2023

Stakeholder perception of financial incentive in truck appointment systems at Chittagong Port

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STAKEHOLDER PERCEPTION OF FINANCIAL INCENTIVE IN TRUCK APPOINTMENT SYSTEMS AT CHITTAGONG PORT

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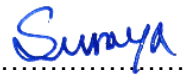
A dissertation submitted to the World Maritime University in partial fulfillment of the requirements for the award of the degree of Master of Science in Maritime Affairs

2023

Declaration

I certify that all the material in this dissertation that is not my own work has been identified and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

(Signature) : 
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Acknowledgments

"And if you should count the favors of Allah, you could not enumerate them. Indeed, Allah is Forgiving and Merciful." (Quran 14:34)

My all praise to the Almighty for giving me the strength to complete this dissertation successfully. Nothing is easy except what He made easy. If He wants, He can make difficult things easy.

I am deeply indebted to the Sasakawa Peace Foundation, specifically Dr. Yohei Sasakawa, for providing me with the precious opportunity to attend an MSc course in a stunning Nordic country. Their financial support made my dream a reality, and for that, I am truly thankful. I would also like to extend my heartfelt thanks to WMU for giving me this priceless opportunity to explore my research skills.

First and foremost, I want to convey my profound appreciation to my esteemed Supervisor, Dr. Daniel Seong-Hyeok Moon, Professor, Head of Port Management, and Director of the Ph.D. program at WMU. Professor Moon graciously welcomed me under his guidance and has been instrumental in overseeing and advising my academic journey. I am genuinely thankful for the opportunities he has opened for me, as well as his unwavering availability, patience, invaluable counsel, and expertise throughout the process of composing my dissertation.

I also wish to express my heartfelt gratitude to my esteemed Co-supervisor, Dr. Gang Chen, an Associate Professor at WMU. This dissertation owes its shape and substance to the countless hours of discussions and unwavering dedication from Dr. Chen. His contributions and guidance have significantly enriched and laid the foundation for this dissertation. Without a doubt, his support, assistance, and professional insights will continue to be invaluable assets for my future research endeavors. I extend my deepest thanks, and my gratitude knows no bounds.

I would like to express my appreciation to the Chittagong Port Authority (CPA) for generously granting me a 14-month paid study leave. My sincere thanks also go out to my seniors and colleagues at Chittagong Port, who provided valuable assistance during the survey process for this dissertation.

I extend my gratitude to all the esteemed stakeholders of Chittagong Port who took the time to respond to the survey questionnaire. Your active participation played a pivotal role in the successful completion of this dissertation. Additionally, I wish to convey my thanks to all the interviewees who dedicated their precious time and shared pertinent information. Without your cooperation, the achievements of this dissertation would not have been possible.

Finally, I want to extend my deepest appreciation to my family, especially my husband, Mohammad Shah Jaman, for his unwavering moral support and encouragement that has been the cornerstone of my entire academic journey at WMU. His steadfast encouragement has been my source of strength.

Abstract

Title of Dissertation: **Stakeholder Perception of Financial Incentive in Truck Appointment Systems at Chittagong Port**

Degree: **Master of Science**

This dissertation investigates Chittagong Port Authority (CPA) stakeholder perceptions of financial incentives in Truck Appointment Systems (TAS), aiming to address the escalating congestion and operational challenges posed by peak-time truck arrival frequency. The objectives of this research are as follows: (i) To identify the factors that influence trucking companies to arrive at the CPA gate during peak hours. (ii) To evaluate stakeholder perceptions of the effectiveness of financial incentives in the TAS to reduce peak-time truck arrival frequency at Chittagong Port. (iii) To identify the key factors influencing stakeholder acceptance or resistance towards financial incentives in the TAS.

By employing a mixed-methods approach combining surveys and interviews, the study identifies the factors influencing stakeholder decisions for peak-time arrivals, evaluates their perceptions regarding the effectiveness of financial incentives in TAS, and determines the key drivers of acceptance or resistance.

Findings reveal that stakeholders' arrival decisions are shaped by factors such as cargo readiness at the port, customs procedures, customer preferences, availability of port operational facilities, and cost-saving considerations. A majority (64%) expressed a positive view of financial incentives, particularly emphasizing operational benefits and increased trip feasibility. Company size significantly impacts acceptance and resistance levels, with micro-sized and small-sized companies expressing varying degrees of cynicism and resistance, while medium-sized companies show the highest acceptance levels, underscoring the need for tailored incentive programs that address varying stakeholder needs and concerns.

KEYWORDS: Peak-time Congestions, Financial Incentive, Truck Appointment System, Stakeholder Perception

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List of Abbreviations

C&F Agent	:	Customs Clearing & Forwarding Agent
CAGR	:	Compound Annual Growth Rate
CPA	:	Chittagong Port Authority
FY	:	Fiscal Year
I-15	:	San Diego's Interstate 15 Congestion Pricing Project
PCS	:	Port Community System
TAS	:	Truck Appointment Systems
TEU	:	Twenty feet Equivalent Unit
TOS	:	Terminal Operating System
VPPP	:	Value Pricing Pilot Program

Chapter 1

Introduction

1.1. Background of the study:

The maritime industry is a vital backbone of the global trade and economy. World GDP and seaborne trade are directly proportionate. According to UNCTAD (2021), more than 80% of global trade is transported by sea. It is well-known that containerization is a revolutionary innovation in the maritime industry. This innovation facilitated the growth of seaborne trade by simplifying the logistics and offering significant advantages in terms of speed, security, and cost-effectiveness.

However, the rising growth in seaborne container traffic volume is resulting in a set of challenges for seaports. Firstly, handling a larger volume of containers requires seaports to expand their infrastructure and capacity to accommodate the increased demand. Secondly, the increase in container traffic can hinder the efficiency of port operations and can lead to congestion and delays. Ports that are able to efficiently absorb changes in marine trade while also responding to changes in the hinterland will be the most competitive in the future. On the other hand, Poor integration with the port and hinterland can significantly slow down the cargo flow, and the port loses its attractiveness (ITF, 2018).

Traditionally, port gate operation involves an entry clerk identifying the import/export cargo and feeding data to the terminal's management system through radio or a similar hand device. This manual gate system is time-consuming and prone to human mistakes, although it may be economical in regions with low labor costs (Bichou, 2009).

Many ports all over the world are introducing Truck Appointment Systems (TAS), as it is playing a significant role in increasing port-gate operation efficiency. Truck drivers are

given time slots by TAS to deliver and pick up containers, and truck companies are required to pre-register to book available time slots. Therefore, trucks may anticipate assured entry to the port and a quick clearing procedure if they submit all necessary paperwork in advance and arrive within the designated timeframe (Heiling et al., 2020; ITF, 2018). Some ports charge a fee for day-shift or peak-hour booking, and night-shift bookings are free (Heiling et al., 2020; Huynh et al., 2016).

TAS worldwide has already recognized an effective system to maximize terminal management efficiency, but it is very important to address the user perspectives. The majority of the literature was concerned with the technical effectiveness and efficiency of using port resources. Ports could claim they are competitive because they are efficient, but customers might see things differently (Mary R. Brooks Transportation Consulting, 2015). Managers are able to grasp existing problems better and finally resolve them by measuring user viewpoints (Notteboom et al., 2022). Furthermore, in order to enhance the acceptability of TAS to port stakeholders, the integration of financial incentives alongside TAS could prove to be a viable and efficient strategy.
This study aims to examine the stakeholder perception of financial incentives in truck appointment systems for reducing peak-time truck arrival frequency; Chittagong Port has been taken as a case study.

1.2. Problem Statement:

Chittagong Port, located in the southeastern region of Bangladesh, plays an important role in the national economy by handling around 90% of the country's import-export trade volume. It is the largest seaport in Bangladesh and serves as a major gateway for international maritime trade and traffic. The strategic location of Chittagong port along the Bay of Bengal makes this port well-connected to various global shipping routes and allows for easy access to major international markets in Asia, Europe, and the Americas. Chittagong Port entered the 100 container port list with 98th position in 2009; after 12 years, in 2021, Chittagong Port Authority (CPA) handled around 3 million TEUs (Twenty

feet Equivalent Units) export-import containers (Chittagong Port Authority, 2023) and ranked as 64th busiest port by throughput in Lloyds list with 13.2% positive annual change (Lloyd's list, 2022).

This doubling of handling volume within one decade is, at the same time, good and bad news. The good news is that it indicates a booming economy and greater trade activity, facilitating the economic development of Bangladesh. It also indicates that CPA has gained increased cargo handling process efficiency over time and is generating potential higher revenue. The bad news is that continuously increasing container traffic volume at CPA puts some constraints on terminal operations, e.g., lengthy truck lines frequently forming at the entrance of the port, causing interference that hinders port operations. CPA does not have any parking area for trucks, so, in the daytime, the trucks that are waiting to receive import containers loiter or stand inside the terminal or outside of the city road, which hampers the equipment movement and port operation and creates congestion in city roads.

The CPA, however, does not currently have a TAS program. Nevertheless, CPA is aiming to introduce the Terminal Operating System (TOS), and through its Port Community System (PCS), port users and trucking companies may pre-register for their port entrance (Chittagong Port Authority, n.d.). However, this pre-registration does not provide trucking companies with a definite arrival time. Trucking companies may not be aware of the precise time they need to be at the port in the absence of a pre-registration definite arrival time. Trucks thus arrive at the port entrance whenever it is convenient for them, which causes a significant amount of congestion throughout the daytime due to the high frequency of truck arrivals. The congestion caused by the truck lines can lead to delays in cargo movement, increased waiting times, and reduced efficiency in the overall port operations. This congestion can have negative consequences for supply chains, potentially impacting delivery schedules, incurring additional costs, increasing costs of doing business, and affecting the competitiveness of the port.

Now the question arises to mitigate this issue; only TAS will be an effective solution? Giuliano & O'Brien (2007) found in their study that port users show a negative perception

of TAS and define it as an ineffective system. A combination of financial incentives program and TAS can be a balancing trade-off for trucking companies and terminal operators. Fu and Jenelius (2018) found in their study, in Stockholm, that the pilot financial incentive program had an impact on spreading the peak period traffic.

Nevertheless, the question arises again will the port stakeholder perceive the financial incentive in TAS positively? According to Notteboom et al. (2022), stakeholder perception in any port initiative is very crucial. It is becoming more important for fixing any operational and governance issues. Ports can better address criticisms from customers when they have a firm grasp on how their services stack up against their customers' expectations.

