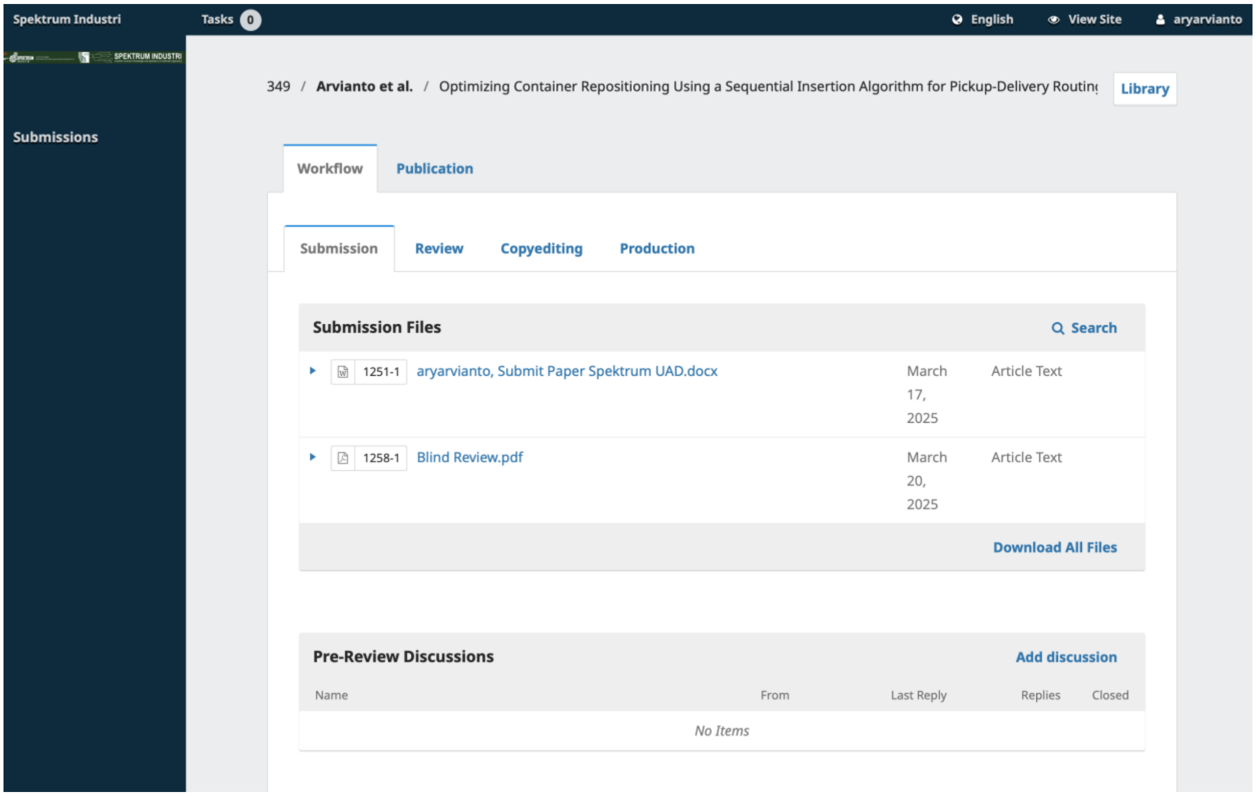
Bukti Korespondensi Publikasi

Judul Artikel	**:**	**Optimizing Container Repositioning Using a Sequential Insertion Algorithm for Pickup-Delivery Routing in Export-Import Operations**
Jurnal	**:**	**Spektrum Industri Journal**

