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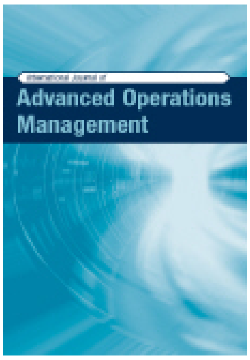

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Abstract: This article has purpose to explore interaction among factors causing the delay in multimodal transportation for containerised exports and provided an integrated interpretative structural modelling (ISM) and cross-impact matrix multiplication applied to classification (MICMAC)-based analysis. The methodology explores the interaction among the factors causing delay in containerised multimodal transportation using ISM. The responses for interconnection among factors affecting set objectives are collected and developed as initial reachability matrix (IRM). The exploration and finalisation of factors, and development of interaction matrices among the factors has been conducted using the MICMAC analysis followed by the development of a structural model. The research derived the factors affecting the containerised movement while considering the overlapping in interpretation among factors and found interaction among factors causing a delay in containerised movement. This work considered the movement of exports by containerisation only. This work considered delay due to operational reasons only and excluded the factors causing delay due to natural factors.

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Keywords: multimodal transportation; containerised exports; export modelling; global supply chain.

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1 Introduction

In any region, two aspects of transportation management exist; internal management of firms and another is planning and management of supporting infrastructure which is done by the government. Independent of ownership; public or private, it requires good internal management. The government controls different aspects regarding transportation and these controls are different in different countries (Farmer, 1965). The density and variety of movement of merchandise is reflected by globalisation and boosted by movement of containers in large quantity (Hammami et al., 2008).

In today's world, every country is involved in export and import due to the open economy and due to this high amount of cargo movement happens across countries. The time when the supply chain has globalised and operations are outsourced and off shored, the performance of the supply chain gets linked with the international transportation of cargo. Containers, since 1960 has taken a steep climb and this medium allows the globalised world to trade in bulk goods rapidly in smooth and secure way. The progress of containerisation is primary force between the globalisation of factory and international trade (Hall et al., 2006). A variety of factors caused by actors of services and the nature of operations affect the containerised export process. These factors make a multimodal transportation system designated for the export complex. Multimodal shipping has many advantages that enable shippers and logistics service providers (LSPs) to reduce costs, improve freight ranking, and expedite delivery and encourage savings.

Multimodal transportation is the transportation of goods by more than one mode and it passes through different nodes. A node is a point where the change of mode or vehicle may happen. Every mode has its distinct attributes over another, e.g., water transport is cheapest and air transport is fastest. Due to multiple modes and multiple nodes, many interfaces are passed during the route like road-rail interface, rail-sea or road-sea interface. At these interfaces, several factors affect the movement of consignment. The factor at one node may be linked with another factor or not. Hence a set of factors may cause the delay in the movement of the container and relationship among them is complex. Several authors had done studies in the supply chain area to find the factors causing delay, affecting performance, or any other attribute. Multimodal transportation is a chain, connecting the points on which the type of goods commodity is not fixed. This research discussed the factors and explored the interaction among factors that cause the delay in the movement of containers for export.

This research was designed for:

1 identification of factor causing delay in movement of container

2 analysis of interrelationship among these factors

3 classification and ranking of factors based on their driving and dependence power by using cross-impact matrix multiplication applied to classification (MICMAC) applied to classification analysis.

This objective will provide a decision-making support to the manager or practitioner in global supply chain and maritime logistics. An understanding relating to interplay between various factor affecting the container movement will be simplified. As a result, the focus of study can be explained by further written research questions (RQ):

RQ1 What factors affect delay in export by multimodal transportation?

RQ2 How do they affect one another and the export on start-ups?

RQ3 Which factors drive others and which factor depends on others?

The research article provides a niche contribution by analysing the factor affecting movement of container. It’s critical to find the reason of delay in container movement and then take corrective action to mitigate their effect. To achieve the above mentioned objectives the total interpretative structure modelling (TISM) has been applied to explore the interrelations hip among factors causing delay in container movement; demonstrated by literature review. TISM is used to integrate and structure the interrelationship among factors causing a particular phenomenon. The TISM is used here to comprehend the relationship among factors causing delay in container movement by multimodal transportation. The MICMAC study provided a graph that categorises factor based on their driving power and dependence power and is also useful for discovering and testing the interpretative structural model drivers to reach the study’s results and conclusions.

The remaining article is drafted with further mentioned structure. Section 2 has surveyed the literature about delays in container movement with multimodal transportation. Section 3 discussed the research methodology and Section 4 provided the findings and discussions. Section 5, gave theoretical and managerial applications, and Section 6 contain the conclusion and limitations and future research directions.