1.3. Significance of the study:

This study's findings will contribute to addressing the challenges faced by CPA due to high truck arrival frequency at peak hours. This research intends to provide useful insights by examining the variables influencing trucking companies' arrival patterns, assessing stakeholder perceptions of financial incentives in TAS, and finding significant variables impacting stakeholder acceptance or opposition.

In order to improve truck scheduling and reduce congestion, it is important to have a deeper understanding of the factors that are driving trucking companies to come during peak hours. This research will give information on the effectiveness and fairness of financial incentives in the TAS in reducing peak-time truck arrival frequency by analyzing stakeholder opinions of such incentives. With this information in hand, policymakers and port authorities will be better able to introduce financial incentives as part of the TAS with confidence.

In addition, examining the critical elements affecting stakeholders' acceptance or opposition to financial incentives will provide light on the organizational, social, and economic aspects that influence stakeholders' opinions. This knowledge may direct the creation and execution of financial incentive programs that are more suited to the requirements and preferences of stakeholders. The research results may be used to

guide policy recommendations and concrete actions to boost Chittagong Port's productivity. The port's dependability, cost savings, and competitiveness will all increase if congestion, delays, and waiting times are reduced.

Moreover, the study's findings may inform the larger area of port and maritime logistics research by offering empirical data and stakeholder viewpoints on the efficiency of financial incentives in TAS to reduce the frequency of truck arrivals during peak times.

1.4. Aims and Objectives:

The primary aim of this study is to examine CPA stakeholder perception of financial incentives in truck appointment systems for reducing peak-time truck arrival frequency. The objectives of this research are as follows:

1. To identify the factors that influence trucking companies to arrive at the CPA gate during peak hours
2. To evaluate stakeholder perceptions of the effectiveness of financial incentives in the TAS to reduce peak-time truck arrival frequency at Chittagong Port
3. To identify the key factors influencing stakeholder acceptance or resistance towards financial incentives in the TAS

1.5. Research Questions:

In accordance with the aims and objectives of the research, the following research questions will be addressed.

1. What factors influence trucking companies to arrive at the CPA gate during peak hours?
2. How do different stakeholder groups perceive the effectiveness of financial incentives in the TAS to reduce peak-time truck arrival frequency at Chittagong Port?
3. What are the key factors that influence stakeholder acceptance or resistance towards financial incentives in TAS?

1.6. Scope of the study:

The primary aim of this study is to examine Chittagong port stakeholders, e.g., trucking companies and customs clearing and forwarding (C&F) agents' [1]perception and response to financial incentives in truck appointment systems for reducing peak-time truck arrival frequency. Also, what is the Port Authority's opinion on this issue has been evaluated in this study.

If CPA introduces TAS to smoothen the peak time truck arrival, whether financial incentives help to motivate the stakeholders to accept the TAS is the main concentration for this study. Various studies show that financial incentives in the transport sector effectively work to reduce peak-hour congestion, but stakeholders' perception towards this type of program was not always positive or negative; rather, they were divided. This study also found various perceptions and responses from different stakeholders.

However, this study has included only trucking companies, C&F agents, and CPA higher management official. This study has concentrated only on import-oriented container-related trucks, exports-related trucks, and bulk cargo-related trucks' arrival has been excluded from this study. This study did not focus on the operational implementation of TAS. It concentrated only on the stakeholder's perception evaluation of financial incentives in TAS. The study area for this research was in Chittagong Port, Bangladesh.

[1] C&F agents, authorized by the Commissioner for Customs & Excise Department, are responsible for processing documentation and ensuring the efficient clearance of goods from customs control, acting on behalf of importers and exporters (Tanzania Revenue Authority, n.d)

1.7. Research Methodology:

1.7.1. Research Design:

The research design of this study is a mixed-methods combination of quantitative and qualitative approaches. This mixed-method approach has given this study a comprehensive understanding of the research problem.

1.7.2. Data Collection:

Quantitative Data: A structured survey questionnaire was developed to collect data from two different stakeholder groups of CPA, such as trucking company owners and C&F agents. The survey has included questions related to factors influencing truck arrival patterns and respondents' perceptions of financial incentives in TAS.

Qualitative Data: Semi-structured interviews were conducted with the key stakeholders of CPA, including respondents from top management of CPA, representatives from C&F agents, and trucking company owners. Open-ended questions were asked to explore respondents' experiences, perceptions, and opinions regarding financial incentives in TAS to reduce truck arrival frequency at peak times.

1.7.3. Sampling:

A snowball sampling approach was used to select participants from two categories of stakeholders. From each category, 30 responses were targeted for the quantitative data collection. For qualitative data, one participant was selected from two stakeholder groups and one from CPA.

1.7.4. Data Analysis:

Quantitative data analysis:

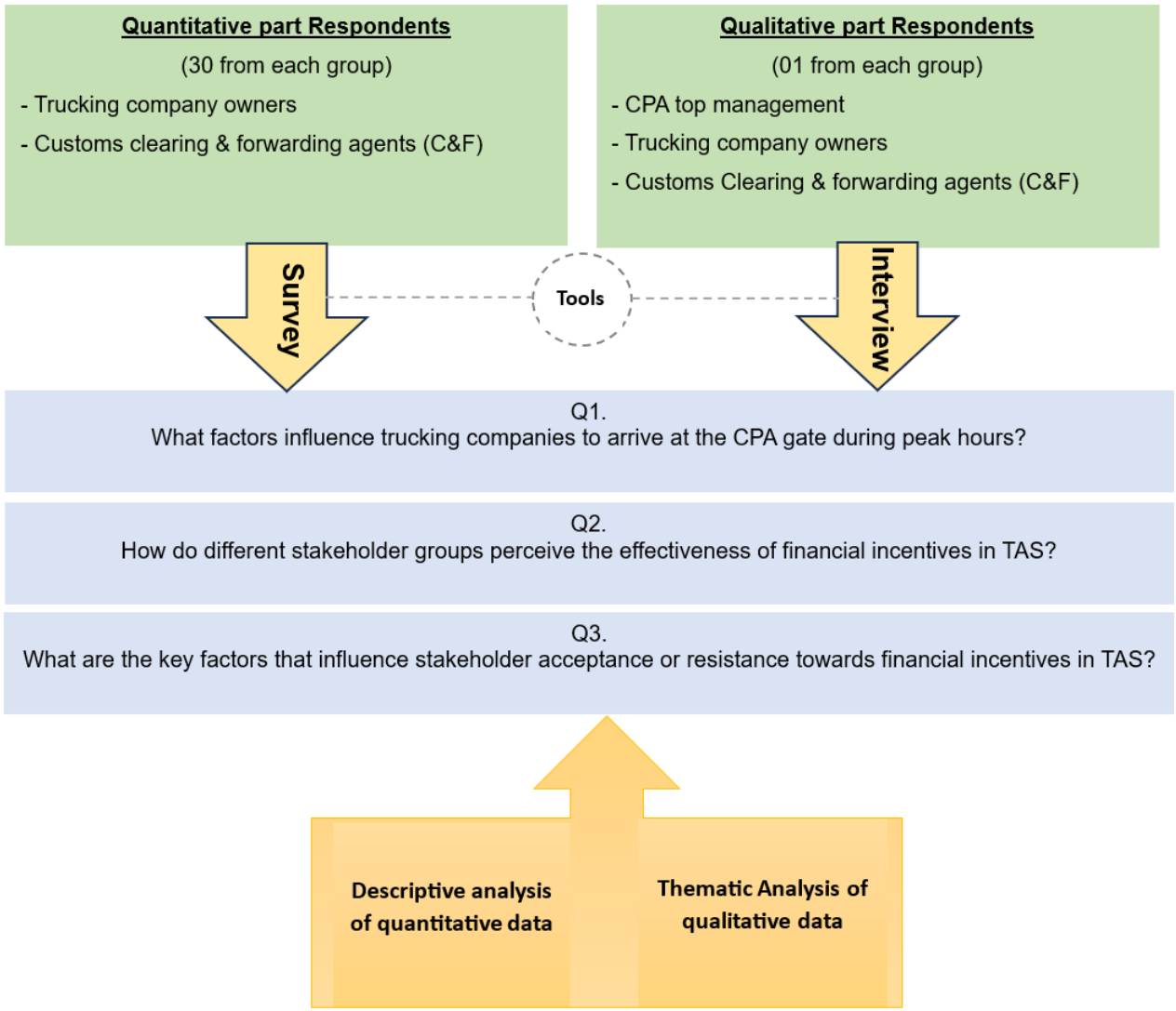
Descriptive statistical analysis was used to summarize respondents' perceptions of financial incentives in TAS and identify factors influencing truck arrival patterns at CPA.

Qualitative data analysis:

Interview transcripts were analyzed in a thematic analysis to identify patterns and insights related to stakeholder perceptions of financial incentives in TAS and factors influencing truck arrival patterns in CPA. Figure 1 presents a brief overview of the research methodology for this study.