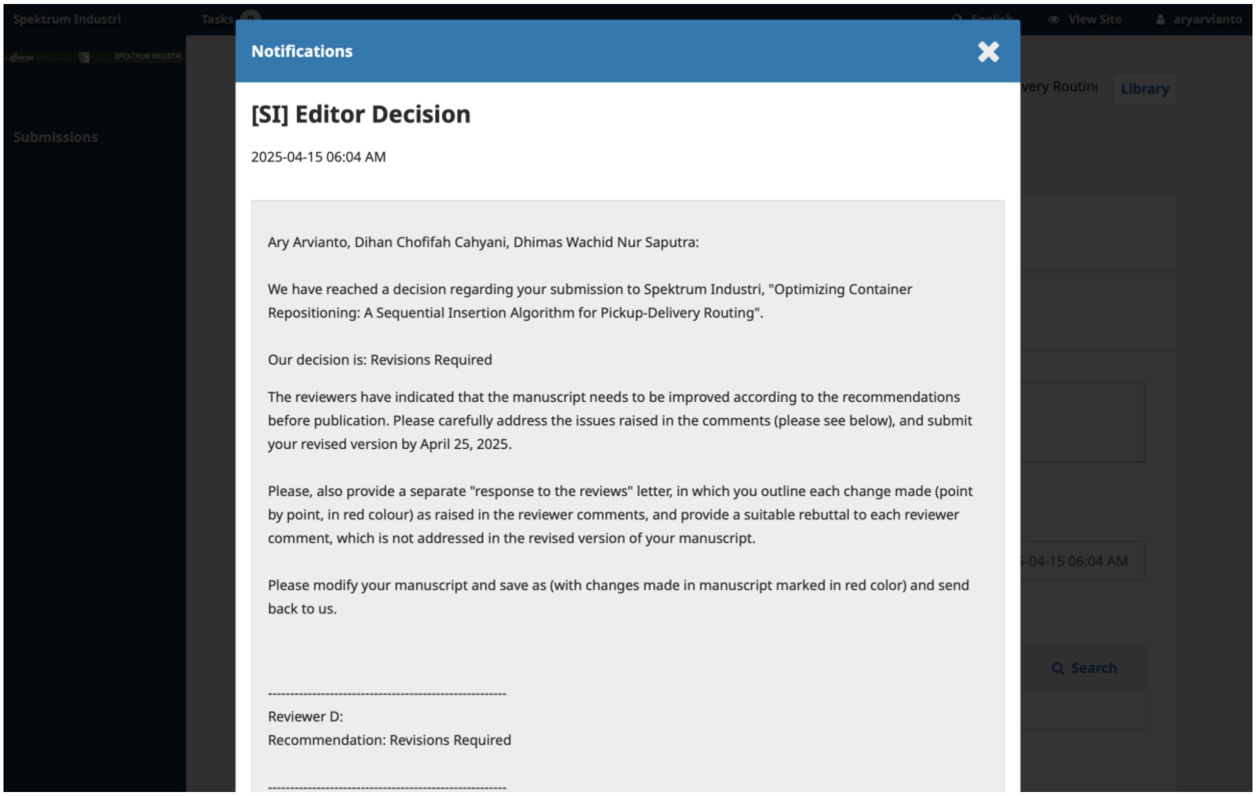
Kegiatan:

1. **Initial Submission : 17 Maret 2025**
   Manuscript initial submission in the Spektrum Industri Journal.
2. **First Round Review : 15 April 2025**
   First round review for submitted manuscripts.
3. **Accept Submission : 28 April 2025**
   Manuscript accepted for publication.
4. **Payment Confirmation : 29 April 2025**
   Payment Confirmation
5. **Accepted and Published : 30 April 2025**
   Paper has been published in Spektrum Industri Journal.

1. Initial Submission, 17 Maret 2025



2. First Round Review, 15 April 2025



Notifications

[SI] Editor Decision

2025-04-15 06:04 AM

Ary Arvianto, Dihan Chofifah Cahyani, Dhimas Wachid Nur Saputra:

We have reached a decision regarding your submission to Spektrum Industri, "Optimizing Container Repositioning: A Sequential Insertion Algorithm for Pickup-Delivery Routing".

Our decision is: Revisions Required

The reviewers have indicated that the manuscript needs to be improved according to the recommendations before publication. Please carefully address the issues raised in the comments (please see below), and submit your revised version by April 25, 2025.

Please, also provide a separate "response to the reviews" letter, in which you outline each change made (point by point, in red colour) as raised in the reviewer comments, and provide a suitable rebuttal to each reviewer comment, which is not addressed in the revised version of your manuscript.

Please modify your manuscript and save as (with changes made in manuscript marked in red color) and send back to us.

Reviewer D:
Recommendation: Revisions Required

From: **Spektrum Industri** <spektrum.industri@ie.uad.ac.id>
Date: Tue, 15 Apr 2025 at 13.05
Subject: [SI] Editor Decision
To: ary arvianto <aryarvi@gmail.com>

Ary Arvianto, Dihan Chofifah Cahyani, Dhimas Wachid Nur Saputra:

We have reached a decision regarding your submission to Spektrum Industri, "Optimizing Container Repositioning: A Sequential Insertion Algorithm for Pickup-Delivery Routing".

Our decision is: Revisions Required

The reviewers have indicated that the manuscript needs to be improved according to the recommendations before publication. Please carefully address the issues raised in the comments (please see below), and submit your revised version by April 25, 2025.

Please, also provide a separate "response to the reviews" letter, in which you outline each change made (point by point, in red colour) as raised in the reviewer comments, and provide a suitable rebuttal to each reviewer comment, which is not addressed in the revised version of your manuscript.

Please modify your manuscript and save as (with changes made in manuscript marked in red color) and send back to us.

3. Accept Submission, 28 April 2025

From: **Spektrum Industri** <spektrum.industri@ie.uad.ac.id>
Date: Mon, 28 Apr 2025 at 10.11
Subject: [SI] Invoice Publication Fee
To: ary arvianto <aryarvi@gmail.com>

Dear Dr Ary Arvinato,

We have reached a decision regarding your submission to Spektrum Industri, "**Optimizing Container Repositioning Using a Sequential Insertion Algorithm for Pickup-Delivery Routing in Export-Import Operations**".