2 Literature review

Containerised multimodal transportation is a multi-actor and multi-stakeholder activity which makes any issue in the entire chain ill-defined due to uncertain relationships (Watson, 1978). The research in container movement had happened around optimisation and network design but discussion on the entire chain are missing and the objective of this research is an effort to put a step ahead in this gap. The next section established the research gap. The scope of this research is limited to movement of container till boarding on vessel i.e., condition met by 'free on board' international commercial term (Inco-Term) therefore literature is considered accordingly. This research aimed to explore factors whose effect can be discussed in terms of operation management.

2.1 Research gap

Comprehensive analysis in literature on multimodal transportation is not rich (Dua and Sinha, 2019a, 2016). Bontekoning et al. (2004) has categorised research on multimodal transportation as emerging and emphasised that multimodal transportation has the potential to act as a linkage between the regions. Due to interfaces between modes, nodes and different actors executing different services, this research field becomes complex. To simplify this complexity the planning systems for multimodal transportation were classified into three planning categories namely strategic, tactical and operational (Steadie Seife et al., 2014). The decision support systems for exploring delay in intermodal transportation system has been mentioned in themes; policy support, terminal network design, intermodal service network design, routing, drayage operations and information and communication technology innovations (Caris et al., 2014). In spite of classification of planning systems and segmentation in decision support systems the decision making regarding challenges in multimodal transportation is ill-defined. Once the container is packed with the goods to be carried, several parties, owned by different organisations, execute its transportation and many regulations control its movement in the source country. Government of every type intends to promote transportation for the social cause (Farmer, 1965), usually disliked by operating managements. Several situations dependent and independent situation originating from several reasons, may affect the container movement. The identified factors which are affecting the delay in container movement are:

- unavailability of transport infrastructure (A)
- unstructured communication among stakeholders (B)
- skill level of persons (C)
- congestion at terminal (ICD or port) (D)

- customs/bureaucratic hurdles (E)
- coordination across parties (F)
- technical faults in ports (G).

The factors effecting the movement of container are summarised in Table 1 along with their references. Further factors are described in detail.

2.2 Factor causing delay in containerised multimodal transportation

After literature review and expert opinion the following seven factors are shortlisted.

2.2.1 Non-availability of transport infrastructure (A)

This factor describes the situation when the delay in movement happened due to the absence of equipment or the container is stationary due to the absence of other support, e.g., stationary container due to crane breakdown. This factor also includes the situation arose due to 'no space at berth' and 'no free space on the feeder' (feeder vessel connects major and minor port and takes cargo from mall ports to the mother vessel because ships of large capacity do not visit to the port where a significant load is not there). Uncertain returns and several externalities are associated with infrastructure and there is high resource requirement for infrastructure for ports (Ministry of Ports, Shipping and Waterways, 2022). This factor has been supported by Hasan et al. (2021) and Yuen and Thai (2017) in their research for multimodal transportation.

2.2.2 Unstructured communication among stakeholders (B)

The role of communication in any supply chain is very crucial and process around this is very important. This factor describes the situation when due to anomaly and confusion in communication the container gets delayed. This may cause the delay due to different operation issues like inappropriate human activity on communication equipment. The communication along the transportation may affect the movement in the chain significantly (Hakam and Solvang, 2012; Kadir, 2017; Yildiz et al., 2016). The pattern of sharing information across sea transportation also affects the movement (Nikghadam et al., 2021). Thai and Jie (2018) in context of container companies have established that process in total quality management practices has impact on supply chain indicators. The issues in multimodal transportation chain happen due to lack of standardisation, delay, asymmetry and unwillingness (Dua and Sinha, 2019b).

2.2.3 Skill level of persons (C)

This factor describes the effect on the movement of container due to the competency of the people involved in processes to execute the task allocated to them. The task may be strategic, tactical and operational. The movement of the container from one mode to another mode or from one place to another will require specialised skills as well as documentation for international movement. Hence lack of expertise may affect the container movement negatively. At interfaces of multimodal transportation, people of skill set are required. This specialised skill set requirement may cause variation in the time required to transport (Yuen and Thai, 2017), e.g., experience gained on the simulator for material handling equipment required in multimodal transportation has a considerable difference in simulator training and real situation in the case of fire truck driving is studied by Brummerová et al. (2021). The same is possible with material handling equipment at terminals.

