# Efficient Line Feeding via E-KANBAN

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**Abstract -** *In today's dynamic manufacturing landscape, optimizing line feeding processes is crucial for ensuring operational efficiency and cost-effectiveness. This paper presents a comprehensive exploration of how the integration of Electronic KANBAN (E-KANBAN) with QR code technology and Excel automation can significantly enhance line feeding efficiency. The methodology involves leveraging a Google Form to scan QR codes, each containing 11-digit encoded data specifying precise line locations. Additionally, an encoding process appends initial part numbers to these QR codes, enabling seamless real-time data entry into Excel sheets. Through the utilization of VLOOKUP formulae within Excel, the system efficiently retrieves part store locations, thereby optimizing the retrieval process. The digitally generated Excel sheets are then distributed to handlers responsible for overseeing part delivery to production lines, ensuring adherence to Production and Feeder Point (PFEP) guidelines. By conducting meticulous case studies, this paper demonstrates tangible improvements in lead times and overall operational efficiency, providing manufacturers with actionable insights for fostering lean, agile, and responsive operations. Ultimately, these enhancements contribute to bolstering competitiveness and augmenting customer satisfaction within the manufacturing domain.*

***Key Words***: *Manufacturing optimization, E-KANBAN, QR code technology, Excel automation, Google Forms.*

## 1. INTRODUCTION

In the rapidly evolving landscape of modern manufacturing, the efficient management of line feeding processes emerges as a fundamental pillar, critical not only for bolstering productivity but also for ensuring effective cost management and customer satisfaction. Across a spectrum of industries, spanning from automotive to electronics, the seamless delivery of components to production lines holds paramount importance for sustaining operations and meeting the ever-shifting demands of consumers. However,conventional methods of line feeding grapple with formidable obstacles, encompassing delays, errors, and inefficient resource allocation. These challenges underscore an urgent call for pioneering solutions capable of revolutionizing line feeding operations, thereby optimizing efficiency, responsiveness, and cost- effectiveness.

Responding to this urgent mandate, this research embarks on a transformative journey aimed at redefining line feeding efficiency within the realm of manufacturing. Through the integration of Electronic KANBAN (E-KANBAN) with cutting-edge QR code technology and the adaptable functionalities of Excel automation, this study unveils a paradigm shift in inventory management and material flow control. The convergence of these innovative technologies promisesto transcend the limitations inherent in traditional methods, endowing manufacturers with unparalleled levels of visibility, control, and adaptability in their linefeeding processes.

At the core of this integrated approach lies the concept of Electronic KANBAN, representing a digital evolution of the esteemed lean manufacturing principle. By harnessing the capabilities of digital platforms and automated data capture, E-KANBAN facilitates real- time monitoring and management of inventory levels, thereby streamlining replenishment processes and curbing wastage. Augmented by QR code technology, which furnishes a standardized and machine-readable format for data encoding, and Excel automation, which empowers users with robust data management and analysis capabilities, this cohesive system promises to revolutionize the modus operandi of manufacturers inapproaching line feeding tasks.

Through a comprehensive exploration, our research endeavors to illuminate the intricacies of implementing and harnessing the potential of E-KANBAN integrated with QR code technology and Excel automation. By delving into the practicalities, challenges, and tangible benefits of this integrated approach, we aim to equip manufacturers with actionable insights and empiricalevidence to navigate their journey toward heightened operational efficiency and competitive prowess. Embracing the opportunities afforded by emerging technologies, we envision a future where line feeding operations serve not merely as operational necessities but as strategic assets driving continuous improvement and innovation across manufacturing enterprises.

## 2. MATERIALS USED AND METHODOLOGY

This research paper introduces a comprehensive methodology aimed at establishing an efficient inventory management system by seamlessly integrating Excel, Google Forms, and QR codes. The materials utilized in this study include Excel spreadsheets, Google Forms, and QR code generation software. Excel serves as the primary tool for data management and analysis, providing a centralized repository for inputting relevant data such as part numbers and line locations. Google Forms, a user-friendly platform for data collection, is employed to capture additional details about each part, such as quantities, timestamps, and relevant comments, facilitating real-time data acquisition and inventory tracking. QR code generation software is utilized to generate unique QR codes for each part based on the input data. These QR codes serve as digital identifiers, encoding critical information such as part numbers and descriptions in a concise and machine-readable format, ensuring a consistent and systematic approach to part identification and tracking.