Our decision is to**: Accept Submission**

to be published in Spektrum Industri No. 1 Vol. 23, April 2025

Each published article is charged an article publication fee of Rp. 1.000.049,- (49 is the last two digits of the manuscript ID) as stated on website. Please complete the payment through wire transfer to:

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This payment can be made no later than April 30th, 2025. Please reply with copy of Bank transfer to this email. Thank you.

Wassalamualaikum wa rahmatullaahi wa barakaatuh

--
Yours sincerely,
Agung Kristanto, Ph.D.
Editor in Chief - Spektrum Industri
Industrial Engineering Department
Universitas Ahmad Dahlan Yogyakarta - Indonesia

http://journal3.uad.ac.id/index.php/Spektrum/index

4. Payment Confirmation, 29April 2025

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Scientific Journal of Knowledge and Application of Industrial Engineering

Ringroad Selatan, Bantul, Special Region of Yogyakarta, Indonesia 55191

April 29, 2025

Assalaamu'alaikum wa rahmatullaahi wa barakaatuh

Alhamdulillah, all praise to Allah who has given various gifts for us to be able to work until today.

Dear Dr. Ary Arvianto,

The warmest greeting from Yogyakarta, Indonesia.

This letter acknowledges that Spektrum Industri has received your payment of 1,000,049,- IDR to complete the publication fee for article ID 349. For further information, we will process your article to be published in the Spektrum Industri Vol. 23, No. 1.

Thank you.

Wassalamualaikum wa rahmatullaahi wa barakaatuh.

Yours sincerely,

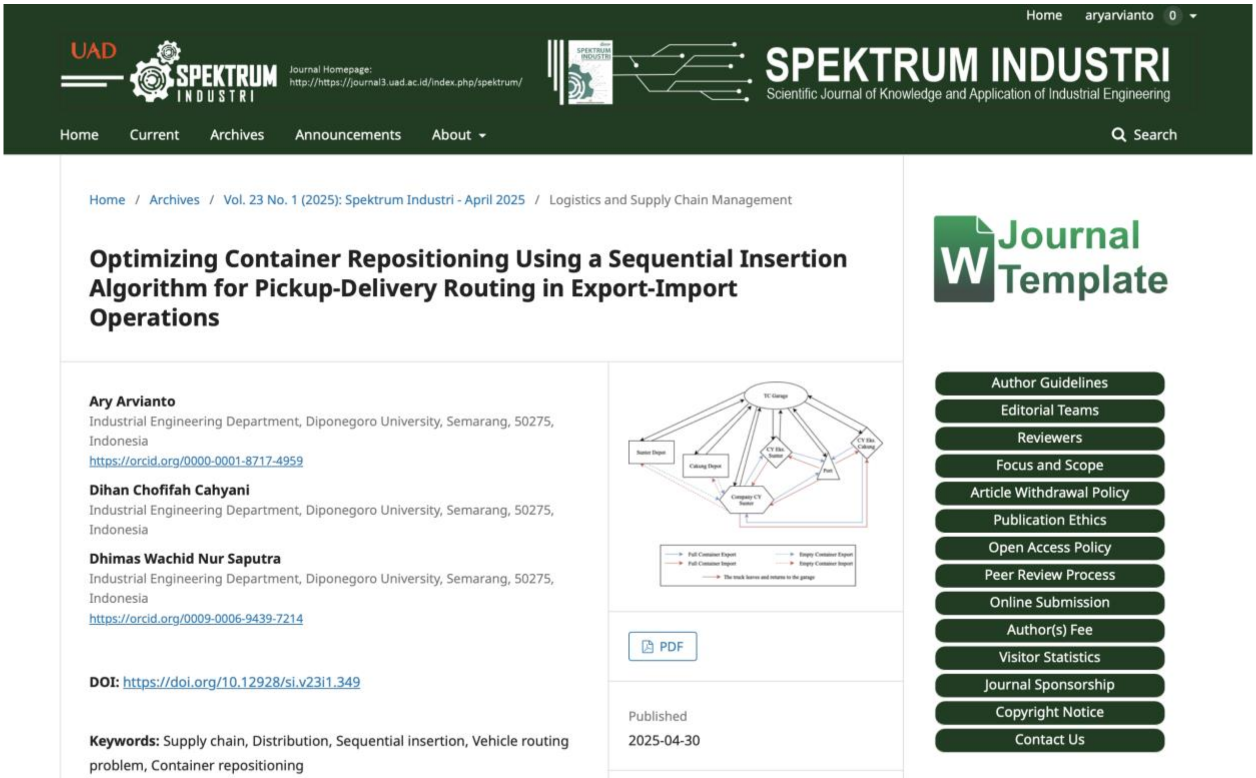
Editor in Chief

Agung Kristanto, Ph.D.

