JOURNAL OF MODERN MANUFACTURING SYSTEMS AND TECHNOLOGY
E-ISSN: 2636-9575
VOLUME 9, ISSUE 1, MARCH, 2025, 13 – 23
DOI: https://doi.org/10.15282/jmmst.v9i1.11867

RESEARCH ARTICLE

A Mini Review Developing an Integrated Delivery System Model Using a Lean Approach

Zahiruddin Mohd Zain[1], Norazlianie Sazali[1,2]*, Ramli Junid[1]

[1] Faculty of Manufacturing and Mechatronic Engineering Technology, University Malaysia Pahang, 26600 Pekan, Pahang, Malaysia
[2] Centre of Excellence for Advanced Research in Fluid Flow (CARIFF), Universiti Malaysia Pahang Al-Sultan Abdullah, Lebuhraya Tun Razak, Gambang, Kuantan, Pahang, Malaysia

ABSTRACT – Delivery system services are a crucial component of the logistical infrastructure supporting Malaysian citizens, particularly in public service delivery. With the rise of digital technology, traditional information dissemination methods have been replaced by advanced digital systems that enhance interactivity, efficiency, and cost-effectiveness. This shift underscores the importance of developing Integrated Delivery System Models (IDSM) to ensure citizens receive timely, accurate information for informed decision-making. This mini review examines the application of lean principles to improve the efficiency and effectiveness of IDSM in Malaysia's public service sector. Lean methodologies, which focus on reducing inefficiencies and optimizing processes, are explored as a framework to enhance transparency, accessibility, and system performance. Existing delivery system models and theories are reviewed to highlight the need for holistic systems thinking in addressing inefficiencies and overcoming the challenges of conventional delivery methods. Furthermore, the role of public policy in supporting lean integration is critically analyzed, with an emphasis on relational database systems to enable data-driven decision-making. These systems play a vital role in enhancing accuracy and operational efficiency, particularly in applications like general elections.This review presents a step-by-step framework for developing a lean-based IDSM, offering practical insights for policymakers and public administrators. By aligning social innovation, open governance, and technological advancements, this study aims to contribute to the design of a sustainable, citizen-centric public service delivery model that meets Malaysia's evolving needs.

ARTICLE HISTORY
Received : 13th Jan. 2025
Revised : 30th Feb. 2025
Accepted : 06th Mar. 2025
Published : 30th Mar. 2025

KEYWORDS
Delivery system
Integrated delivery system model
Lean approach
Public policy

1.0 INTRODUCTION

Delivery system services are a critical component of the logistical framework supporting Malaysian citizens. In today's digital age, technological advancements serve as a key benchmark for national progress. Information technology not only expedites service delivery and reduces costs but also transforms the way citizens receive and interact with information [1.2]. Traditional methods, such as newspapers, posters, and physical documents, have largely been replaced by digital systems incorporating features like animation, sound, and simulations. The efficiency and effectiveness of these systems significantly influence how citizens process and respond to information, underscoring the importance of a well-functioning delivery system.

A system is defined as a structured set of interconnected components designed to achieve a specific objective Aslam, For example, a lorry functions as a system aimed at providing transportation, with each subsystem—such as the engine and fuel system—playing a vital role [3]. Similarly, an Integrated Delivery System Model (IDSM) for public services aims to ensure that citizens receive timely, accurate, and relevant information to make informed decisions. This emphasizes that systems are best understood by examining their purpose and how individual components interact. Therefore, the success of an IDSM depends on the seamless integration and alignment of its parts to deliver information effectively [4,5]. Systems thinking emphasizes understanding systems holistically and leading them toward achieving their intended purpose. This approach addresses challenges posed by human tendencies to focus on immediate threats rather than slow-developing issues [6].

In Malaysia, social innovation has been increasingly integrated into local governance to enhance citizen participation in public service delivery [7]. However, open-governance systems alone do not guarantee sustainable, high-quality services. Citizens' ability to comprehend and analyze information plays a crucial role in fostering informed decision-making. This highlights the need for a robust and user-friendly IDSM to overcome the limitations of conventional delivery methods [8,9].

To address these challenges, this paper are to review existing delivery system models, propose a lean-based integrated delivery system framework, and explore the role of public policy in facilitating this integration. This review focuses on

*CORRESPONDING AUTHOR | NORAZLIANIE SAZALI | ✉ azlianie@umpsa.edu.my

the application of lean principles in public service delivery systems, particularly in Malaysia. The paper examines how lean methodologies can enhance the efficiency, transparency, and accessibility of these systems. Additionally, the study discusses the integration of relational database systems to support informed decision-making, with a specific focus on applications such as general elections.