Table 1 List of factors used in structural modelling

Label used in the model	*Factor*	*Sources*
A	Non-availability of transport infrastructure	Hasan et al. (2021), Yuen and Thai (2017), and Ministry of Port Shipping and Waterways (2022)
B	Unstructured communication among stakeholders	Dua and Sinha (2019b, 2019a), Hakam and Solvang (2012), Kadir (2017), and Yildiz et al. (2016)
C	Skill level of persons	Yuen and Thai (2017), and Brummerová et al. (2021)
D	Congestion at terminal (ICD or port)	Russell et al. (2020)
E	Customs/bureaucratic hurdles	Farmer (1965)
F	Co-ordination across parties	Raghuram and Shah (2004), and Hu et al. (2018)
G	Technical faults in ports	Ministry of Port Shipping and Waterways (2022), and Manaadiar (2018)

2.2.4 Congestion at terminal (ICD or port) (D)

This factor describes the situation when a container is not dispatched on scheduled time due to slow processing of containers at any node in the transportation chain. This is similar to traffic jams in the movement of the container at the port. This may be due to high demand or any other issue which may be the natural or geopolitical reason. For a container port or terminal different interfaces happen because it acts as a merging point from water transport to rail transport or road transport. The interface capacities involved in multimodal transportation are seaside interface capacity, platform capacity, landside interface capacity and system-wide capacity. These interfaces may cause congestion due to limitations on capacity (Russell et al., 2020). Bottleneck or any overload may also cause congestion across the chain.

2.2.5 Customs/bureaucratic hurdles (E)

This factor describes the situation of delay in container movement due to which excessive checking by customs and/or regulating authorities. Mentioned by Farmer (1965), the government of different countries regulates and controls transportation on different modes. Supply chain efficiency gains might also result from the regional or global simplification and harmonisation of border clearance procedures. It's important to note that this issue is not limited to customs; actual data indicates that in many nations, other governmental entities engaged in the clearance process, such as health, quarantine, and standards authorities, are the ones that place the greatest burden on logistics operators. There may be different unwarranted interventions in the movement of containers and can be categorised as bureaucratic hurdles. The port operations are also affected by local government policies (Feng et al., 2021).

2.2.6 Co-ordination across parties (F)

In context of supply chain organisations and stakeholders are dependent upon each other to remain competitive (Ferrer et al., 2010). Stakeholders in multimodal transportation are dependent upon each other. This factor describes the effect in the movement of containers due to the absence of coordination among actors executing multimodal transportation. Containerised movement by different modes of transportation is a multi-actor activity and requires an understanding of rules and regulations on different issues. These rules and regulations may be nationally or internationally recognised. To achieve this coherence and harmony coordination on different issues and different situations is required between different stakeholders. The delay in the movement of container is linked with its interaction with operations in port and operations in the mainland (Raghuram and Shah, 2004; Hu et al., 2018).

Reshuffling of containers on the ship, is the situation when the loading of the container is delayed due to the order of container needs to be rearranged. The reshuffling of containers during loading and unloading also depends upon coordination between stakeholders working near the port. The main contract in the context of multimodal transportation is done by the principal-agent and defined the governing contract also called the multimodal transport document. The compliance on multimodal transportation documents depends on the coordination between stakeholders.

2.2.7 Technical faults in ports (G)

This factor describes situations of delay in the container when equipment around ports are not functioning properly. This may include material handling equipment around the port, vessel issues, or any other issue due to which port might not be functional. This also includes any fault in the vessel when it is near the port. Also vessel is unstable due to various factors near the ports. When unloading and loading of container happens it needs to align with fuel and freshwater tank.

3 Methodology

Complex contextual relationships among factors can be suitably represented by the application of graph theory because learning and analysing through graph interaction makes complex mess structures simple (Warfield, 1976). Interpretative structural modelling (ISM) (ISM) has been extensively used to establish models and find interaction among factors for different issues in the supply chain. Few examples are the interaction between variables of supply chain performance measurement system implementation (Charan et al., 2008); for the interaction of criteria and sub-criteria for selection in built-in -order environment; for modelling barriers of supply chain collaboration (Ramesh et al., 2010); for risk prioritisation (Pfohl et al., 2011).

Watson (1978) mentioned ill-defined problem as one in which the effect of one factor on another is unclear. Delay in containerised multimodal transportation is an ill-defined problem because the effect of one factor on another is unclear and therefore a structure to understand the causes of delay in containerised multimodal transportation is required. Hence this research developed the structural model by using TISM (total interpretative structural modelling). In different contexts the TISM has been used to analyse barriers of supply chain, e.g., barrier analysis for green supply chain implementation and sustainability implementation barriers (Balon et al., 2016; Dube and Gawande, 2016; Kumar et al., 2016); barrier analysis for performance measurement (Charan et al., 2008; Holmberg, 2000). The methodology is also applied for nascent issues like block chain (Etemadi et al., 2021; Yadav and Singh, 2020). Analysis of barriers in multimodal transportation for containerised exports is untouched in academic literature and this work fill the gap and analysed the interaction between factors causing a delay in containerised multimodal transportation. The scope of the factors studied was limited to export by containerised till loading into the vessel. The abstract and mesh structure of multimodal container transportation makes it a multi-stakeholder activity and requires discussion in opinion mode. Hence TISM is used in this research to establish the structural relationship. On guidelines from Watson (1978) this research started with two parallel steps which were literature review and discussion with practitioners. The discussion and literature finalised the seven factors mentioned in Table 4, on which the structural model is developed.