"SPEKTRUM INDUSTRI"

spektrum.industri@ie.uad.ac.id

5. Accepted and Published 30 April 2025



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Optimizing Container Repositioning Using a Sequential Insertion Algorithm for Pickup-Delivery Routing in Export-Import Operations

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https://orcid.org/0009-0006-9439-7214

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Keywords: Supply chain, Distribution, Sequential insertion, Vehicle routing problem, Container repositioning

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Reviewer's Comments

1. Abstract

<table>
<tr><td>Reviewer A</td><td>Clarify the specific improvements observed (e.g., what exactly does the reduction in vehicle usage mean (%) for real-world operations). Consider mentioning the limitations or areas for future work briefly to provide a more balanced perspective.</td></tr>
<tr><td>Reviewer B</td><td>The contribution of the study should stated explicitly
-see the details in attached file</td></tr>
<tr><td colspan="2">Response:
Thank you, we have added an explanation of the reduction in vehicle usage mean and mentioning the limitations in the abstract. Also We have added the contribution of the study.</td></tr>
<tr><td colspan="2">Revised Abstract:
The growing number of empty containers significantly contributes to traffic congestion and increased operational costs, necessitating the development of an optimized routing model to enhance fleet utilization and minimize transportation expenses. This study focused on optimizing container repositioning for pick-up and delivery operations using a heuristic approach derived from the Vehicle Routing Problem with Pick-Up and Delivery and Time Windows (VRPPD-TW). This model employed a sequential insertion algorithm, grounded in a mathematical framework, implemented through a Python program, and verified for accuracy through manual calculations aligned with the algorithm's defined steps. The primary objective is to minimize vehicle usage within available time constraints. Empirical data involve six nodes, comprising a garage, two depots, two external container depots, and a port terminal, handling the daily relocation of 44 containers for export-import operations. The model effectively reduces the number of tours from 37 to 6, demonstrating significant optimization. The findings illustrate that the sequential insertion algorithm efficiently addresses the VRPPD-TW problem, improving solution space exploration, workload distribution, and adaptability to dynamic constraints. Managerial implications include a 75% reduction in tour (fleet requirements) and enhanced logistics efficiency. This approach offers the potential to reduce operational costs and alleviate congestion, thereby enhancing fleet utilization. However, the model has notable limitations, as it does not account for the queuing time of trucks at each node (dynamic queuing), or address issues related to computational scalability. These aspects are essential for future research.</td></tr>
</table>

2. Introduction

<table>
<tr><td>Reviewer A</td><td>Discuss more specifically how this research fills a gap in the existing literature, especially concerning the use of sequential insertion algorithms for container repositioning in export-import logistics. Highlight the contributions of this study to existing models.</td></tr>
<tr><td>Reviewer B</td><td>- The author should highlight more in developing mathematical model/VRP model instead of case studies. So it’s better to rewrite the explanation about ‘the company’
- Please showing the state of the art from this study, considering that many similar studies have been conducted
- Contribution of this study need to be stated clearly; It is important for authors to explain how the proposed model can advance the current state of knowledge beyond the existing VRPPD-TW framework</td></tr>
<tr><td colspan="2">Response:
Thank you for your insightful feedback. We have filled research gaps based on previous studies, and highlight the research contributions. We also have revised this section to focus more on developing the mathematical model and adding the contribution of the study.</td></tr>
<tr><td colspan="2">Revised Abstract:
Despite significant advancements in container logistics optimization, previous research has primarily focused on either empty container repositioning or vehicle routing in isolation, often under idealized conditions that fail to account for real-world disruptions such as port closures or unexpected delays. Existing models frequently overlook the complexities introduced by time windows, split deliveries, and multiple trips, limiting their applicability to practical logistics networks. This research bridges the gap by integrating both empty container repositioning and vehicle routing within a unified framework that considers realistic constraints.

The optimization of container repositioning in export-import logistics has been extensively studied through various heuristic and exact methods, including Large Neighborhood Search (LNS), mixed-integer programming (MIP), Clarke-and-Wright, Tabu Search, and metaheuristics. However, existing models often struggle with scalability and computational efficiency when addressing real-time constraints in complex logistics networks. This study addresses these gaps by implementing a Sequential Insertion Algorithm (SIA) tailored for Vehicle Routing Problems with Pick-Up and Delivery and Time Windows (VRPPD-TW). SIA incrementally constructs optimized solutions, enhancing adaptability to dynamic constraints such as sudden changes in container availability or routing conditions. Through a mathematical model and the development of a Sequential Insertion Algorithm, the proposed solution optimizes fleet efficiency while minimizing non-value-added costs. This approach represents a significant departure from conventional studies, offering a robust and adaptable method suitable for dynamic, high-demand industries such as automotive logistics.