2.0 EXISTING MODELS AND THOERIES

The development of numerical databases for delivery management has been an ongoing research endeavor since 1995, with key contributions from Gregory A. Pascucci and Waukesha (1995) and Wynne J. Whyman (2004) [10,11]. These early works laid the groundwork for creating database systems that allow users to efficiently query and retrieve data. Such systems facilitate access to historical records, help summarize information, assist decision-making, and provide tools for future projections. Over time, researchers have developed various database systems that cater to different needs, such as managing property information, inventory records, equipment tracking, and staff details. These systems often include functionalities for report generation, data extraction, query editing, and addressing user satisfaction with the system's performance [12,13]. These advances in database systems are crucial for enhancing delivery management systems.

To improve the effectiveness and functionality of delivery management systems, several strategies have been proposed, such as automation and the use of simple, user-friendly interfaces that leverage existing hardware resources. One of the key challenges in delivery systems is the variety of data sources, which can be internal (e.g., inventory, staff information) or external (e.g., citizen requests, real-time updates) [14,15]. By automating the system and enabling it to extract relevant data from existing databases, citizens can access accurate and timely information regarding the source and status of deliveries [16]. This model enhances transparency, efficiency, and overall user experience, making it applicable to a wide range of delivery services.

In terms of research variables, Maria C.M, Ridley S.M, and Raha A (2015) employed an Operations Research (OR) model with stochastic components to address the challenges of forecasting demand and supply in delivery management systems. Their research focused on the complexity of determining the appropriate number and types of resources needed, managing infrastructural damages, and optimizing delivery processes [17]. The integration of stochastic components into the model helped account for uncertainties and variability in the system, which is critical for improving decision-making. Building on this approach, Huseyin O.M and Zelda B.Z (2010) proposed a stochastic optimization approach aimed at improving delivery storage and distribution systems. Their work involved the development of a stochastic programming model that suggests optimal inventory levels for different property types, ensuring that the correct number of resources is available at any given time to meet demand. The ability to dynamically evaluate the most up-to-date information for customers, considering factors like inventory levels and delivery schedules, enhances the flow of information and improves service delivery [18].

The field of facility management has also seen the adoption of variable-driven research models. These models, driven by new technological developments such as computer-aided graphic-based databases, environmental assessments, outsourcing, benchmarking, and flexible space planning, help to address complex issues related to delivery management [19]. The need for competitive advantage in the global market, particularly in fast-paced industries, has led to the increasing significance of investment in a built environment, where efficiency and cost-effectiveness are paramount. The trend towards faster, better solutions is influencing the evolution of integrated systems that improve delivery management. Moreover, strategic management and re-engineering efforts are enabling organizations to reimagine their processes, fostering greater innovation and creativity. These changes, often supported by new technologies, are driving organizations to optimize their workflows and enhance value delivery. Effective integration of these technologies requires support from top management and coordination with other departments, especially human resources and IT, to ensure smooth implementation. Enterprise Resource Planning (ERP) systems serve as an example of how information can be shared seamlessly across organizations, promoting efficiency and reducing silos.

In the context of lean approaches, software development organizations have increasingly adopted agile methodologies to optimize their operations in recent years. Agile practices are designed to reduce overhead and enhance responsiveness to change, making them an attractive solution for dynamic environments. Jacobs (2011) highlighted that agile software development has led to improvements in flexibility and efficiency, though it also poses challenges related to scalability and the consistency of productivity and quality [20]. These issues become more pronounced in large organizations with complex structures, such as Volvo Car Corporation (VCC) and Volvo Truck Corporation (VTC), where simple agile implementations may not fully address the coordination and communication challenges present [21-23]. Mikell (2008) further emphasized that applying agile methods as a standalone solution in such complex environments may not be sufficient. A more tailored approach is required to adapt agile principles to large-scale organizations, ensuring that they are properly integrated into the overall organizational structure and workflow [24].

Several IDSMs have been implemented in different sectors with varying degrees of success. For instance, the Veterans Health Administration (VHA) in the United States has adopted an IDSM to integrate healthcare services, reducing duplication and improving patient outcomes. Similarly, the Singapore Smart Nation initiative integrates various public services through digital platforms, streamlining service delivery [25,26].

The review of existing models and theories highlights the evolution of delivery management systems, from early database-driven approaches to more sophisticated stochastic optimization models and agile software development methodologies. The integration of lean approaches, technological advancements, and strategic management practices offers significant potential for improving the efficiency, transparency, and effectiveness of delivery systems across various sectors. As these systems continue to evolve, it is clear that both technological and managerial innovations will play a critical role in shaping the future of delivery management and enhancing the user experience.

3.0 THE ROLE OF PUBLIC POLICY IN DEVELOPING INTEGRATED DELIVERY SYSTEM MODELS USING LEAN APPROACHES

Integrated Delivery System Models (IDSMs) are comprehensive frameworks designed to integrate various aspects of complex systems, offering a holistic view for analysis and decision-making. These models often combine disciplines such as energy systems, environmental impacts, and economic factors to better understand the interactions and interdependencies within a system [27-29]. IDSMs are particularly valuable in addressing complex challenges like transitioning to carbon-neutral societies or improving healthcare systems. Lean approaches, though not always explicitly mentioned in relevant literature, refer to methodologies that focus on maximizing value while minimizing waste in processes or systems. The core aim of lean principles is to streamline operations, reduce inefficiencies, and improve overall system performance [30,31].