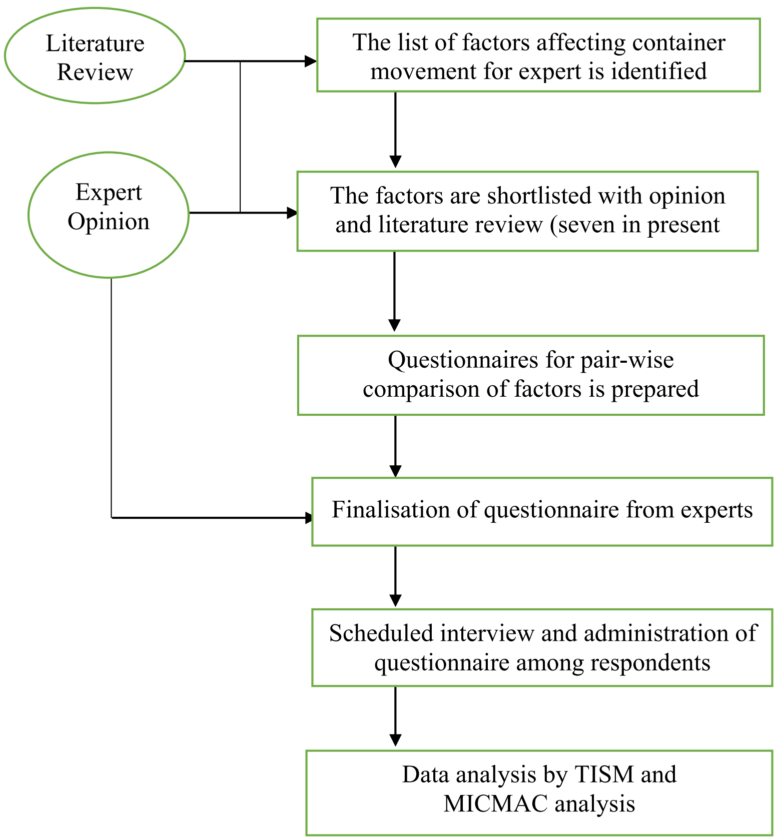
Table 2 Details of respondents in the survey

Sl. no	*Type of organisation*	*Number of respondents*	*Average years of experience*
1	Manufacturer	7	6
2	Transporter(third party and fourth party LSPs)	4	4
3	Inland container depot	4	4
4	Shipping line	4	4
5	Multimodal transport operator	4	5
6	Principal agent	5	8
7	Inspecting agency	2	20

Scheduled interviews with a closed ended questionnaire were made which included pair-wise comparisons. The questionnaire was administered on a five point Likert scale. In scale ‘1’ indicated no effect and ‘5’ indicated the ‘very high influence/effect’, for example,’ between factor ‘A’ and Factor ‘B’. If influencing each other than rate the influence from ‘2’ to ‘5’ of not, then rate as ‘1’. The respondents for this questionnaire were selected from different nodes and modes in the multimodal transportation chain. Each respondent was first contacted from phone for explain the context of questionnaire and relevance of objective and then the questionnaire was sent to him on mail. To avoid the late response and unconcerned bias the responses were collected in one week from contact from phone. Table 2, contained the information about respondents. Figure 1, illustrated the flow of methodology for this article.

The TISM approach has been utilised here to meet objectives outlined in Section 1. Figure 2 illustrated the steps executed to conduct the analysis by TISM approach in this work. It starts with finalisation of factor affecting the issue under consideration and there after an initial reachability matrix (IRM) is established by collecting the response from experts and converting them to binary. This IRM is given in Appendix 1. After this the relationship between factors is interpreted with analysis of context and understanding of how relationship between the factors. This is followed by 'transitivity checks' (an enquiry about indirect relationship among factors) and if a transitive relationship exists then '0' is replaced by '1'. The FRM (final reach ability matrix) is then partitioned into levels shown in Appendix 2. The level partition for the factors finalised was done and five levels emerged from the level partition exercise. Level 1 was taken by factor A; level 2 was taken by factor B, F, and G; level 3 was taken by factor E; level 4 was taken by D and level 5 was taken by factor C. As per levels achieved, the factors are placed in diagraph. Diagraph is obtained when factors in form of nodes are interconnected with each other. The diagraph is shown in Figure 3.