The methodology involves several sequential steps to establish the proposed inventory management system. Initially, relevant data, including part numbers and line locations, is inputted into an Excel spreadsheet. Sophisticated formulas and functions within Excel are then applied to generate distinct QR codes for each part, encoding essential information for efficient identification and tracking. Subsequently, the generated QR codes are seamlessly integrated into Google Forms, allowing stakeholders to input additional details about each part in real-time. By leveraging QR codes, stakeholders can efficiently scan and update inventory information using mobile devices or barcode scanners, thereby minimizing manual data entry errors and enhancing overall data accuracy and reliability. Furthermore, filtering options within Excel enable efficient retrieval of parts based on line and part center locations, optimizing operational efficiency and reducing downtime.

Additionally, to ensure the seamless integration and functionality of the proposed inventory management system, rigorous testing and validation procedures were conducted. This involved simulating various scenarios and use cases to assess the system's performance under different conditions. Any identified issues or discrepancies were addressed through iterative refinement of the system components and processes. Moreover, extensive training and support were provided to stakeholders to ensure their proficiency in utilizing the system effectively. By prioritizing robust testing and user training, the implementation of the integrated methodology was executed with precision, ultimately leading to the successful establishment of an efficient and responsive inventory management system within the manufacturing environment.

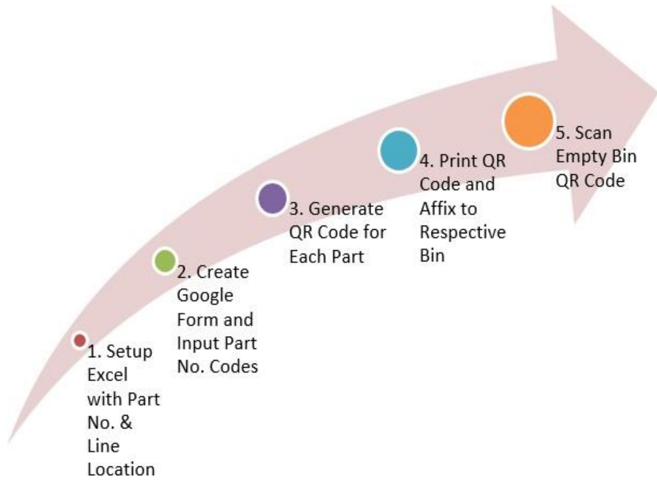


Fig. 1 Steps of E-KANBAN system

Overall, this integrated approach offers a practical and cost-effective solution for establishing an efficient inventory management system within manufacturing environments. Through the utilization of modern tools and technologies, such as Excel, Google Forms, and QR codes, manufacturers can enhance their inventory control processes, minimize disruptions, and ultimately improve overall productivity and profitability.

## 3. RESULTS AND DISCUSSION

Our E-KANBAN implementation offers valuable insights into inventory management and line feeding dynamics. By recording timestamps meticulously, the system provides a comprehensive overview of part call-offs, enabling detailed analysis of material requisitions. This chronological record helps monitor material demands and identify bottlenecks or inefficiencies in the ordering process, enhancing operational efficiency.

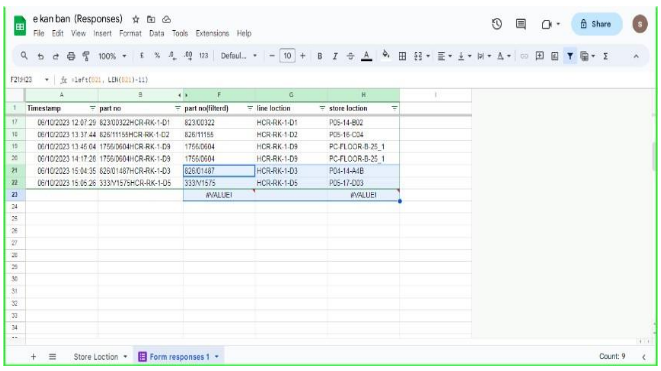

Fig. 2 Response of Call-off Data

Furthermore, the E-KANBAN system's ability to capture detailed part store locations has optimized material handling processes. By providing real-time data on part whereabouts, it revolutionizes inventory management, reducing time and resources spent on searching for components. Eliminating manual tracking and guesswork, the system streamlines inventory replenishment, enhancing productivity and minimizing disruptions.