The development and implementation of integrated system models (IDSMs) and lean approaches are significantly shaped by public policy presuppositions, which influence their effectiveness in various ways. Public policy priorities can dictate which aspects of a system are emphasized within integrated models, such as a focus on environmental sustainability that prioritizes energy systems and waste reduction, thus affecting the model's scope and accuracy [32,33]. The level of funding and institutional support provided through public policies directly impacts the feasibility and scale of developing and implementing IDSMs and lean methodologies. Policies that allocate resources to innovation in governance and public service delivery can accelerate the adoption of these models. Additionally, the regulatory framework created by public policies plays a crucial role in facilitating or hindering the adoption of integrated models [34]. For instance, policies promoting data sharing, transparency, and accountability can enhance the effectiveness of IDSMs in public service delivery [35]. Furthermore, public policies concerning data privacy and sharing practices influence the quantity and quality of information available for integrated models, and inadequate data governance can limit the scope of analysis and reduce model performance. Effective collaboration among various sectors and stakeholders is essential for the success of integrated approaches, and policies promoting inter-sectoral cooperation and public participation can significantly strengthen the design and implementation of IDSMs. Moreover, recent public policy trends emphasizing health and social equity influence the development of models like Equity Promoting Integrated Care (EPIC). This focus on equity ensures that integrated delivery systems are designed to serve the needs of diverse populations and promote fairness in public service access.

4.0 STEP-BY-STEP DEVELOPMENT OF THE INTEGRATED DELIVERY SYSTEM MODEL USING LEAN APPROACH

It should disclose any financial or non-financial interests such as political, personal, or professional relationships that may be interpreted as having influenced the manuscript. The phrase "The authors declare no conflicts of interest" should be included if there is no conflict of interest. Several important concepts in simulation study methodology include verification, validation, and credibility. Verification ensures that the conceptual simulation model (model assumptions) has been correctly translated into a computer program, i.e., debugging the simulation program. Techniques for debugging include structured walkthroughs, trace analysis, and animation. Validation determines whether a simulation model accurately represents the system for the study's specific objectives. If a model is valid, it can be used to make decisions similar to those made through actual system experiments [36-38].

Credibility involves the acceptance of a simulation model, and its results as correct by decision-makers and key personnel. Validity does not imply credibility and vice versa. For instance, a valid model might not be credible if its assumptions are unclear to the decision-maker, while a credible model with impressive animations might lack technical accuracy. Input modeling addresses the statistical issue of determining the best probability distribution to represent system randomness. Output analysis estimates the true measures of performance in a simulation model, considering factors such as run length, warm-up period, and independent replications.

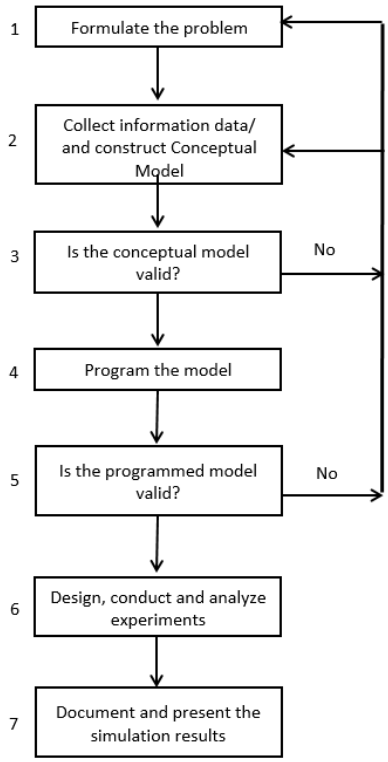

Figure 1: A Seven-Step Approach for Conducting a Successful Simulation Study

The first step involves identifying the problem to be investigated through simulation modeling. This includes defining the study's objectives and scope. In this study, the problem statement, objectives, and scope. Additionally, it is crucial to define the performance metrics for the integrated delivery system. Clearly articulating the problem ensures alignment between the model and the desired outcomes, enabling effective exploration of potential solutions.

Data collection is essential to provide accurate input for the simulation model. The key data points include target respondents, their locations of residence, and the type of integrated delivery service. These inputs, such as respondent types, are obtained from the conventional delivery system and analyzed using tools like Google Docs. Google Docs provides an intuitive platform for collecting and organizing data, offering features for managing various data distributions efficiently. The conceptual model acts as a blueprint, documenting assumptions, algorithms, and summarized data. It encompasses project goals, specific issues, and performance measures, along with system layout diagrams where relevant. Detailed descriptions of the system's components, their interactions, and simplifying assumptions are included, with technical data placed in appendices. The model must also cite sources of critical information to ensure transparency and validate controversial elements. This document serves both analysts and decision-makers, bridging technical details and strategic goals.