Figure 1

Research Methodology Design

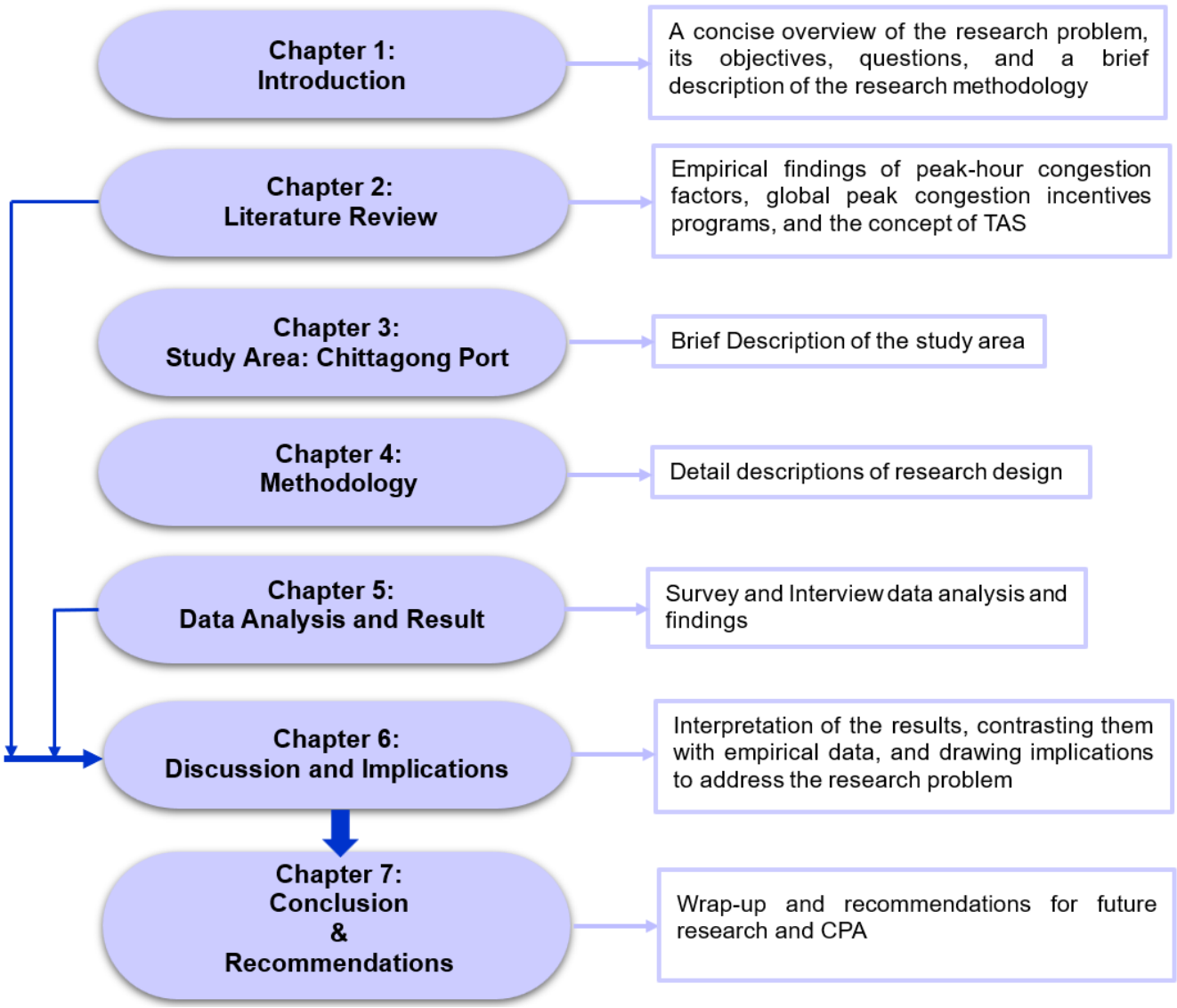


1.8. Structure of the study:

The study's structure comprises 7 chapters, as indicated in Figure 2 below.

Figure 2

Structure of the study



Chapter 2

Literature Review

2.1. Peak-hour congestion factors in port:

Peak-hour congestion is a crucial challenge for both ports and logistics chains, even in port area city traffic. Truck arrival demonstrates a pattern of peaks, one in the morning and one in the early afternoon (Chen et al., 2013). According to Ramírez-Nafarrate et al. (2016), about 51% of trucks arrive at the port during peak hours, which leads to congestion. This congestion then causes longer truck waiting times, higher air pollution, lower terminal operation efficiency, and increased operating and business costs (Abdelmagid et al., 2022; Chen & Jiang, 2016; Chen & Yang, 2010; Shiri & Huynh, 2016).

Researchers in this field have mentioned the main reasons for peak-hour congestion as the continuous growth of container volume, the introduction of mega-ships, and the number of containers they carry (Chen & Jiang, 2016; Chen, et al., 2011; Guan & Liu, 2009; Huynh et al., 2016; Im et al., 2020; Lange et al., 2017; Motono et al., 2016).

The most significant factor cited by academics as a leading cause of peak-time congestion at ports is the improper management of truck arrivals. This issue arises due to a lack of coordination, poor communication, and the absence of real-time information exchange among multiple parties involved in the port operations. Schulte et al. (2017) point out that peak-time congestion at ports is primarily caused by a lack of coordination among truckers. According to Nadi et al. (2022), Peak time congestion at ports often occurs due to a lack of port hinterland alignment. This refers to the nonparallel arrival timings between trucks and the cargo they have to pick up or deliver, as well as issues related to the port's connectivity to its hinterland or the area it serves. In their research,

Namboothiri & Erera (2008) found that the majority of US seaports permit unscheduled truck entry, which causes chaotic truck congestion.

Azab, et al. (2017) also stated the same; according to them, peak time congestion at ports often results from the lack of coordination in the scheduling of truck arrivals. When terminal operators do not know the arrival times of trucks in planning and scheduling operations, these trucks may arrive during peak, congested times. This leads to long queues at the terminal gates and yards. Moreover, if trucks arrive based on their external operations schedule without considering the terminal's capacity, this can exacerbate the congestion.

Azab & Eltawil (2016) also emphasize the importance of coordination and time allocation for truck arrival. They mention that if too many trucks arrive all at once, it can quickly overwhelm the port's capacity, leading to congestion. According to Shiri & Huynh (2016), if there is no proper system to schedule and manage arrivals, many trucks may end up arriving at the same time, creating congestion. Ioannou et al. (2006) claim that unplanned truck arrivals during peak hours are caused by poor information sharing and communication among multiple stakeholders, including trucking companies, terminal operators, shippers, consignees, and other relevant parties.

Terminal Operators have little control and typically do not impose constraints on truck arrival times (Chen & Jiang, 2016; Namboothiri & Erera, 2008); as a result, trucks arrive to the terminal at their earliest convenience without providing any previous notification to the terminal operator of their arrival. (Huynh, 2009). Because they want to optimize their schedule based on their opening hours (Davies & Davies, 2009), and they send their trucks to the terminal at the same time slots during peak hours, which leads to significant congestion at peak hour in the terminal gate (Abdelmagid et al., 2022; Phan & Kim, 2015).

On the other hand, terminal gate capacity is a very crucial factor in improving terminal efficiency. Guan & Liu (2009) point out that congestion at the ports arises due to limited gate capacity that cannot keep up with the demand. Bichou (2009) stated that if quay productivity and yard productivity yield high performance, but gate productivity yields low performance, it will ultimately affect the whole terminal operation. Inadequate infrastructure, terminal resources, such as yard cranes, storage capacity, and the workforce to handle increased traffic also disrupt the terminal operation flow, resulting in peak-hour congestion (Li et al., 2021; Ramírez-Nafarrate et al., 2016; Torkjazi et al., 2018).

Im et al. (2020) and Li et al. (2021) mentioned in their study that outdated port technology is also a potential factor for peak hour congestion. Besides that, equipment failure, IT system problems, and sometimes seasonality can also create peak-hour congestion.

Moreover, improper documentation is also a factor in peak-hour congestion. Motono et al. (2016) found that between 10 and 12.7 percent of containers arriving at ports such as Nagoya and Hakata have improper documentation or incorrect cargo information, postponing their entrance and contributing to congestion. Torkjazi et al., (2018) mentioned that additional key factors that contribute to peak time congestion are potential conflicts with other operations in the yard, such as vessel operations, warehouse operations, rail operations, and customs inspections, and the time required for customs inspections and other administrative tasks.

According to Bentolila et al. (2016), the determination of the appropriate time of arrival at a terminal is not always within the jurisdiction of truck drivers or trucking companies. The primary external factors contributing to truckers' tendency to arrive during peak hours can be attributed to various factors. These include the specific demands and supply chain management practices of cargo owners, which may dictate the timing of

truck arrivals. Furthermore, periodic restrictions [2]on truck usage on certain road networks can hinder container deliveries. Moreover, legal regulations pertaining to driving and rest periods for truck drivers and restrictions on night work can also impact trucking companies by incurring additional costs for night shifts.

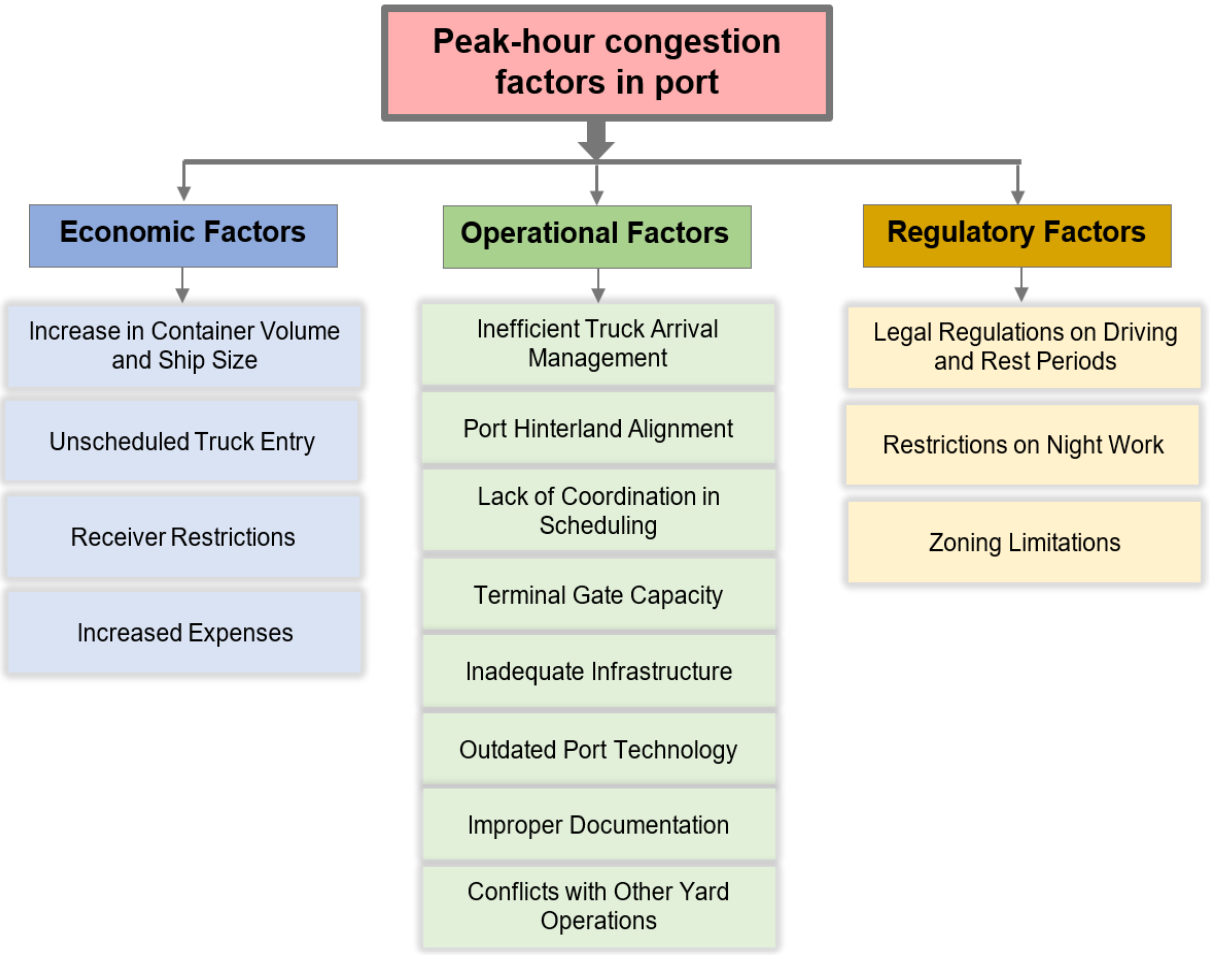
Holguin-Veras et al. (2005) conducted a study on off-peak cargo transportation, focusing on stakeholder perspectives. Their findings revealed that truck drivers prefer daytime operations due to receiver-imposed delivery restrictions. Receivers often overlook the challenges faced by trucking companies. Key challenges include customer reluctance to accept off-peak deliveries, limited operating hours, higher personnel costs, equipment utilization, community concerns, and zoning limitations affecting competitiveness. Holguin-Veras et al. (2005)'s study echoed Bentolila et al. (2016)'s research. Participants in both studies suggested that increased expenses would result from trucking companies compensating drivers for extended hours. Additionally, recipients would incur higher costs to employ personnel for receiving and accepting deliveries.