Figure 1 Flow of methodology for the research (see online version for colours)



The level partitioning phase tells the hierarchy of factors and there after the diagraph is developed which is shown in Figure 3, after level portioning the conical matrix was developed shown in Appendix 3. These factors at the same level are clubbed together and arranged according to their levels obtained in the level partition exercise. The inputs are taken from FRM and level partitions are used for the development of the diagraph. The diagraph developed in this research is shown in Figure 3.

Figure 2 Methodology steps for TISM (see online version for colours)

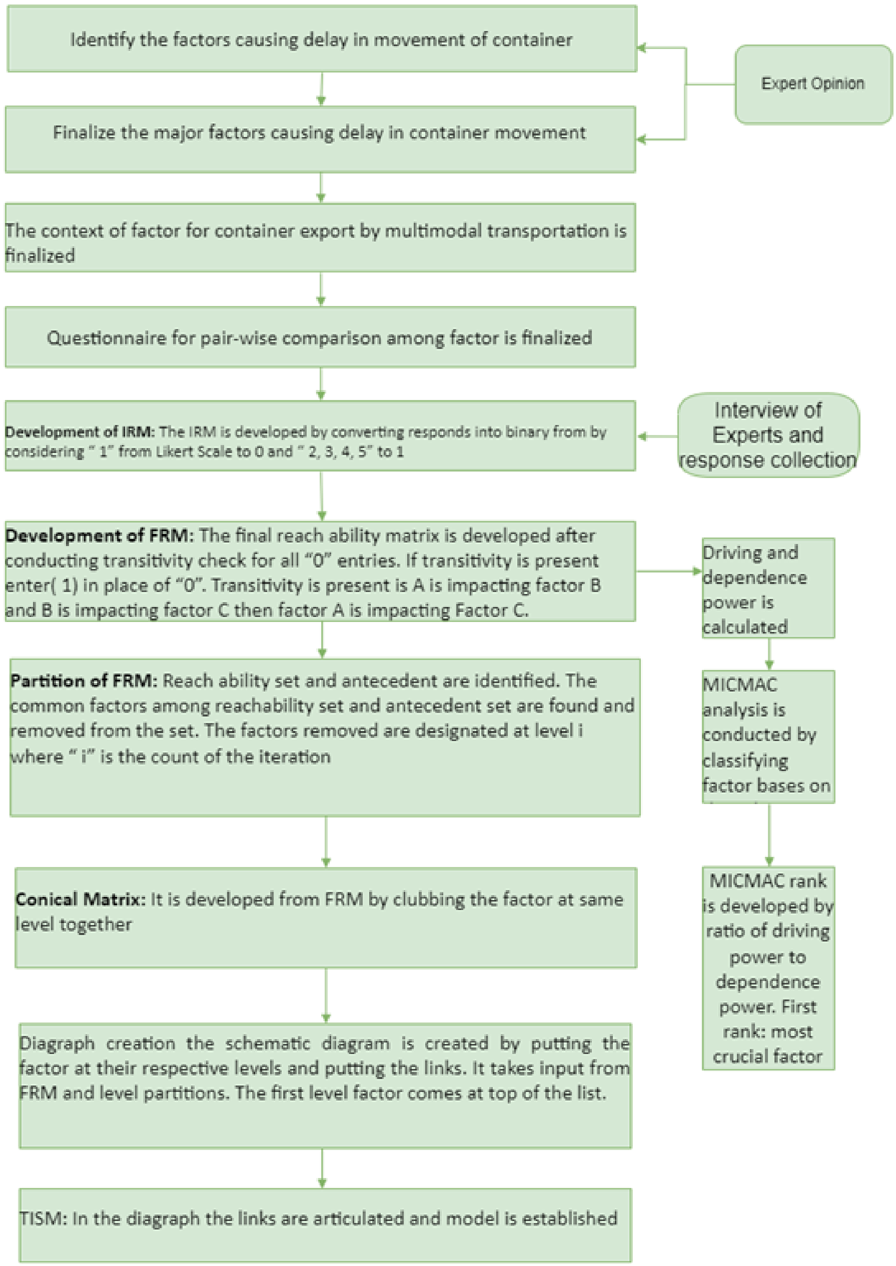
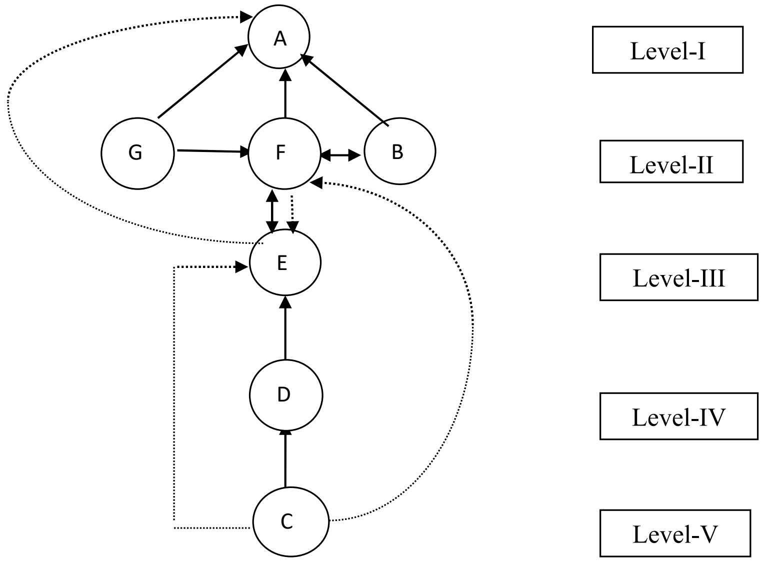