Validation of the conceptual model is performed through walkthroughs with delivery system management and User Acceptance Testing (UAT). This collaborative review ensures that the model's assumptions are comprehensive and accurate. It fosters team interaction, promotes model ownership, and minimizes political challenges by aligning stakeholder expectations. Early identification of errors during this phase prevents costly reprogramming in later stages. Any identified gaps are resolved before moving on to programming the model.

Once validated, the conceptual model is translated into a functional program. This step involves using tools like Google Docs or commercial simulation software such as the Industrial SAP System. Google Docs is chosen for its simplicity and effectiveness in this study, enabling efficient implementation of the model's logical and mathematical components. Programming translates abstract concepts into actionable simulations, forming the foundation for subsequent testing and analysis.

Program validation ensures the accuracy and reliability of the simulation model. Performance measures from the simulation are compared with those from the actual system, evaluating the model's fidelity. In this study, comparisons are made between the system's performance before and after implementing improvements, with an acceptable tolerance of ±10%. This step bolsters confidence in the model's predictive capabilities and supports its credibility among stakeholders.

This step involves designing experiments to test the model's functionality and analyze the delivery system's performance using lean principles. At this stage, the model's robustness is tested under various scenarios to uncover

inefficiencies and potential improvements. Experimentation provides actionable insights and validates the model's applicability in real-world contexts, ensuring that lean methodologies effectively enhance system operations.

The final step is to compile and present the findings comprehensively. The simulation results include data on target respondents, their improved locations, and a detailed discussion of the model's development and validation processes. This documentation serves as a reference for stakeholders and academic review, promoting model credibility and facilitating informed decision-making.

5.0 CASE STUDIES

This chapter explores real-world applications of lean integrated models (IDSMs) across various industries, highlighting their potential to improve efficiency, reduce waste, and enhance overall performance. In the transportation sector, a Peruvian company successfully reduced delivery delays from 10.53% to 5.36% by using Lean tools such as Total Productive Maintenance (TPM), Heijunka, and Andon, which improved operational efficiency and economic outcomes. Similarly, the construction industry benefited from an Integrated Scheduling Platform (ISP) that combined Building Information Modeling (BIM) and Lean Construction for a healthcare project. This platform facilitated effective master and detailed scheduling, as well as on-site work progress monitoring, resulting in enhanced project performance [39]. The automobile parts industry implemented an integrated ergo-green-lean framework that not only increased job satisfaction by 49% but also reduced high-risk postures by 100%, carbon emissions by over 30%, and cycle time by 15.5%. These cases illustrate the significant impact of lean principles when integrated with other management approaches [40].

Key lessons from these case studies reveal that combining methods such as Lean, BIM, and Integrated Project Delivery (IPD) can result in more holistic improvements. Regular updates to planning processes and visual schedules are critical to project success, as are considerations for ergonomic and environmental factors alongside lean principles. Despite these successes, challenges such as resistance to change, policy gaps, and a lack of expertise in integrated approaches were encountered. Organizations addressed these challenges by conducting pilot tests, developing comprehensive frameworks like the BIM-IPD-Lean Construction Maturity Model (BIL MM), and employing assessment techniques such as REBA and Value Stream Mapping (VSM) to evaluate performance metrics. Additionally, frameworks that combine Lean, Six Sigma, and ISO 9001:2008 principles helped minimize implementation effort and cost.

Further examples illustrate the versatility of lean approaches in various sectors. In healthcare, a hospital used lean methods like value stream mapping and 5S to reduce emergency department wait times by 50% and improve patient outcomes [41,42]. In manufacturing, an automotive company applied Just-in-Time (JIT) inventory management and Kanban systems, achieving a 40% improvement in on-time deliveries [43,44]

. E-commerce fulfillment centers adopted lean layouts and error-proofing techniques, resulting in faster order processing and fewer errors, while a restaurant chain optimized its food delivery system using standardized work, route optimization, and real-time tracking to reduce delivery times by 35% and increase customer satisfaction [45,46]. These case studies demonstrate how lean integrated models, when effectively implemented, can drive significant improvements in operational efficiency, environmental performance, and customer satisfaction. By addressing common challenges and building on lessons learned, organizations can achieve sustained success through lean delivery systems.

Lean integrated delivery systems have been adopted in various industries, offering valuable insights into their practical applications, challenges, and benefits. Several case studies illustrate how these systems have enhanced efficiency, reduced waste, and improved overall performance. In the construction industry in Sri Lanka demonstrated the potential of Lean Integrated Project Delivery (LIPD) to enhance long-term planning, productivity, and sustainability in projects [47]. Another case involved a data centre construction project that integrated lean practices with digital tools, such as the Last Planner System® (LPS) and digital command rooms, which facilitated efficient production planning, monitoring, and collaboration among dispersed teams [48].