There are numerous factors that are contributing to peak-time congestion in maritime ports. Key drivers include the growth in container volume and ship size, mismanagement of truck arrivals, port hinterland misalignment, and limited gate capacity. Outdated technology, improper documentation, and conflicts with other yard operations also play a role. Additionally, external factors like receiver restrictions and legal regulations impact truck arrival times. These factors can be broadly categorized into three groups: economic, operational, and regulatory factors. Figure 3 provides a concise representation of the factors that contribute to peak-hour congestion in ports.

[2] The prohibition of trucks weighing over 7.5 tons from driving on weekends in France is an example of periodic restrictions (Bentolila et al., 2016).

Figure 3

Peak-hour congestion factors in port



Source: Created by author based on diverse scholarly studies

2.2. Driving Off-Peak Participation: Financial Incentives:

Shifting goods delivery in an off-peak hour is not a new approach; it has a long history, and Julius Caesar already implemented this approach in ancient Rome. He prohibited commercial delivery during the daytime as a mitigation tool for peak-time congestion in the streets (Dessau, 1902, as cited in Fu and Jenelius, 2018). Currently, many transportation specialists assert that congestion pricing represents a cost-efficient method for mitigating traffic congestion.

2.2.1. Global Peak Congestion Incentives Programs:

Various global financial incentive programs are employed to reduce peak-hour traffic congestion. Some examples are highlighted below.

PierPASS OffPeak Program:

The OffPeak program was initiated at the San Pedro Bay ports in July 2005. Marine Terminal Operators (MTOs) have implemented the PierPASS Offpeak program. It is a financial disincentive, known as the Traffic Mitigation Fee (TMF), to encourage cargo movement during off-peak hours. The program aimed to divert 15% to 20% of cargo movements to off-peak hours in its first year. Surpassing expectations, it achieved 30% to 35% off-peak diversions by year-end, leading to reduced emissions and improved quality of life by shifting truck traffic away from peak hours (Giuliano & O'brien, 2008a; Giuliano & O'brien, 2008b; Mani & Fischer, 2009).

The Ports of Long Beach and Los Angeles considered PierPASS an essential strategy for managing the increasing trade volumes. They supported the idea of extended gate hours but claimed that they had no direct influence on the formation of PierPASS or the determination of its fees (Giuliano & O'brien, 2008a).

However, while terminal operators and ports generally had a positive view of PierPASS and it effectively reduced congestion, but it was not universally well-received among all stakeholders. Some truck drivers did not experience additional benefits because they were not compensated for working during evening and weekend hours (Giuliano & O'brien, 2008b).

Additionally, according to Giuliano & O'brien (2008a), certain stakeholder groups had to absorb the program's additional costs and had limited input in its development. Operators of warehouses and distribution centers believed that the program primarily benefited MTOs and forced them to adapt their business practices without financial gain, unlike the financial benefits (TMF) enjoyed by MTOs (Mani & Fischer, 2009). The direct costs of PierPASS were paid by cargo owners, but the impact on consumers is unclear.

"Good Night" program in Israel

Israel's Ministry of Transport has implemented the "Good Night Program" to spread traffic flow at the port. The method of this program was a "fine-reward" system, in which customers carrying containers to the port during the day would be paid a "day fee," and those shifting containers during the night would get a financial incentive. The program led to a significant increase in nighttime container transfers compared to the period before its implementation. However, this economic model was not feasible for small and medium-scale customers. Later on, the method of the "Day fee" option was abandoned due to the Manufacturers Association of Israel's strong objection (Bentolila et al., 2016).

Congestion pricing or VPPP:

The Value Pricing Pilot Program (VPPP) is a congestion pricing program to reduce traffic congestion by charging drivers for their usage of roads, especially during peak hours. It is based on the economic principle of supply and demand—when demand is high, prices increase. VPPP has effectively reduced traffic congestion by implementing pricing strategies (Federal Highway Administration, 2018).

However, Pre-implementation public opinion studies have shown that around 70% of the population had a negative stance toward congestion pricing. Nevertheless, with the implementation and execution of congestion pricing, the rejection rate decreases to around 30% (Federal Highway Administration, 2008).

Norwegian Trondheim toll cordon:

Norwegian city Trondheim implemented a cordon-based toll system in 1991. This project was considered a successful traffic management measure, and the revenue from the toll helped the local government to invest in other infrastructure development and facilitated to flatten the peak congestion (Meland et al., 2010). According to Tretvik (2006), the Trondheim toll cordon program was never popular among motorists. It was found in 2005 that 47% of people showed a negative attitude, and only 19% showed a positive one, and this potential traffic management system was removed because the project lost public support.

San Diego's Interstate 15 (I-15) Congestion Pricing Project:

San Diego's Interstate 15 (I-15) Congestion Pricing Project by the San Diego Association of Governments. This project shifted traffic away from the peak period and reduced congestion on the I-15 main lanes. Users found the I-15 Congestion Pricing Project to be a very time-saving option; although the toll price was high, they reported time savings and the need for on-time arrival as the main reasons for joining the program. Overall, the project received support and acceptance from customers and the public (Supernak et al., 2001).

The Stockholm congestion – charging trial 2006:

Stockholm has implemented cordon pricing, making it the latest major international city to adopt this strategy (Federal Highway Administration, 2008). Prior to the trial of the program, the approval rate of the public was less than 30%, but it rose to over 52% at the conclusion of the trial. A significant decrease in car trips led to shorter travel times. The inner city had a reduction of 14% in exhaust emissions, while Stockholm County observed a fall of 2%-3% (Eliasson et al., 2009; Hugosson et al., 2006). Stockholm citizens voted in favor of continuing the existing system, leading to its reinstatement and subsequent permanence. (Hugosson et al., 2006).

2.2.2. Understanding Off-Peak Dynamics: Stakeholder Views:

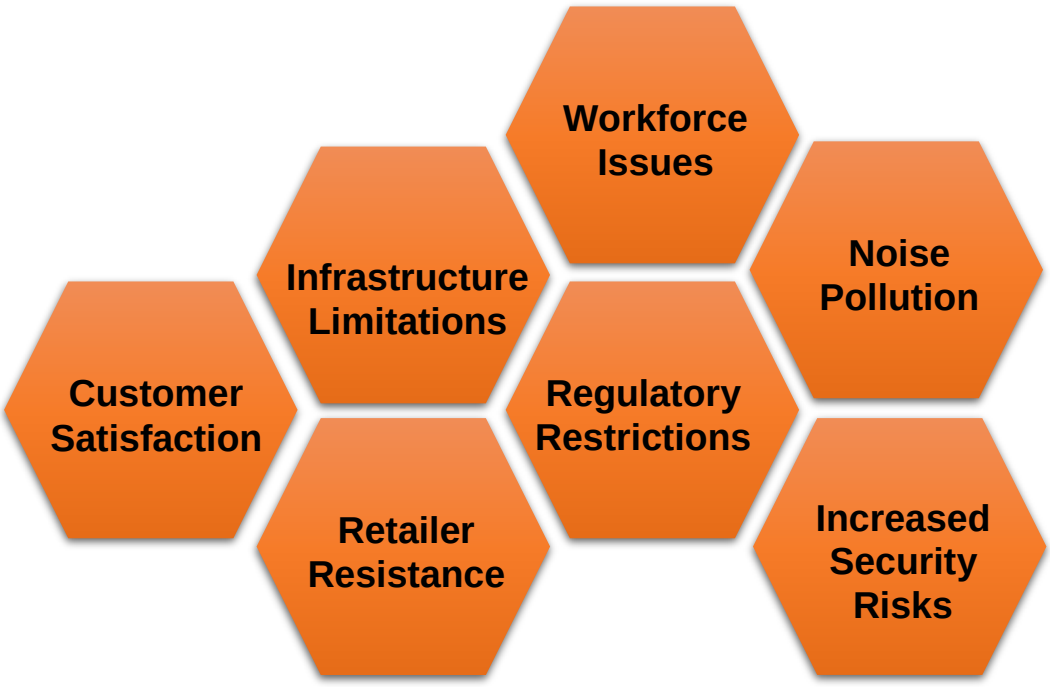
According to José Holguín-Veras et al. (2005), private sector stakeholders, such as shippers, play a central role in decision-making regarding off-peak shipping and delivery. Off-peak deliveries impact receivers, requiring additional personnel and potentially complicating labor agreements and management during non-peak hours. Receivers also bear the financial responsibility for heating and lighting costs.

In their study, José Holguín-Veras et al. (2005) referenced a 1968 experiment conducted in London. This experiment highlighted the importance of scale economies for trucking companies in off-peak operations. Conversely, it emphasized that shippers and customers need to perceive clear benefits for themselves to participate. The study also suggested that if off-peak delivery is deemed socially advantageous, compensation programs may be needed to offset associated costs.

Bentolila et al. (2016), Holguín-Veras et al. (2007), and José Holguín-Veras et al. (2005) identified various challenges encountered by stakeholders in the context of off-peak operations.
Figure 4 succinctly captures these multifaceted challenges, offering a visual summary of the key issues that stakeholders encounter in off-peak operations.