Additionally, data on line locations offers precise insights into consumption points along the assembly line. This granularity enables precise coordination between material supply and production demand, ensuring timely delivery and minimizing delays. Seamlessly integrating different production stages, the E-KANBAN system fosters efficiency and reduces waste.

These findings highlight how the E-KANBAN system has significantly improved our manufacturing operations. It boosts efficiency, minimizes waste, and lays the groundwork for continuous improvement. By providing real-time insights, it helps us spot optimization opportunities and adapt to market changes swiftly. This adaptability is crucial for staying competitive. Overall, integrating the E-KANBAN system ensures our sustained excellence and future growth.

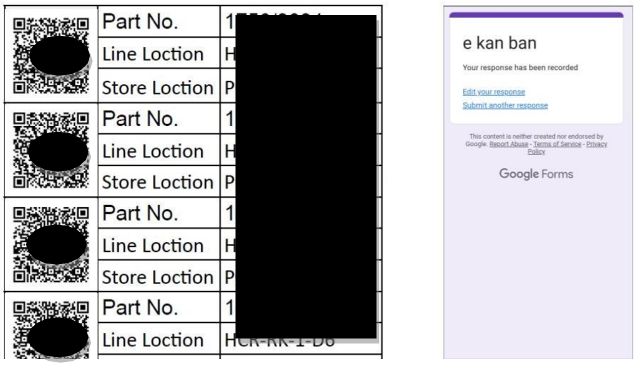


Fig. 3 Integration of E-KANBAN System

## 4. FUTURE SCOPE OF PRESENT WORK

While our current study has provided valuable insights into the implementation and impact of the E-KANBAN system on inventory management and line feeding processes, several avenues for future research warrant exploration. Firstly, further investigation into the long-term effects of E-KANBAN adoption on organizational performance metrics such as cost savings, throughput, and customer satisfaction would be beneficial. For instance, a comparative case study examining the outcomes of E-KANBAN implementation in different manufacturing environments, such as the automotive industry, could draw from the example of Toyota's successful application of Kanban principles in its production system. Similarly, a study exploring the scalability of the E-KANBAN system across different manufacturing contexts and industries could look to examples such as Flex Ltd (formerly Flextronics), which has effectively implemented E-KANBAN solutions across its global network of manufacturing facilities. Furthermore, investigating the integration of advanced technologies such as artificial intelligence and machine learning algorithms into the E-KANBAN framework could benefit from case studies like Siemens AG, where AI-driven predictive analytics have been leveraged to optimize inventory management and production planning processes. Moreover, comparative studies evaluating the efficacy of E-KANBAN systems against traditional Kanban approaches or other inventory management methodologies could draw on case studies such as those conducted by General Electric, which has evaluated the performance of various inventory management systems across its diverse portfolio of manufacturing operations. By addressing these areas in future research endeavors and drawing on relevant case studies, we can continue to advance the field of manufacturing operations management and drive continuous improvement in supply chain practices.

## 5. CONCLUSION

In conclusion, the implementation of our KANBAN system has yielded significant findings that have reshaped our approach to inventory management and line feeding practices. Through meticulous utilization of timestamps to track call-off times and the integration of comprehensive knowledge regarding part store locations, our system has provided us with invaluable insights into streamlining replenishment processes. These insights not only facilitate the timely delivery of parts, minimizing downtime and enhancing operational efficiency but also offer a deeper understanding of our manufacturing operations.

Findings from our KANBAN system implementation reveal that our enhanced visibility into line locations has empowered us to optimize workflows and mitigate waste effectively. By ensuring timely part delivery and reducing operational disruptions, we have been able to bolster productivity levels within our manufacturing environment significantly.

Furthermore, the strategic insights gained from our KANBAN system have bolstered our competitiveness within the industry landscape. As we continue to refine and leverage our system, we are well-positioned to drive continuous improvements that propel our organization towards sustained success and prominence in the marketplace.

These findings underscore the transformative impact of embracing innovative technologies like E-KANBAN, not only as operational tools but also as strategic assets driving ongoing improvement and innovation across manufacturing enterprises. By remaining dedicated to leveraging emerging technologies and refining our processes, we are committed to maintaining our position as leaders in operational excellence and driving continuous innovation in the manufacturing sector, ensuring sustained growth and competitiveness.

## 6. ACKNOWLEDGEMENT

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## 8. BIOGRAPHIES

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