The lessons learned from these case studies reveal both successes and challenges. On the positive side, lean systems improved stakeholder collaboration, streamlined production processes, reduced inventory, and enhanced long-term project planning. However, some companies did not achieve the expected benefits, often due to incomplete lean implementation or regulatory constraints, such as restrictive design-bid-build tender rules. Key insights indicate that integrating lean principles with digital platforms fosters a collaborative and efficient environment, while contextual and organizational factors play a critical role in determining success. A holistic approach that prioritizes customer needs and optimizes the entire project delivers superior results.

Despite their potential, lean integrated systems face several challenges. Resistance to change is a common obstacle, as stakeholders may be reluctant to move away from traditional methods. Policy gaps and limited understanding of lean principles also hinder successful implementation. To overcome these challenges, organizations can employ various strategies, such as providing comprehensive training on Lean Integrated Project Delivery (LIPD), engaging lean experts to guide the process, and encouraging team members to adopt lean principles. Additionally, adapting regulatory frameworks and developing collaborative contracts aligned with lean methodologies can facilitate smoother implementation. Integrating digital tools enhances transparency and supports lean processes, while tailoring lean approaches to the specific organizational context ensures greater effectiveness.

By addressing these challenges and applying the lessons learned from real-world implementations, organizations can maximize the benefits of lean integrated delivery systems. This leads to improved operational efficiency, better project outcomes, and increased stakeholder satisfaction, highlighting the potential of lean approaches to revolutionize industry practices.

6.0 FUTURE DIRECTION

The integration of lean principles into IDSMs holds significant potential for transforming the public sector by enhancing efficiency, transparency, and citizen-centric service delivery. Future research should focus on the following key areas to drive further innovation and effectiveness:

6.1 Digital Integration

Leveraging advanced technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), and blockchain can revolutionize real-time system optimization, data security, and transparency. For example, blockchain can enhance traceability and accountability in public service delivery by providing an immutable record of transactions. Similarly, IoT devices can facilitate real-time data collection to improve system responsiveness, while AI can streamline decision-making through predictive analytics.

6.2 Policy Alignment

The successful implementation of lean practices in IDSMs requires developing frameworks that align with existing regulatory and policy requirements. Future studies should explore how to ensure regulatory compliance while maintaining the flexibility and efficiency of lean systems, particularly in the context of rapidly evolving governance and public sector regulations.

6.3 Scalability and Adaptability

IDSMs need to be scalable and adaptable to address the diverse needs of rural and urban populations. Future research should investigate strategies for tailoring these systems to different contexts, considering factors such as infrastructure, access to technology, and user demographics. This adaptability is crucial for ensuring equitable service delivery across varying environments.

6.4 Emerging Technologies

The role of emerging technologies, such as machine learning and robotics, in optimizing IDSMs should be further explored. Machine learning algorithms can provide predictive analytics to anticipate citizen needs and streamline processes, thereby reducing service delivery time. Additionally, advancements in robotics could automate repetitive tasks, freeing up resources for more strategic initiatives.

6.5 System Prioritization and Implementation

The proposed IDSM can be visualized as a solar system model, where the 'sun' represents the core aims and objectives, and the 'planets' symbolize key activities or components required to achieve these goals. Activities closer to the 'sun' hold greater importance in achieving the system's objectives. Future research should focus on translating these conceptual models into actionable practices. For instance, activities defined in the system model (e.g., defghij) must be implemented as concrete actions (e.g., DEFGHIJ) in real-world scenarios.

6.6 Bridging Mental and Practical Models

A significant challenge in implementing IDSMs lies in bridging the gap between conceptual lean system models (A) and their practical applications (B) in dynamic environments. Future studies should emphasize the development of tools and methodologies to facilitate this translation, ensuring that theoretical frameworks are effectively realized on the ground.

7.0 CONCLUSION

This review underscores the critical role of public policy in shaping the development and implementation of Integrated Delivery System Models (IDSMs) using lean approaches. By addressing inefficiencies, high costs, and delays, lean methodologies provide a structured framework to enhance the performance of delivery systems across various sectors, particularly in public services. The success of these integrated models hinges on multiple policy-driven factors, including the prioritization of objectives, resource allocation, regulatory frameworks, data governance, and stakeholder engagement. Public policies that align with lean principles foster innovation, promote transparency, and ensure the delivery of citizen-centric services. Moreover, integrating relational database systems within IDSMs enhances data management and supports informed decision-making, which is particularly vital in applications such as general elections.

The findings of this review highlight the potential of lean principles to revolutionize public service delivery by streamlining processes and maximizing value. They also demonstrate the importance of a supportive policy environment in overcoming barriers to the adoption of integrated models. Future research should explore the practical implementation of these frameworks in different sectors, addressing challenges related to policy integration, technological advancements, and stakeholder collaboration. By fostering a deeper understanding of the interplay between lean methodologies and public policy, this study contributes valuable insights for policymakers and practitioners aiming to improve the efficiency, equity, and sustainability of delivery systems.