Figure 4

Challenges Faced by Stakeholders for Off-Peak Operations



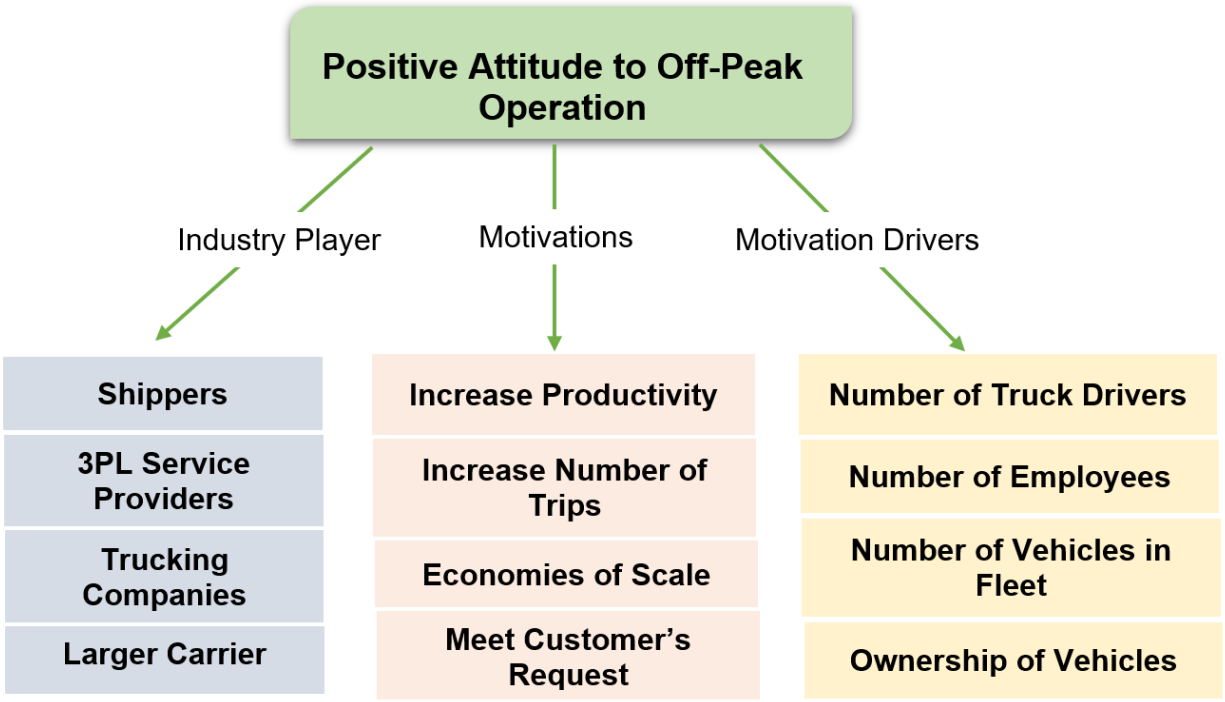
Source: Created by author based on Bentolila et al. (2016), Holguín-Veras et al. (2007), and José Holguín-Veras et al. (2005) study

In their survey regarding stakeholder attitudes toward off-peak delivery, Holguín-Veras et al. (2007) found that businesses in primary sectors, including shippers, third-party logistics providers, trucking companies, larger carriers with more employees, and carriers using their own vehicles, exhibited a strong inclination toward adopting off-peak operations. This preference primarily stemmed from the potential for enhanced productivity, achieving economies of scale, conducting more trips, and effectively meeting customer demands. Additionally, the study revealed a positive correlation between a company's vehicle fleet size and the likelihood of engaging in off-peak deliveries.

Figure 5 provides a comprehensive summary of the research findings of Bentolila et al. (2016), Holguín-Veras et al. (2007), and José Holguín-Veras et al. (2005) related to stakeholders' positive attitudes and motivations and elements for off-peak operations.

Figure 5

Positive Attitude elements and motivations of Stakeholders for Off-Peak Operations.

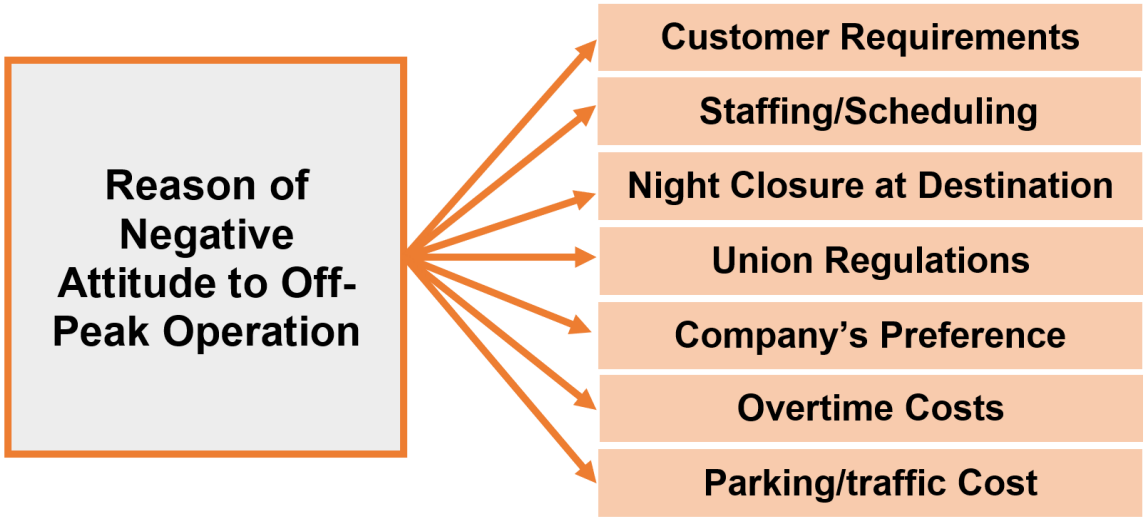


Source: Created by author based on Bentolila et al. (2016), Holguín-Veras et al. (2007), and José Holguín-Veras et al. (2005) study

In contrast, Holguín-Veras et al. (2007) found that companies with minimal or no monthly parking fine expenses may lack motivation to engage in off-peak deliveries. Similarly, companies that incur overtime costs or are subject to union regulations are less inclined to consider off-peak operations. Additionally, limited access to destination buildings during off-peak hours and customer demands also contribute to a decreased likelihood of carriers engaging in off-peak operations. Figure 6 illustrates the factors contributing to an unfavourable attitude towards off-peak operation.

Figure 6

Factors Influencing Stakeholders' Negative Attitudes towards Off-Peak Operations.



Source: Created by author from Holguín-Veras et al. (2007) study

2.3. Truck Appointment Systems (TAS):

2.3.1. Conceptual Understanding of TAS:

TAS is a structured scheduling system (Azab & Eltawil, 2016) where mainly two considerations are taken into account: the available time for the terminal resources and trucking companies' resources, such as trucks, drivers, etc., and the terminal space relating to truck densities and storage spaces.
According to (Davies & Davies, 2009), a truck appointment system is a scheduling method by which terminal operators and trucking companies arrange specific times for transactions. These transactions primarily concern the pick-up of import containers and the export drop-off and pick-up and drop-off of empty containers.

These systems are typically carried out in pre-defined time slots, with certain quotas or limits on the number of trucks allowed in each slot (Shiri & Huynh, 2016). Typically, terminal operators announce opening hours and an entry quota for each hourly time slot for truck arrivals. Appointments are scheduled either 24 hours in advance or on the same day (Davies & Davies, 2009). Terminal operators divided the port operating hours into equal-duration time slots. During each time slot, the number of truck accesses to the port is capped at an upper limit known as the slot capacity (Namboothiri & Erera, 2008). In some terminals, this system is implemented either on a container or on a truck basis, meaning appointments have to be made to deliver or pick up a specific container (Zehendner & Feillet,2014).

2.3.2. Effectiveness of TAS:

The main purpose of implementing TAS in container terminal gate areas is to spread out the demand throughout the day (Chen & Yang, 2010) and manage truck arrivals (Abdelmagid et al., 2021; Azab, et al., 2017; Morais & Lord, 2006; Phan & Kim, 2015) efficiently. It helps in improving operational efficiency by reducing congestion (Azab, et al., 2017; Azab & Eltawil, 2016; Lange et al., 2017; Shiri & Huynh, 2016; Yang et al., 2013; Zhang et al., 2013).

The system benefits both the ports and truck carriers by reducing waiting times (Ramírez-Nafarrate et al., 2016); moreover, it ensures smoother and more efficient operations of the terminal and potentially enhances productivity (Shiri & Huynh, 2016; Huynh & Walton, 2005). (Chen et al., 2013) noted that the demand and supply of truck service at such terminals are not always balanced, often causing long truck queues at the gate. TAS is a solution to optimize the appointment quotas, manage truck arrivals, and subsequently reduce queueing significantly.

Nadi et al. (2022) stated that the implementation of a truck appointment system significantly improves truck operation costs. By scheduling truck arrivals and allowing for flexibility in adjusting these schedules, the system helps minimize waiting times at terminal gates. This reduction in waiting times can reduce idling and, consequently, related costs and emissions. Therefore, the primary benefits are cost efficiency and time efficiency. This system aims for better alignment between port operations and hinterland trucking logistics, which can improve the port's operational efficiency.

Ramírez-Nafarrate et al. (2016) and Zhang et al. (2013) stated a similar opinion that implementing a TAS might have a significant impact on yard operations; it helps to decrease not only truck waiting time but also container rehandling operations.
To describe the potentiality of TAS Zehendner & Feillet (2014) mentioned the efficient utilization of yard cranes; according to the study, the use of a truck appointment system contributes to better management and allocation of straddle carriers.

According to Abdelmagid et al. (2022), TAS could optimize the appointment schedule for external trucks. Additionally, it can help control truck densities inside the terminal to avoid bottlenecks, effectively managing the terminal issue of overcrowding.

As depicted in Figure 7, the use of TAS has the potential to optimize the operational efficiency of a container terminal. The system regulates the arrival of trucks to the port and mitigates traffic congestion during peak hours. Motono et al. (2016) found in their study that the implementation of TAS effectively alleviates the landside congestion in the ports of Hakata and Nagoya.

Figure 7

Truck Arrival Pattern Before and After Implementing TAS

Source: Abdelmagid, A. M., Gheith, M. S., & Eltawil, A. B. (2021). A comprehensive review of the truck appointment scheduling models and directions for future research. *Transport Reviews*, *42*(1), 102–126. https://doi.org/10.1080/01441647.2021.1955034

2.3.3. Challenges in Implementing TAS:

Several successful TAS are operating in various regions worldwide. Zhang et al. (2013) stated that the effectiveness of this system varies among different ports, implying there could be factors or conditions that might influence its successful application.