Figure 3 Diagraph developed from conical matrix



4 Findings and discussions

4.1 Interpretation of model developed

The diagraph shown in Figure 3 is illustration of model obtained from TISM exercise. In this diagraph five levels emerged have emerged which are associated with each other by transitive links and links.

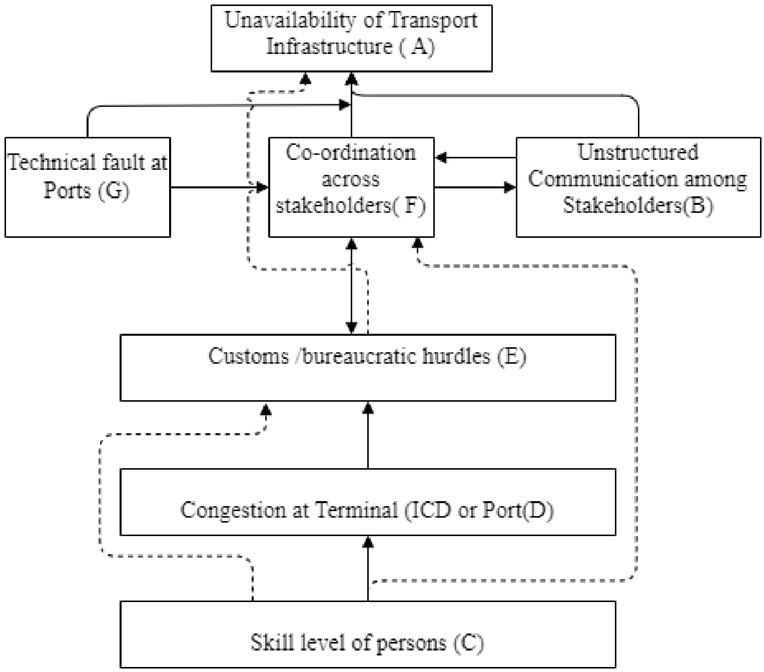
4.1.1 Level 5

The level has one factor i.e., C (skill level of persons doing the activity involved in containerised export). C has direct effect on the D and has a transitive link with E and F. It implies that custom hurdles can be managed effectively if skill levels of person are excellent and skill of persons executing the task will affect the coordination among stakeholder.

4.1.2 Level 4

At level 4, factor D i.e., congestion at terminal or port appeared and effected by skills of people involved and is instrumental in bureaucratic hurdles experienced. This implies the congestion at terminal effect the custom hurdles and gets effected by skill level of persons executing them. It indicates that if pendency of containers in multimodal transportation may increase the appearance of bureaucratic hurdles.

Figure 4 Structural model for factors causing delay in containerised exports



4.1.3 Level 3

Factor E (custom/bureaucratic hurdles) appeared at level 3 and effect the coordination across parties and due to transitive link it affects the unavailability of transportation infrastructure. The bureaucratic hurdle may affect the coordination among stakeholders and coordination among stakeholders affects each other. Bureaucratic hurdles may lead to unavailability of transport infrastructure. It is so because many transportation infrastructures are governed by government regulations and lacking in custom compliances may appear as unavailability of transport infrastructure.

4.1.4 Level 2

Factor B (unstructured communication among stakeholders), F (co-ordination across parties) and G (technical faults in ports) appeared at level II. Unstructured communication among stakeholders and Co-ordination across parties affects each other and these two effect unavailability of Transport Infrastructure. Technical fault at port will definitely cause disturbance in coordination and breakdown will lead to unavailability of transport infrastructure.