8.0 AUTHORS CONTRIBUTION

Z. M. Zain (Writing - original draft; Methodology)

N. Sazali (Writing - review & editing; Methodology; Conceptualization; Supervision)

R. Junir (Writing - review & editing; Methodology; Conceptualization; Supervision)

9.0 ACKNOWLEDGEMENTS

This study was not supported by any grants from funding bodies in the public, private, or not-for-profit sectors.

10.0 REFERENCES

[1] Wang, Pei, and Ming Luo. "A digital twin-based big data virtual and real fusion learning reference framework supported by industrial internet towards smart manufacturing." *Journal of manufacturing systems* 58 (2021): 16-32. https://doi.org/10.1016/j.jmsy.2020.11.012

[2] Choi, Tsan-Ming, and Tana Siqin. "Blockchain in logistics and production from Blockchain 1.0 to Blockchain 5.0: An intra-inter-organizational framework." *Transportation Research Part E: Logistics and Transportation Review* 160 (2022): 102653. https://doi.org/10.1016/j.tre.2022.102653

[3] Mughees, Zhili Gao, and Gary Smith. "Integrated implementation of Virtual Design and Construction (VDC) and lean project delivery system (LPDS)." *Journal of Building Engineering* 39 (2021): 102252. https://doi.org/10.1016/j.jobe.2021.102252

[4] Jeon, Kahyun, Ghang Lee, Seoungwoo Kang, Hyunsung Roh, Jeaeun Jung, Kyungha Lee, and Mark Baldwin. "A relational framework for smart information delivery manual (IDM) specifications." *Advanced Engineering Informatics* 49 (2021): 101319. https://doi.org/10.1016/j.aei.2021.101319

[5] Gao, Huan, Xing-li Du, Jia-zhi Liao, and Li Xiang. "The pathway of China's Integrated Delivery System: based on the analysis of the Medical Consortium policies." *Current Medical Science* 42, no. 6 (2022): 1164-1171. https://doi.org/10.1007/s11596-022-2654-9

[6] Effective delivery systems require continuous improvement and problem-solving frameworks to address root causes of inefficiencies and ensure optimal performance Karam, Marcel, Hanna Fares, and Salah Al-Majeed. "Quality assurance framework for the design and delivery of virtual, real-time courses." *Information* 12, no. 2 (2021): 93. https://doi.org/10.3390/info12020093

[7] Kanbara, Sakiko, and Rajib Shaw. "Disaster risk reduction regime in Japan: An analysis in the perspective of open data, open governance." *Sustainability* 14, no. 1 (2021): 19. https://doi.org/10.3390/su14010019

[8] Dovers, Elliot, Gordana C. Popovic, and David I. Warton. "A fast method for fitting integrated species distribution models." *Methods in Ecology and Evolution* 15, no. 1 (2024): 191-203. https://doi.org/10.1111/2041-210X.14252

[9] Zhang, Yumin, Xuan Zhang, Xingquan Ji, Xueshan Han, and Ming Yang. "Optimization of integrated energy system considering transmission and distribution network interconnection and energy transmission dynamic characteristics." *International Journal of Electrical Power & Energy Systems* 153 (2023): 109357. https://doi.org/10.1016/j.ijepes.2023.109357

[10] Pascucci, Gregory A. "Networked facilities management system with balanced differential analog control outputs." U.S. Patent 5,384,697, issued January 24, 1995.

[11] Whyman, Wynne. "Database system for outdoor property management and maintenance." U.S. Patent Application 10/735,416, filed July 1, 2004.

[12] Spena, A., C. Cornaro, and Plf Traini. "Noria data management software for PV modules characterization in the outdoor ESTER test facility." In *Proceedings of the 23rd European photovoltaic solar energy conference and exhibition*, pp. 2846-2849. WIP-Renewable Energies, 2008.

[13] Nolet, Michiel, Charles Brian O'kelley, Andrew S. Dilling, and Frederick Bou-Hsuon Lu. "Advertising platform user data store management." U.S. Patent 10,445,781, issued October 15, 2019.