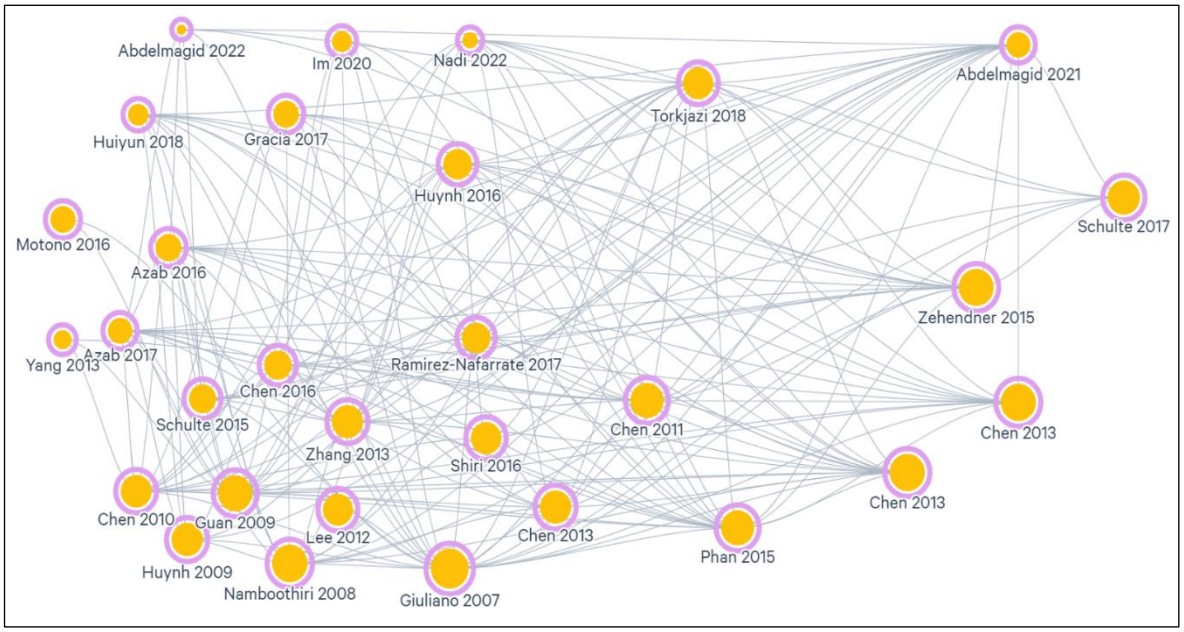
Giuliano & O'Brien (2008) and Giuliano & O'Brien (2007) mentioned in their study that TAS implemented in Los Angeles and Long Beach ports did not show a clear improvement in terminal efficiency. They did not find any evidence that TAS reduced queue lengths or transaction times. The reasons for this included the variability in operational frameworks across different terminals, a lack of priority gates, the need to make appointments 24 hours in advance, and the appointment system being tied to individual drivers rather than containers, leading to overbooking or no-shows. As a result, driver participation in the TAS program was limited. Essentially, this particular study shows that the TAS did not necessarily gain efficiency in these ports.

Chen & Yang (2010) stated that to control truck arrival influx, the terminal gate reservations technique gained popularity in North America, but the method actually failed to achieve the purpose because the rule was imposed by the government without the consent of significant port stakeholder organizations.

The author of this study analyses more than 30 well-connected research papers exclusively based on TAS (see Figure 8) in order to comprehend the perspective of key port stakeholders regarding the implementation of TAS in seaport. However, the majority of the study concentrates on the operational aspects of the TAS, such as its effects on arrival patterns, terminal performance, and reducing the total waiting cost of trucks.

Figure 8

Connections Between Research Papers Related to TAS During The Last Two Decades



Note: Connections developed based on citation

Source: Developed by author by using literature mapping software

However, there are very few studies on the explicit discussion of stakeholders' satisfaction with TAS participation. This is a crucial question to investigate: Are the stakeholders participating in TAS voluntarily, or does the state or port authority leave them to absorb the rule? Furthermore, is TAS adequate to smooth the arrival patterns of trucking companies, or is there a need for some kind of financial incentive to boost stakeholder participation willingness in TAS?

In conclusion, the literature review has investigated the complex dynamics relating to port peak-hour congestion variables. The existing research has predominantly emphasized port and terminal operators' perspectives. There is a significant research gap that exists to address the diverse perspectives of stakeholders. This study seeks to shed light on the drivers of peak-hour truck arrivals from the stakeholders' viewpoint, uncovering critical insights into their decision-making process.

On the other hand, most of the existing research on financial incentive programs has primarily focused on the roads and transportation sectors. Unfortunately, there is a noticeable dearth of studies that exclusively examine the viewpoint of seaports. Moreover, few studies have explicitly explored how different stakeholder groups perceive the impact of financial incentives within the TAS on mitigating congestion. It is crucial to turn our attention to the issue of peak-time congestion in seaports and to consider the opinions of stakeholders before putting any new policies into action. By focusing on Chittagong Port, this study intends to bridge this gap by examining stakeholders' attitudes towards these incentives.

In light of these research gaps, this dissertation titled "Stakeholder Perception of Financial Incentive in Truck Appointment Systems at Chittagong Port" seeks to comprehensively understand the interactions between financial incentives within the TAS, stakeholder perspectives, and peak-time congestion management.

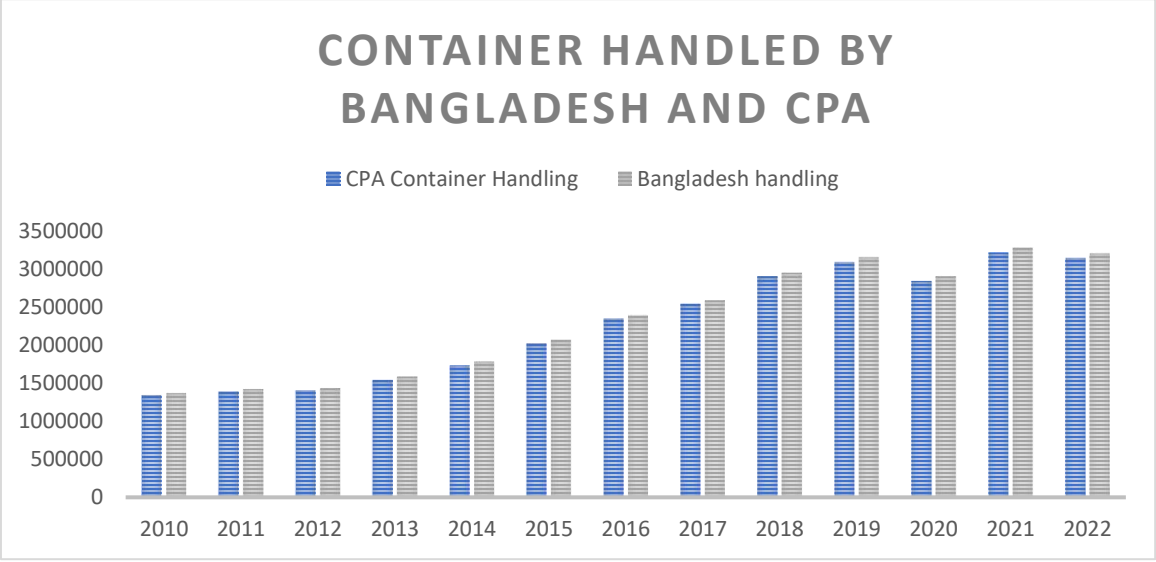
Chapter 3

Study Area: Chittagong Port

Chittagong port serves as a national gateway to international trade in Bangladesh; more than 90% of Bangladesh's exports and imports are handled by Chittagong Port (Asian Development Bank, 2018). Currently, three seaports are operational in Bangladesh: Chittagong, Mongla, and Pyra Port. However, Figure 9 provides insights into the container handling statistics for both Bangladesh and Chittagong Port. It is evident from the data that Chittagong Port is responsible for handling an overwhelming 98% of the total container volume of Bangladesh.

Figure 9

Container handled by Bangladesh and Chittagong Port

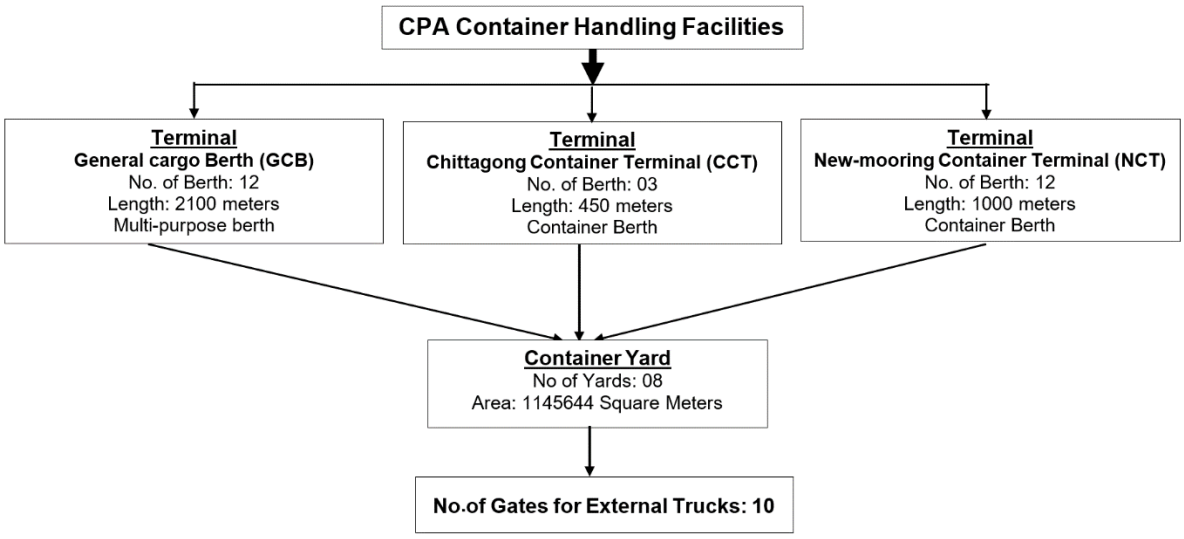


Source: Developed by Author from World Bank (n.d.) and CPA (n.d.) Data

The Chittagong Port Authority (CPA) operates independently as a self-governing body under the supervision of the Ministry of Shipping, which is a part of the Government of the People's Republic of Bangladesh. The CPA is responsible for managing its own planning, financial matters, and the administration of its workforce (Chittagong Port Authority, 2018). CPA has three terminals for vessel berthing facilities and 10 gates for external trucks to access and depart. The CPA container handling facilities are charted in Figure 10.

