODs serves as a prime example of these benefits (Chiles & Dau, 2005). Similarly, DHL's use of RTODs helped improve fleet management and optimization through real-time tracking of delivery times and fuel consumption (Chiles & Dau, 2005).

On the other hand, RTODs limitations are often encountered during implementation. (Marjani et al., 2017) highlights that the benefits are often undermined by the complexities of integration, particularly when dealing with outdated systems and distinct data sources. Many traditional manufacturing firms have struggled to adopt RTODs due to incompatible legacy systems in addition to the high cost of upgrading the infrastructure (Schönsleben, 2016).

The predictive analysis provided by RTODs has been another point of debate, with some studies emphasizing its great potential for enhancing forecasting accuracy and reducing product lead times. However, (Waller & Fawcett, 2013) suggests tentative action against over-reliance on algorithm-driven insights, especially in unpredictable markets.

Financial costs present yet another significant hurdle in RTOD implementation. Deploying these dashboards requires investment in infrastructure, software, training, and maintenance. Companies like Maersk, which adopted RTODs to optimize their global shipping operations, faced substantial upfront costs related to system migration and data standardization (Jensen, 2018). For smaller organizations, these financial barriers can be prohibitive, making it difficult to justify the return on investment, particularly if cost-saving metrics don't show immediate results. Moreover, ongoing costs related to system

upgrades and personnel training can further strain resources, challenging long-term sustainability. These contrasting views highlight the need for a balanced approach that leverages technology while addressing integration challenges and ensuring human oversight.

Conclusion

Real-time operational dashboards have demonstrated their important role in supply chain management. This was evident throughout the literature surrounding real-time operational dashboards which was both extensive and resourceful, offering valuable insights into their advantages. It is safe to assume that the adoption of RTODs will demonstrate transformative power to enhance supply chain performances, improving visibility, responsiveness, and predictive capabilities. Industry leaders such as Amazon and Maersk exemplify how real-time tracking and predictive analytics can optimize operations, reduce delivery times, and improve customer satisfaction (Chiles & Dau, 2005; Jensen, 2018). However, implementing these systems presents significant challenges.

Moreover, selecting the right KPIs is also crucial for aligning dashboard insights with organizational goals. Misaligned metrics can lead to inefficiencies, where companies prioritize data that doesn't directly impact performance (Christopher, 2016). However, several researchers emphasized the significance of cost-related metrics to streamline operations and reduce expenses.

While the literature reveals a diverse range of tools and approaches, the underlying goal remains the same: enhancing supply chain agility, efficiency, and resilience. Given the current growth in popularity of RTODs, future research should focus on encouraging companies to adopt RTODs, with a focus on simplifying integration processes and promoting a data-driven culture (Gunasekaran et al., 2004). Unlocking the full potential of Real-time operational dashboards relies on developing frameworks that address both technical and organizational challenges and is essential for driving widespread adoption.

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