Logistic company in Indonesia faces significant challenges in managing its export-import operations, particularly in the transportation of containers. The imbalanced flow of goods between exports and imports leads to an increase in the number of empty vehicles and non-value-added costs. This presents a complex challenge that requires routing modeling to minimize the movement of empty trucks and improve the overall route efficiency. The developed routing model is also expected to be applicable to other similar logistics networks.</td></tr>
</table>

3. **Method**

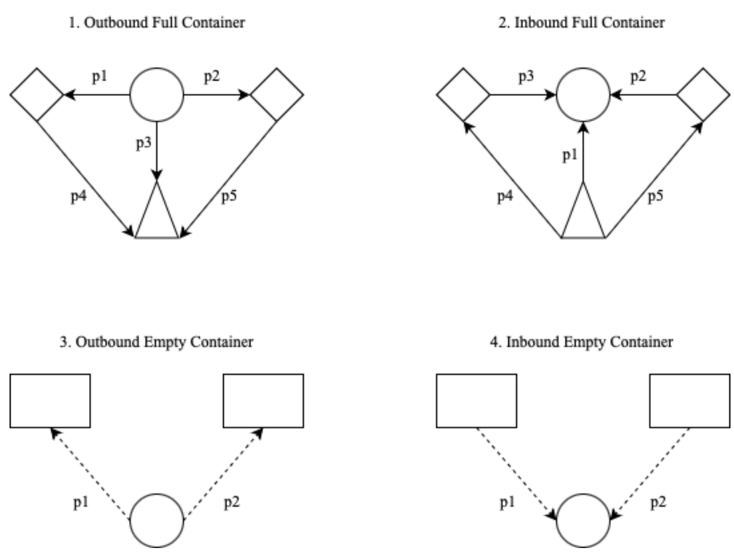
<table>
<tr><td>Reviewer A</td><td>- The model's characteristics (e.g., homogeneous fleet, multiple trips, split delivery) are listed clearly, but it might be helpful to group them into broader categories or provide a clearer rationale for each choice. Also, it would be beneficial to provide more detail on the algorithm's implementation steps and its complexity.
- Please use the higher resolution for each picture/graph.
- Could you please clarify the software and tools you used for data processing in this study, and provide more details on the computational environment or programming languages involved?</td></tr>
<tr><td>Reviewer B</td><td>- Author need to explore the assumptions, or challenges, that might affect model generalizability or performance in different settings.
- It might better to explain the research stages into bullet points.
- it is necessary to explain the data collection methods
- Each pictures shown should be in a higher resolution
- The author needs to explain the language program and any software that was used to solve the issue.
- It is imperative to modify the punctuation of the data presented in numerical form by converting the commas (,) to point (.).</td></tr>
<tr><td colspan="2">Response:
Thank you. Explanations regarding the grouping or characteristics of the model have been considered based on the needs of actual conditions of practical systems and become a reference for algorithm development. We have revised the manuscript and added Explanations regarding the use of software and programming languages used in this study have been added. The availability of software is also presented in the form of a link that has been written in the manuscript. We also have revised figures quality and modified the punctuation of the data presented in numerical form by converting the commas (,) to point (.).</td></tr>
<tr><td colspan="2">Revised Method:
Based on previous research on the vehicle routing problem (VRP) for truck trailer management in container relocation (Zhang et al., 2020), the present study develops an enhanced VRP model. In this formulation, route planning is refined to permit truck trailers to perform both pickups and deliveries at the same location, and vehicles are allowed to revisit nodes if additional transportation demand exists. The model's objective function is designed to minimize the number of vehicles required to satisfy container repositioning needs. Conceptually, the model is characterized by five key variants: (a) a homogeneous fleet, wherein vehicles possess similar attributes in terms of truck type and capacity. In practice, this type of grouping is because the repositioning process only uses one type of container fleet (truck); (b) multiple trips, enabling a vehicle to serve more than one node or route within a single delivery cycle. The company does not specifically regulate the minimum number of fleet visits to container facility (nodes). Empirical data shows that each fleet may visit more than one node. Therefore, the multiple trips characteristic can be assigned in this study; (c) time windows, which enforce fixed service periods during which nodes may operate. Although operating for 24 hours, there are time restrictions (time windows) in the container yard for access in and out of the container fleet. Time window characteristics must be included in this study model; (d) split delivery, a node can be visited by more than one vehicle to fulfill the demand. This characteristic aligns with the operational constraint that container repositioning occurs at a predefined set of facility</td></tr>
</table>

nodes—six in this study. Consequently, demand at each node, whether related to pick up or container delivery, can be satisfied by multiple vehicles independently within the designated operating hours, ensuring flexibility in resource allocation and optimizing logistical efficiency; and (e) a single product, where only one type of product (one container size) is involved in the shipping process. These characteristics become a reference for the development of the algorithm built on this model.