Figure 10

CPA Container Handling Facilities

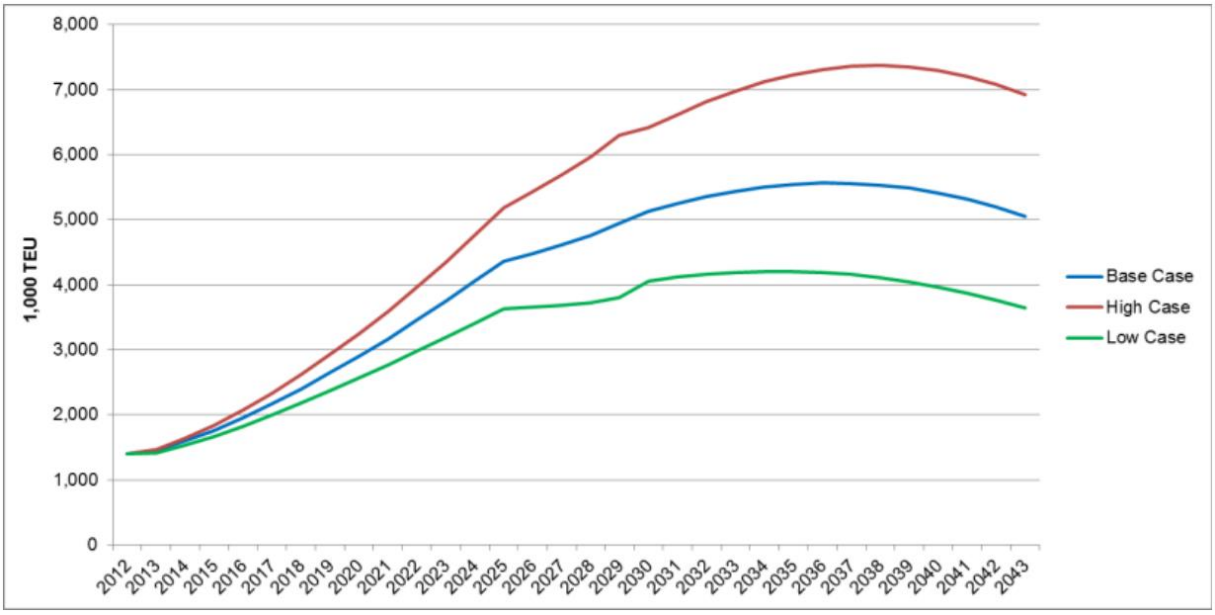


Source: Developed by Author, information from Chittagong Port Authority. (2023). Overview 2023 [Fact sheet]. Chittagong Port Authority. http://cpa.portal.gov.bd/sites/default/files/files/cpa.portal.gov.bd/page/4a3e1831_9543_416f_957d_079e2a12363a/2023-05-09-04-47-dda2fdda428c8a599a2ba24f71940897.pdf

HPC Hamburg Port Consulting GmbH forecasted Chittagong port's container volume for the year 2043. The forecast for Chittagong port's container handling volume by 2043 varies from 3.64 million TEU in the low-case scenario to 6.92 million TEU in the high-case scenario, as shown in the accompanying figure. Based on these statistics, it is apparent that Chittagong port is faced with the task of managing nearly twice the traffic volume, even in the base case scenario. Consequently, it is imperative for the CPA to proactively implement an effective traffic management strategy to uphold its competitive appeal and operational efficiency.

Figure 11

Chittagong Port Container Handling Potentials to 2043



Source: HPC Hamburg Port Consulting GmbH (2015). *Strategic Master Plan for Chittagong Port. Final Report, Part 1.* Asian Development Bank and Chittagong Port Authority.

However, Chittagong port, the primary port of Bangladesh with substantial growth potential, currently struggling with congestion issues. This congestion extends beyond the port itself, affecting the national logistics system, including roadways, seaports, and land ports. Traffic congestion on roads leads to a twofold rise in trucking costs, prompting shippers and service providers to adopt costly measures to mitigate these challenges and enhance logistics reliability (Dappe et al., 2019).

By addressing the research questions, this study aims to enhance the literature on port operations and congestion management, offering practical implications for policymakers of Bangladesh, port authorities, and the wider logistics community. The results of this research are expected to contribute meaningfully to the ongoing efforts in optimizing port operations and fostering sustainable solutions for peak-hour congestion challenges at the Chittagong Port.

Chapter 4

Methodology

This chapter presents the methodology employed in this research to investigate the stakeholder perception of financial incentives in truck appointment systems for reducing peak-time truck arrival frequency at Chittagong Port.

This chapter provides a comprehensive overview of the research design, data collection methods, and data analysis techniques, as well as the justifications behind these decisions.

4.1. Research Design:

This study employs a mixed-methods research design, incorporating both qualitative and quantitative approaches. The incorporation of both quantitative and qualitative data has the potential to significantly increase the efficacy and worth of mixed-methods research (Bryman, 2006). According to Migiro & Magangi (2011), the mixed-method approach provides flexibility to the researcher in data collection and analysis and its utility for deeper understanding and explanation of results, and this strategy acknowledges the inherent limitations of relying solely on a single method. Fetters et al. (2013) mentioned that the benefit of this approach is that the validity of quantitative results may be evaluated using qualitative data.

However, the mixed-method approach brought completeness to this research by widening numerous inquiries, allowing for a broader analysis of stakeholder perspectives on financial incentives in truck appointment systems.

4.1.1. Quantitative Phase:

The quantitative phase employs a survey to collect data from a representative sample of port users, including trucking companies and C&F. The survey will be designed to assess attitudes, preferences, and perceptions regarding peak-hour congestion, financial

incentives in TAS. The survey data will be statistically analyzed to quantify trends and relationships among variables.

4.1.2. Qualitative Phase:

The qualitative phase involves semi-structured interviews with the stakeholders of CPA, such as trucking companies, C&F agents, and port authority personnel. These interviews aim to gain insights into the perceptions, challenges, and motivations of stakeholders related to peak-hour congestion and financial incentives in TAS. The interview data has been thematically analyzed to identify common themes and patterns.

4.2. Data Collection Methods:

4.2.1. Quantitative Data:

A structured survey questionnaire was developed to gather data from trucking companies and C&F agents in CPA. Two different sets of questionnaires were developed for two respondent groups (see Appendix 1 and 2). Various types of items, including Likert scale, multiple choice, etc., were furnished in the questionnaires to capture stakeholders' perceptions of financial incentives in the TAS and factors influencing truck arrival patterns.

4.2.2. Qualitative Data:

Semi-structured interviews were conducted with key stakeholders, including top management representatives of CPA, customs clearing & forwarding agents, and trucking company owners. These interviews included open-ended questions designed to explore respondents' experiences, opinions, and perceptions regarding financial incentives in TAS and factors influencing truck arrival patterns. The interviews were audio-recorded with participants' consent to ensure accurate transcription and analysis.

4.3. Sampling Strategy:

A snowball sampling approach was used to select participants from different categories, including trucking company owners and C&F agents. From each group, 30 responses have been targeted for the quantitative data collection. For qualitative data, a purposive sampling strategy was used to select the interview respondents. One participant was selected from two stakeholder groups and one from CPA.

4.4. Data Analysis:

4.4.1. Quantitative Data Analysis:

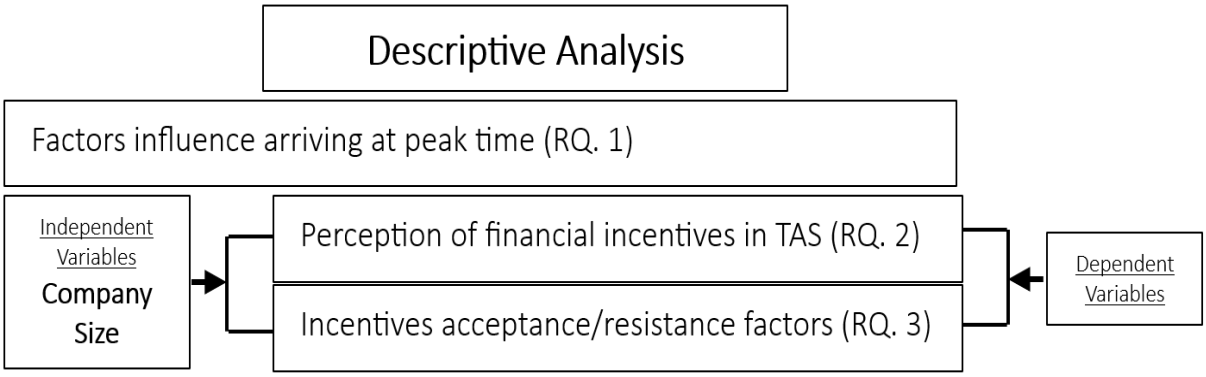
Descriptive statistical analyses were conducted to summarize quantitative survey responses. Frequencies were calculated to get an overview of stakeholder perceptions of financial incentives in TAS and to identify the most prominent factors influencing truck arrival patterns.

To gain a deeper understanding of how financial incentives are perceived in TAS across different company sizes, the author examined the data for research questions 2 and 3, treating company size as a key independent variable. This examination aimed to determine whether the stakeholders' perceptions of financial incentives in TAS were influenced by the size of their companies and whether company size played a role in influencing various factors related to the acceptance and resistance of incentive programs.

Figure 12 depicts a visual representation of the analysis strategy of quantitative data.