Table 3 Synthesis of relationship emerged in TISM

Level	*Relationship*	*Interpretation*
5	C-D	Skill level of persons involved in process of containerised export will affect the congestion at inland container deport or sea port.
	C-E	Skill level of person involved in process of containerised export will affect the experience of bureaucratic or regulatory hurdles experienced by transported or/and exporter.
	C-F	Skill level of person involved in process of containerised export effects the coordination across stakeholders also
4	D-E	Congestion at inland container depot effect the bureaucratic hurdles
3	E-F	Customer or bureaucratic hurdles faced by stakeholders in export by containerised multimodal transportation effect the coordination across stakeholders.
	E-A	Customer or bureaucratic hurdles faced by stakeholders in export by containerised multimodal transportation effect unavailability of transport infrastructure
2	G-F	Technical faults happened at/or near port effect the unavailability of transport infrastructure
	G-A	Technical faults happened at/or near port effect the coordination among stakeholders
	F-A	Coordination among stakeholders effects the unavailability of transport infrastructure for containerised export by multimodal transportation.
	F-B	Coordination among stakeholders effects the unstructured communication among stakeholders of containerised export by multimodal transportation
	F-E	Coordination among stakeholders effects the custom or bureaucratic hurdles experienced in containerised export by multimodal transportation
	B-F	Unstructured communication among stakeholders of containerised export by multimodal transportation effects the coordination among stakeholders. In fact the both effect each other.
	B-A	Unstructured communication among stakeholders of containerised export effects the unavailability of transport infrastructure for containerised export by multimodal transportation.
1	A	Unavailability of transport infrastructure for containerised export by multimodal transportation gets effected by remaining factors.

4.1.5 Level 1

At this level factor A (unavailability of transport infrastructure) appeared. This gets affected by B (unstructured communication among stakeholders), F (coordination across parties) and G (technical faults in ports). Factor A gets also gets effected by factor bureaucratic hurdles.

4.2 MICMAC analysis

It is obtained by plotting them on the graph with driving power and dependence power on horizontal and vertical axis respectively. Based on the positions of factors in the quadrant they are classified as – driving factors, linkages factors, dependent factors, and autonomous factors and shown in table update table number. From the four-quadrant graph and placements of factors in quadrants following classification is developed, guided by Watson (1978). Table ranks the factors affecting the movement of containerised export by multimodal transportation by ratio of driving power and dependence power. With this ratio total five ranks appeared and the factor C is ranked first and factor A appeared at rank fifth.

Figure 5 MICMAC graph of factors used in structural model

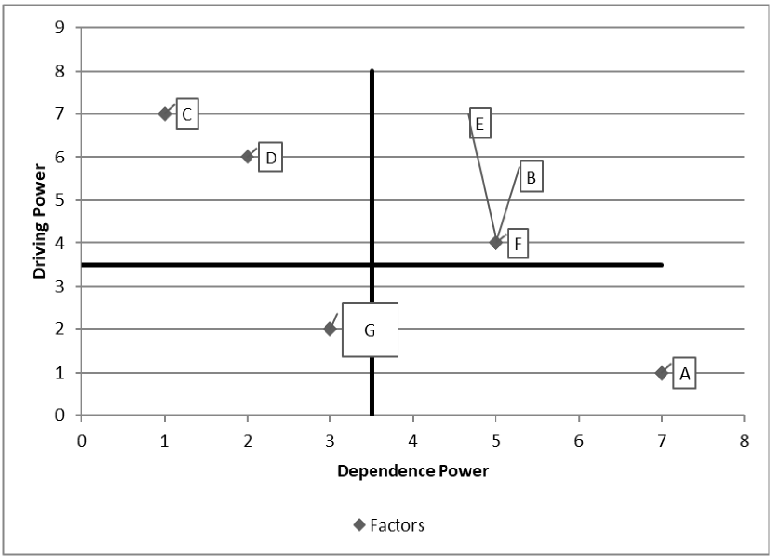


Table 4 Classification of factors based on driving and dependence power

S. no	*Type of factor*	*Driving power*	*Dependence power*	*Factor*
1	Independent factor	High	Low	C, D
2	Linkage factor	High	High	B, E, F
3	Autonomous factor	Low	Low	G
4	Dependent factor	Low	High	A

Table 5 Rank of the factors in TISM

Factor	*Driving power*	*Dependence power*	*(Driving power)/ (dependence power*	*MICMAC rank*
A	1	7	0.14	5
B	4	5	0.80	3
C	7	1	7.00	1
D	6	2	3.00	2
E	4	5	0.80	3
F	4	5	0.80	3
G	2	3	0.67	4

From the chart shown in Figure 3, it is evident that factors B, E, F i.e., Unstructured communication, bureaucratic hurdles and coordination are linkages factors and appear at level 2 and level 3. Factor G, which is Technical malfunctioning at ports is also at level 2 but in MICMAC analysis appeared as an autonomous factor. It is so because the choice of line is subjective (Watson, 1978) and here considered at half of the maximum driving power i.e., at 3.5 from the model, it is evident that the skill level of the workforce involved in the independent factor it may lead to congestion at the terminal. The centrally located factors in the model are – technical fault at ports, coordination among stakeholders, unstructured communication and bureaucratic hurdle. The combined effect of these, lead to the unavailability of transportation infrastructure.