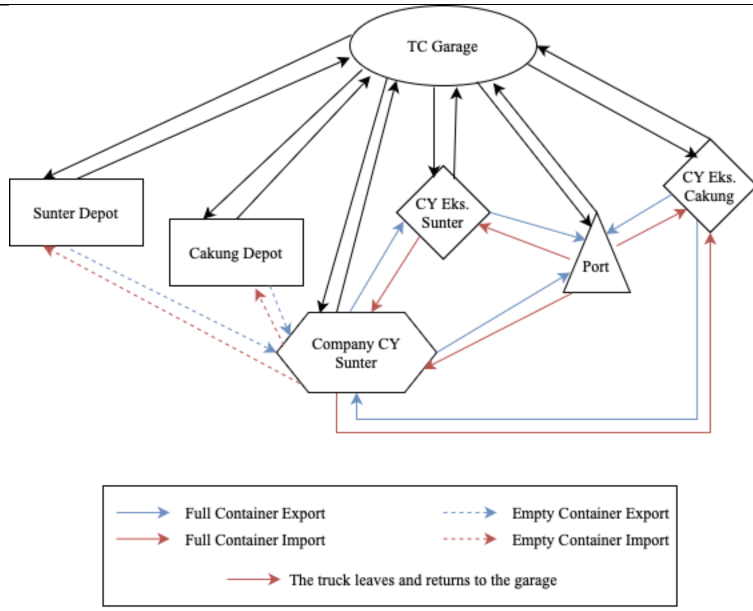
The solution to the VRP problem, incorporating the five specified characteristics, is approached in three primary stages:

- First, a comprehensive mathematical model is formulated to incorporate all the relevant characteristics, ensuring that the unique constraints and parameters are accurately captured.
- Second, an algorithm based on the sequential insertion technique is developed to solve the resulting optimization problem effectively.
- Third, this phase involves testing the optimization model using the sequential insertion algorithm. The process evaluates whether the resulting route selections comply with constraint functions and align with manual calculations. Validation is conducted by comparing the total number of tours obtained through manual computation in Excel with those generated by the algorithm-based program. Consistency between results indicates the algorithm's validity.

The VRPPD-TW solution model was developed using *Python* programming language on the *Google Colab* web-based platform. The libraries used include *Streamlit* for creating an interactive web application and OR-Tools for solving optimization problems in vehicle routing. After the algorithm is developed, the next step is the testing process using empirical data. The data for testing was collected directly from the field through observations and interviews with operational staff of the company. Data was gathered regarding shipment and return node data, vehicle types and quantities, operating hours, and vehicle routes. The collected data was then verified for consistency and validated by cross-checking it with historical records maintained by the company to ensure its accuracy and relevance.



Container Repositioning Task



Container Delivery Route

Furthermore, an optimization framework based on a sequential insertion algorithm was developed in conjunction with the mathematical model. The mathematical notation of the VRPPD-TW is subsequently solved using the sequential insertion algorithm. The design of the algorithm is developed to address the objective function of the VRPPD-TW mathematical model, considering the entire set of model constraints. It means that the output of the sequential insertion algorithm must comply all the mathematical equations. Figure 3 illustrates the flowchart outlining the sequential insertion algorithm employed in this investigation. The flowchart procedure is systematically translated into a computer program, developed using the Python programming language to serve as a computational tool for this study. The software algorithm iteratively evaluates combinations of transportation tours, halting once no further tours satisfy the constraint functions, such as time windows or operational limits. Demonstrating computational efficiency, the software processes input data and delivers optimal solutions within an average runtime of less than 5 minutes. Access to the complete VRPD-TW software is provided via the corresponding link. (https://bit.ly/VRPPD_Planning_Route_ContainerTruck).

4. Result and Discussion

Reviewer A	Expand on the significance of reducing the number of tours and vehicles. For example, explain how this reduction translates to cost savings or operational efficiency in a real-world setting. Discuss the limitations of the sequential insertion algorithm in more depth, such as its scalability issues, and explore potential improvements or future research directions (e.g., considering heterogeneous fleets or dynamic routing constraints).
Reviewer B	- Is there any modifications conducted in this algorithm for this case? It is important to point out the differences in the sequential insertion algorithm used in this research, as this is a new approach. - The discussion section needs to be described scientifically, accompanied by adequate references to the results obtained

	- A subsequent sensitivity analysis is recommended to enhance the findings.

Response:

Thank you for your insightful feedback. Thank you. revisions regarding the significance of reducing the number of tours and vehicles have been added. In addition, the discussion of algorithm limitations has also been improved according to comments. Also we have revised explanation of sequential insertion as a new approach has been added. The explanation of the need for sensitivity analysis has been adjusted to the focus of the discussion, namely solving limited situations (systems with a fixed and limited number of nodes). However, the need for sensitivity analysis has also been suggested if the focus of the study is to examine the model.