[14] Raouf, Ayman M., and Sami G. Al-Ghamdi. "Effectiveness of project delivery systems in executing green buildings." *Journal of Construction Engineering and Management* 145, no. 10 (2019): 03119005. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001688

[15] Radaideh, Moh'D. A., and Rakan Abdelqader. "A proposed cloud-based platform of information technology services delivery management." *The Journal of Supercomputing* 78, no. 16 (2022): 18258-18287. https://doi.org/10.1007/s11227-022-04600-6

[16] Chen, Shi, Junfei Lei, and Kamran Moinzadeh. "Inventory and supply chain management with auto-delivery subscription." *Production and Operations Management* 32, no. 12 (2023): 4068-4087. https://doi.org/10.1111/poms.14078

[17] Hoyos, Maria Camila, Ridley S. Morales, and Raha Akhavan-Tabatabaei. "OR models with stochastic components in disaster operations management: A literature survey." *Computers & Industrial Engineering* 82 (2015): 183-197.https://doi.org/10.1016/j.cie.2014.11.025

[18] Mete, Huseyin Onur, and Zelda B. Zabinsky. "Stochastic optimization of medical supply location and distribution in disaster management." *International Journal of Production Economics* 126, no. 1 (2010): 76-84. https://doi.org/10.1016/j.ijpe.2009.10.004

[19] Langston, Craig, and Rima Lauge-Kristensen. *Strategic management of built facilities*. Routledge, 2013.

[20] Jacobs, F. Robert, William L. Berry, D. Clay Whybark, Thomas E. Vollmann, and Thomas Vollmann. *Manufacturing planning and control for supply chain management*. New York: McGraw-Hill, 2011.

[21] Jonsson, Anna, and Jan-Erik Vahlne. "Complexity offering opportunity: Mutual learning between Zhejiang Geely Holding Group and Volvo Cars in the post-acquisition process." *Global Strategy Journal* 13, no. 3 (2023): 700-731. https://doi.org/10.1002/gsj.1424

[22] Prystrom, Joanna. "Eco-innovation as a factor of competitiveness on the example of Volvo Car Corporation." *Marketing i Rynek* 4 (2023): 35-46. http://.doi.org/10.33226/1231-7853.2023.4.4

[23] Eugensson, Anders, and Jan Ivarsson. "What the Car Industry Can Do, Volvo Cars." In *The Vision Zero Handbook: Theory, Technology and Management for a Zero Casualty Policy*, pp. 1-39. Cham: Springer International Publishing, 2022.https://doi.org/10.1007/978-3-030-23176-7_28-1

[24] Groover, Mikell P. *Automation, production systems, and computer-integrated manufacturing*. Pearson Education India, 2016.

[25] DuMontier, Clark, Nathanael R. Fillmore, Cenk Yildirim, David Cheng, Jennifer La, Ariela R. Orkaby, Brian Charest et al. "Contemporary analysis of electronic frailty measurement in older adults with multiple myeloma treated in the national us veterans affairs healthcare system." *Cancers* 13, no. 12 (2021): 3053. https://doi.org/10.3390/cancers13123053

[26] Stevens, Hallam, and Yvonne Ruperti. "Smart food: novel foods, food security, and the Smart Nation in Singapore." *Food, Culture & Society* 27, no. 3 (2024): 754-774. https://doi.org/10.1080/15528014.2022.2163455

[27] Wu, Wenchuan, Penghua Li, Bin Wang, Yingshang Liu, Tao Xu, Hongwei Du, and Yan He. "Integrated distribution management system: architecture, functions, and application in China." *Journal of Modern Power Systems and Clean Energy* 10, no. 2 (2022): 245-258. https://doi.org/10.35833/MPCE.2021.000600

[28] Mbiada, Alain Kabo, Bassey Isong, Francis Lugayizi, and Adnan Abu-Mahfouz. "Towards integrated framework for efficient educational software development." In *2023 IEEE/ACIS 21st International Conference on Software Engineering Research, Management and Applications (SERA)*, pp. 53-60. IEEE, 2023. https://doi.org/10.1109/SERA57763.2023.10197734

[29] Demidowich, Andrew P., Kristine Batty, Teresa Love, Sam Sokolinsky, Lisa Grubb, Catherine Miller, Larry Raymond et al. "Effects of a dedicated inpatient diabetes management service on glycemic control in a community hospital setting." *Journal of Diabetes Science and Technology* 15, no. 3 (2021): 546-552. https://doi.org/10.1177/1932296821993198

[30] Palange, Atul, and Pankaj Dhatrak. "Lean manufacturing a vital tool to enhance productivity in manufacturing." *Materials Today: Proceedings* 46 (2021): 729-736. https://doi.org/10.1016/j.matpr.2020.12.193

[31] Vlachos, Ilias P., Rodrigo Martinez Pascazzi, George Zobolas, Panagiotis Repoussis, and Mihalis Giannakis. "Lean manufacturing systems in the area of Industry 4.0: A lean automation plan of AGVs/IoT integration." *Production planning & control* 34, no. 4 (2023): 345-358. https://doi.org/10.1080/09537287.2021.1917720

[32] Ciliberto, Cristina, Katarzyna Szopik-Depczyńska, Małgorzata Tarczyńska-Łuniewska, Alessandro Ruggieri, and Giuseppe Ioppolo. "Enabling the Circular Economy transition: A sustainable lean manufacturing recipe for Industry 4.0." *Business Strategy and the Environment* 30, no. 7 (2021): 3255-3272. https://doi.org/10.1002/bse.2801