5 Theoretical and managerial implications

5.1 Theoretical implications

This work identified the refined list of factor causing barriers in container movement and developed a model between them. This model provides the relation between them and tells the sequence of effect on one another. This interaction among barriers can provide the basis of hypothesis development for empirical testing for multimodal transportation. The factors identified here can be utilised as a starting point for detailed and product-wise exploration for cause of delay in multimodal transportation. The interrelationship and ranking of factors developed in this research is critical according to several literatures. The understanding of factors is improved with classification based on driving and dependence power shown in Figure 3 and this classification can be used further to forecast the bottleneck caused by any barrier. This type of model can help to develop machine learning based model to predict the possible issues in future course of research aligned with Industry 4.0. The similar combination has been exemplified by Liu et al. (2023) for risk evaluation of oil tankers and berth allocations. This work has provided the structure of factors causing the delay in containerised exports and this is first attempt to develop a structure of this kind for exports originating from India and research in multimodal transportation is still nascent (Dua and Sinha, 2019a; Steadie Seife et al., 2014).

5.2 Managerial implications

Recent crisis of containers (Edwin, 2021) and increase demand of container enhanced the importance of hassle-free container movement further for policy makers. Due to complex and multi-actor nature of multimodal container chain, the analysis of causes for barriers is difficult and this work provides a picture which makes it easy to visualise and initiate policy level actions.

6 Conclusions

Containerised multimodal transportation is crucial for any country as it holds relevance for import as well as export. The export perspective is more crucial for developing countries as it improves the economic position of a country in global trade. The hassle-free export chain is required for the development of the industry as well as a country. It brings improvement in any country on different parameters required by the World Bank. This study has explored and developed the interrelationship among factor causing delay in containerised multimodal transportation. The structural model provides the interaction among factors in terms of dependence. This study helps in improving the movement of containers in the area considered. Classification of factors as dependent factors, linkage factors and independent factors provides further insights into the nature of factors. This classification of factors affecting delay in containerised transportation, provided the relative importance of the factor in terms of dependence on each other.

This study has few shortcomings also as it does not comprehensively cover the other form of cargo. This study only focuses on export situation while trade consist of export as well as import. The TISM methodology is a strategy for developing theories and their interconnections. TISM provides the initial structure to proceed and understand the matrix but exploratory factor analysis and structural equation modelling are promising extensions for methodology as it tests the relationship statistically.

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Appendix 1

Table A1 Initial reachability matrix

	A	*B*	*C*	*D*	*E*	*F*	*G*
Non-availability of transport infrastructure (A)	1	0	0	0	0	0	0
Unstructured communication among stakeholders (B)	1	1	0	0	1	1	0
Skill level of persons (C)	1	1	1	1	0	0	1
Congestion at terminal (ICD or Port) (D)	1	1	0	1	1	1	1
Customs/bureaucratic hurdles (E)	0	1	0	0	1	1	0
Coordination across stakeholders (F)	1	1	0	0	0	1	0
Technical fault at Ports (G)	1	0	0	0	0	0	1

Appendix 2

Table A2 Final reachability matrix

	A	*B*	*C*	*D*	*E*	*F*	*G*
Non-availability of transport infrastructure (A)	1	0	0	0	0	0	0
Unstructured communication among stakeholders (B)	1	1	0	0	1	1	0
Skill level of persons (C)	1	1	1	1	(1)	(1)	1
Congestion at terminal (ICD or Port) (D)	1	1	0	1	1	1	1
Customs/bureaucratic hurdles (E)	(1)	1	0	0	1	1	0
Co-ordination across stakeholders (F)	1	1	0	0	(1)	1	0
Technical fault at Ports (G)	1	0	0	0	0	0	1

Appendix 3

Table A3 Conical matrix

		A	*B*	*F*	*G*	*E*	*D*	*C*
Level 1	A	1	0	0	0	0	0	0
Level 2	B	1	1	1	0	1	0	0
Level 2	F	1	1	1	0	1	0	0
Level 2	G	1	0	0	1	0	0	0
Level 3	E	1	1	1	0	1	0	0
Level 4	D	1	1	1	1	1	1	0
Level 5	C	1	1	1	1	1	1	1