Revised Result and Discussion:

This VRPPD-TW model is designed with the objective of minimizing the number of tours (or vehicles) required to satisfy container repositioning demands, as defined by the formulated mathematical notation. To achieve this, the sequential insertion algorithm is employed, which optimally integrates nodes into route combinations to determine the most efficient number of tours. The generation of routes and tours is influenced by the combinations of transportation and delivery location points. As the number of visitable locations increases, the number of potential route combinations expands, thereby enhancing the solution's accuracy, albeit with increased computational complexity. This model implements a soft time window system, where, in the absence of active pickup or delivery nodes, the model pauses and rechecks the status of these nodes every minute. This process iterates continuously until a valid repositioning request is detected.

Table 3 provides the distance matrix for each node. These distances were converted into corresponding travel times for container delivery trucks, assuming a constant speed of 40 km/h.

Travel Distance Matrix

Node	Travel distance matrix (km)						
	0	1	2	3	4	5	6
0	0	8.1	6.4	18	7	13.3	5.2
1	8.1	0	7.7	14.1	8.1	17	12.4
2	6.4	7.7	0	14.5	2.7	15.9	11.3
3	18	14.1	14.5	0	15	5.1	16.4
4	7	8.1	2.7	15	0	15.9	11.3
5	13.3	17	15.9	5.1	15.9	0	11.7
6	5.2	12.4	11.3	16.4	11.3	11.7	0

Following the collection of all requisite data in accordance with the variables and parameters of the formulated mathematical model, computational evaluations were conducted using a sequential insertion algorithm. These computational outcomes were then validated through manual calculations. For example, the results for Tour 1 exhibited complete agreement with the manual analysis in terms of the node visitation sequence and the working time requirement, which encompasses both travel and service durations at each node. Manual calculations (Tour 1) using Microsoft Excel resulted in the route n0-n6-n4-n6-n5-n6-n1-n2-n1-n2-n1-n4-n1-n6-n1-n6-n0 which was carried out in 15 iterations. This compatibility confirms the validity of the computational program, and the verified tool was subsequently used to derive the study's overall results. The optimal route cost calculations obtained from the computational program are presented in Table 4.

Validation of Computational Result

Tour	Route	Distance (km)	Working time (minutes)
1	n0-n6-n4-n6-n5-n6-n1-n2-n1-n2-n1-n4- n1-n6-n1-n6-n0	135.4	366
2	n0-n6-n1-n6- n2-n1-n6-n2- n1-n6-n2-n1- n6-n2-n1-n6- n2-n1-n0	143.2	364
3	n0-n5-n1-n6-n2-n1-n3-n1-n3-n1-n5-n0	148.4	282
4	n0-n3-n1-n2- n1-n2-n1-n2- n1-n2-n1-n3- n1-n0	130	295
5	n0-n3-n1-n3- n1-n3-n1-n3- n1-n3-n1-n0	153	267
6	n0-n3-n1-n3- n1-n0	68.4	110

The use of this VRPPD-TW model is still focused on a limited situation (the pick-up and delivery process occur at fixed nodes), where the demand parameters and travel times do not change significantly. Therefore, sensitivity analysis is not performed in this study, as changes in parameters would not significantly affect the results. However, for future research, this model should involve sensitivity analysis to understand the reliability and stability of the model.

Based on the routing results presented in Table 4, the mechanism of sequential insertion in addressing container repositioning is elucidated. All processes are systematically computed using the established model algorithm illustrated in Figure 3. Containers are incorporated into the solution incrementally, adhering to a predetermined order or priority sequence. In particular, algorithm modifications are performed. This sequence is guided by specific criteria, including container requests, time windows, and proximity to the target location. At each step, the algorithm rigorously evaluates all possible positions or actions (determining optimal repositioning points). This modification process makes this approach able to produce a more robust initial solution while remaining adaptable to data changes.

Performance Comparison of Existing Tours versus Research Model Outputs

Indicator	Existing	Research result
Number of tours	37	6
Number of Vehicles/Day	12	6

Table 5 demonstrates that the tour and route configuration produced by the computational program in this study is markedly superior. This result is consistent with the study by Lai et al. (2013), which discusses the use of meta-heuristic methods to address container repositioning problems, resulting in improved operational efficiency in terms of both the number of tours and the number of vehicles used. This research generating only six tours compared to the existing 37 tours. This significant difference is attributable to the fact that the company's current approach does not incorporate fleet sizing to adequately meet the daily container repositioning demand. In contrast, the proposed model optimizes vehicle usage, reducing the average daily truck requirement from 12 to 6—a 50% reduction. This efficiency improvement largely stems from the limitations of the current intuitive route determination method, which restricts each truck to a maximum of two tasks and confines container repositioning management to the Sunter container yard.