[33] Chang, Miguel, Jakob Zink Thellufsen, Behnam Zakeri, Bryn Pickering, Stefan Pfenninger, Henrik Lund, and Poul Alberg Østergaard. "Trends in tools and approaches for modelling the energy transition." *Applied Energy* 290 (2021): 116731. https://doi.org/10.1016/j.apenergy.2021.116731

[34] Céspedes-Mota, Armando, Dinesh Shenoy, and Leopoldo Eduardo Cárdenas-Barrón. "Application of lean manufacturing concepts to evolving a policy for engineering education." *Education Sciences* 11, no. 11 (2021): 755. https://doi.org/10.3390/educsci11110755

[35] Candel, Jeroen JL. "The expediency of policy integration." *Policy Studies* (2021). https://doi.org/10.1080/01442872.2019.1634191

[36] Lichtig, William A. "The integrated agreement for lean project delivery." *Improving healthcare through built environment infrastructure* (2010): 85-101. https://doi.org/10.1002/9781444319675.ch6

[37] Rashidian, Sara, Robin Drogemuller, and Sara Omrani. "An integrated Building Information Modelling, Integrated Project Delivery and Lean Construction Maturity Model." *Architectural Engineering and Design Management* (2024): 1-17. https://doi.org/10.1080/17452007.2024.2383718

[38] Kurdve, Martin, Mats Zackrisson, Magnus Wiktorsson, and Ulrika Harlin. "Lean and green integration into production system models–experiences from Swedish industry." *Journal of Cleaner Production* 85 (2014): 180-190. https://doi.org/10.1016/j.jclepro.2014.04.013

[39] Morales Peralta, Ariana, Diego Toullier Aguilar, and Pedro Chavez Soriano. "Transport Service Optimization Model using Integrated Tools under the Lean Approach-A Peruvian Case Study." In *Proceedings of the 2023 9th International Conference on Industrial and Business Engineering*, pp. 212-219. 2023. https://doi.org/10.1145/3629378.3629465

[40] Kanan, Mohammad, Ansa Rida Dilshad, Sadaf Zahoor, Amjad Hussain, Muhammad Salman Habib, Amjad Mehmood, Zaher Abusaq, Allam Hamdan, and Jihad Asad. "An Empirical Study of the Implementation of an Integrated Ergo-Green-Lean Framework: A Case Study." *Sustainability* 15, no. 13 (2023): 10138. https://doi.org/10.3390/su151310138

[41] Marin-Garcia, Juan A., Pilar I. Vidal-Carreras, and Julio J. Garcia-Sabater. "The role of value stream mapping in healthcare services: A scoping review." *International journal of environmental research and public health* 18, no. 3 (2021): 951. https://doi.org/10.3390/ijerph18030951 Henrique, Daniel

[42] Barberato, Antonio Freitas Rentes, Moacir Godinho Filho, and Kleber Francisco Esposto. "A new value stream mapping approach for healthcare environments." *Production Planning & Control* 27, no. 1 (2016): 24-48. https://doi.org/10.1080/09537287.2015.1051159

[43] Choi, Thomas Y., Torbjørn H. Netland, Nada Sanders, ManMohan S. Sodhi, and Stephan M. Wagner. "Just-in-time for supply chains in turbulent times." *Production and Operations Management* 32, no. 7 (2023): 2331-2340. https://doi.org/10.1111/poms.13979

[44] Klug, Florian. "Modelling oscillations in the supply chain: the case of a just-in-sequence supply process from the automotive industry." *Journal of Business Economics* 92, no. 1 (2022): 85-113. https://doi.org/10.1007/s11573-021-01049-6

[45] Liu, Yan, Bin Guo, Chao Chen, He Du, Zhiwen Yu, Daqing Zhang, and Huadong Ma. "FooDNet: Toward an optimized food delivery network based on spatial crowdsourcing." *IEEE Transactions on Mobile Computing* 18, no. 6 (2018): 1288-1301. https://doi.org/10.1109/TMC.2018.2861864

[46] Ulmer, Marlin W., Barrett W. Thomas, Ann Melissa Campbell, and Nicholas Woyak. "The restaurant meal delivery problem: Dynamic pickup and delivery with deadlines and random ready times." *Transportation Science* 55, no. 1 (2021): 75-100. https://doi.org/10.1287/trsc.2020.1000

[47] Hettiaarachchige, Nadeesha, Akila Rathnasinghe, K. A. T. O. Ranadewa, and Niraj Thurairajah. "Lean integrated project delivery for construction procurement: the case of Sri Lanka." *Buildings* 12, no. 5 (2022): 524. https://doi.org/10.3390/buildings12050524

[48] McHugh, Kevin, Bhargav Dave, and Marzia Bolpagni. "THE ROLE OF LEAN IN DIGITAL PROJECT DELIVERY."https://doi.org/10.24928/2023/0214