The configuration of routes and tours in the model is determined by the combination of pickup and delivery points. As the number of visited points increases, the number of potential route combinations grows, necessitating a higher degree of accuracy in the computational process. This precision directly influences the reliability of the route calculations. In this study, the sequential insertion algorithm was implemented in Python, yielding an average processing time of 10 seconds for a scenario involving six pickup and delivery nodes and 30 route combinations. It is anticipated that variations in the number of nodes and route combinations will correspondingly affect the computational processing time and the number of iterations required.

The final outcomes of route and tour generation through the VRPPD-TW model significantly impact operational cost efficiency. For instance, vehicles (truck) rental charge are directly proportional to the number of tours generated by the model. Empirical computation (from the model's implementation) reveal that the computational program produced a solution requiring only 6 trucks (represented as the number of tours), compared to the current average daily usage of 12 trucks. This indicates that the model can directly contribute to a 50% reduction in operational costs, demonstrating its potential for substantial cost savings in logistics operations.

Key findings that differentiate this model from previous LNS approaches in container repositioning (Zhang et al., 2020), are evident in several aspects. Sequential Insertion effectively overcomes the susceptibility of LNS to local optima by systematically integrating elements (e.g., containers or routes) and exploring a broader solution space. It reduces the computational complexity associated with searching large neighbourhoods by focusing on incremental solution construction, thereby lowering computational demands. Moreover, it addresses the issue of imbalanced workload by optimizing task distribution across resources, considering constraints such as capacity and time windows. Unlike LNS, which heavily relies on the quality of the initial solution, Sequential Insertion generates robust initial solutions by prioritizing cost-effective insertions, allowing for further refinement. Lastly, its adaptability to dynamic or real-time constraints, such as sudden changes in container availability or routing conditions, ensures recalculated and adjusted solutions, enhancing overall efficiency.

This model exhibits several limitations. The algorithm primarily focuses on optimizing the number of vehicles, represented by the number of tours, without accounting for the balance of total working time across the generated tours. Additionally, the model does not account for queue times; if multiple trucks arrive at the same location simultaneously, dynamic waiting times may occur within the queue, which should be addressed in future model development. From a computational perspective, the software output restricted to optimizing a maximum of 20 nodes and 360 route combinations, limiting its applicability and scalability to larger networks. Moreover, the software output is restricted to providing a sequence of visit routes, without offering detailed scheduling information.

5. Conclusion

<table>
<tr><td>Reviewer A</td><td>Highlight the model's potential for application in various industries, beyond the specific case studied. Consider mentioning future directions for research, such as incorporating more complex constraints or testing the model in a larger network.</td></tr>
<tr><td>Reviewer B</td><td>The conclusion does not provide an adequate explanation of the limitations.</td></tr>
<tr><td colspan="2">Response:
Thank you. We have revised this section. The description of the potential of the model for applications in various actual industries has been improved and supplemented. Further research directions have also been added at the end of the conclusion.</td></tr>
<tr><td colspan="2">Revised Conclusion:
The proposed sequential insertion algorithm and VRPPD-TW framework demonstrate significant potential for applications across diverse industries, including supply chain optimization, urban logistics, automotive industry, and healthcare delivery systems. More specifically, industries that involve import-export processes using containers in their business operations. By addressing pick-up and delivery routing challenges within constrained environments, the model's adaptability can enhance efficiency in real-world scenarios. Future research could expand on this foundation by incorporating heterogeneous fleets, dynamic queuing mechanisms, and additional constraints such as varying service priorities or stochastic demands. Furthermore, testing the model's scalability in larger networks would provide valuable insights into its robustness and practical viability for complex operational landscapes.</td></tr>
</table>

6. General Comment Reviewer's A

The title is suggested change to "Optimizing Container Repositioning Using a Sequential Insertion Algorithm for Pickup-Delivery Routing in Export-Import Operations."
Response: Thank you. We have revised the title
I recommend that the author proofread the manuscript to improve clarity, conciseness, and ensure the language is consistent throughout.
Response: Thank you. The manuscript has been revised according to suggestions.
Clarity of the Model: While the mathematical formulation is thorough, it would be helpful to provide a brief, non-technical summary of how the sequential insertion algorithm works before diving into the equations.
Response: Thank you for the review. Revisions have been made by adding a brief explanation of the sequential insertion algorithm mechanism in complying with mathematical equations.
Real-World Validation: The validation process is mentioned, but a more detailed comparison with real-world data would make the findings more compelling. Including a sensitivity analysis would be useful to show how changes in parameters (e.g., demand, vehicle capacity) affect the results.
Response: Thank you, the revised validation explanation has been added by mentioning the results in more detail using the sample data in tour 1. Furthermore, an explanation regarding sensitivity analysis has been added.
Figures and Tables: Some figures (e.g., Figures 1, 2, 3) could use more detailed captions that explain their relevance in the context of the problem. Tables could be more clearly referenced and discussed in the text for better integration.
Response: Thank you. The Figures 1,2,3 have been revised.