Figure 12

Quantitative Data Analysis Variables



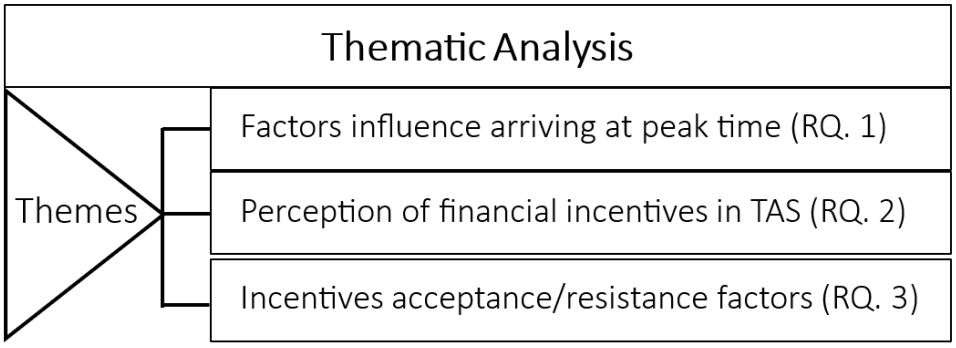
Note: RQ=Research Question

4.4.2. Qualitative Data Analysis:

Qualitative data analysis followed a thematic analysis approach. Interview transcripts were thoroughly reviewed, coded, and categorized to identify the themes and patterns related to stakeholder perceptions of financial incentives and reasons for peak-time truck arrivals. Factors of peak time, perception of financial incentives, and acceptance/resistance of financial incentives in TAS were the main three themes for qualitative data analysis (see Figure 13).

Figure 13

Qualitative Data Analysis Themes



Note: RQ=Research Question

4.5. Ethical Considerations:

The research design and data collection methods prioritize ethical considerations. Informed consent was obtained from all participants, ensuring their willingness to contribute to the study. Confidentiality and anonymity of respondents were maintained throughout the research process. Any potential conflicts of interest were addressed, and participants were assured that their participation or withdrawal would have no consequences on their existing relationships with Chittagong Port.

4.6. Validity and Reliability:

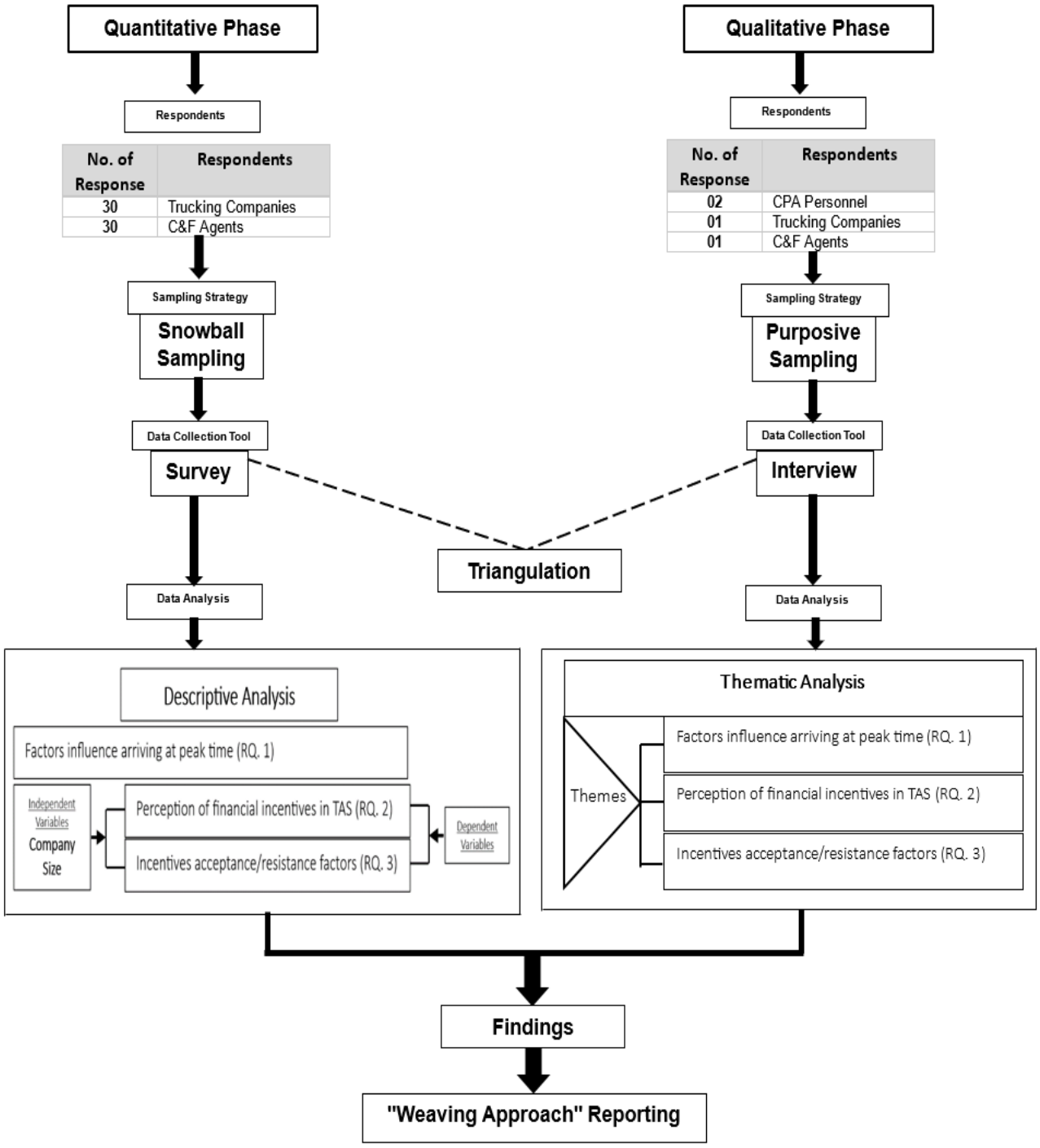
To enhance the validity and reliability of the study, a triangulation strategy was employed. According to Migiro & Magangi (2011), triangulation enables the comparison of quantitative and qualitative datasets in order to generate well-validated findings. A weaving approach [3]has followed to reporting the findings of this research.

Figure 14 depicts a comprehensive illustration of the research methodology used in this study.

[3] **"**The weaving approach involves writing both qualitative and quantitative findings together on a theme-by-theme or concept-by-concept basis" (Fetters et al.,2013, p. 2142).

Figure 14

Comprehensive Illustration of Research Methodology



4.7. Limitations:

A potential limitation of this research is the relatively small sample size in relation to the whole population. Therefore, it is possible that the results may not accurately represent the perspectives of every stakeholder involved in CPA.

Additionally, the study focuses solely on import-oriented container-related trucks, excluding exports-related trucks and bulk cargo trucks. This narrower scope may limit the generalizability of findings to other types of trucking operations.

The survey questionnaire was developed to collect the respondents' responses. Most of the respondents did not have access to the Internet, so the researcher sought an assistant from the study area to collect the responses physically in a printed survey questionnaire form. Later on, responses were gathered in an Excel spreadsheet. Misinterpreting various terms or negligence responses can be a potential limitation of this study.

The pilot testing of the survey questionnaire could not be conducted prior to its final administration due to time constraints. This is a potential limitation of this survey's methodology.

In addition, the survey questionnaire items were developed solely from existing scholarly literature and were not validated using experts' opinions. It is possible that the dynamics of the study area differ from those of the scholastic literature area. This may be a significant flaw in the study's methodology. Nevertheless, an effort has been made to mitigate this limitation by triangulating the survey results with in-depth interviews.

This chapter has provided a comprehensive overview of the research methodology employed in this study. The chosen mixed-methods approach, combining quantitative and qualitative methods, aims to yield a holistic understanding of stakeholder perceptions and factors influencing truck arrival patterns. The subsequent chapter will present the analysis and discussion of the collected data, contributing to the fulfillment of the research objectives.

Chapter 5

Data Analysis and Result

This study's primary objective is to investigate how CPA stakeholders view financial incentives in truck appointment systems for reducing peak-time truck arrival frequency. Since CPA plays a pivotal role in Bangladesh's national economy, overseeing about 90% of the country's import-export trade, it is important to acknowledge the issue of frequent truck arrivals during the day. A mixed-method approach has been implemented to get a comprehensive understanding of the research problem. 60 Stakeholder responses have been collected through a survey questionnaire, and three personal interviews have been conducted to understand the factors driving stakeholders' decisions to arrive at the port at peak time and their perception of the effectiveness of financial incentives in TAS to tackle the peak time truck arrival frequency. In this chapter, the calculation of the surveyed questionnaire and the insights gathered from interviews are shown sequentially.

5.1. Respondents' information:

The company size of the surveyed respondents was determined based on the number of employees and the number of trucks in their fleet. For C&F, who do not have their own trucks, their company size was determined based on only their number of employees. Table 1 shows the company size determinant. However, based on the company size, the number of respondents from each group is shown in Figure 15.

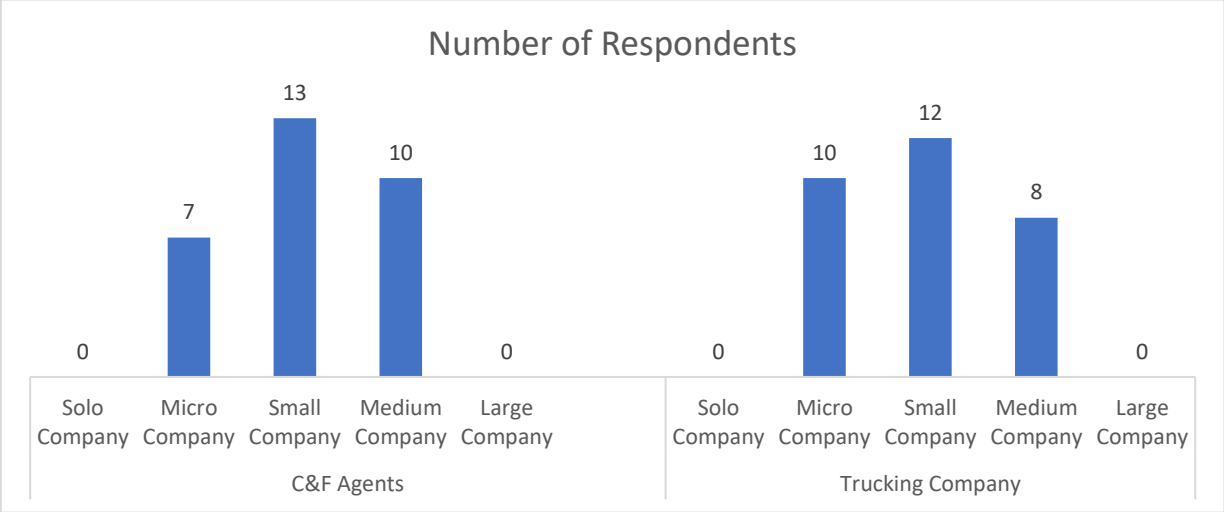
Table 1

Company Size Determinant

Company Size	Number of Employees	Number of Trucks
Solo Company	1 employee (Owner/staff)	1 truck (Owner/Driver)
Micro Company	2-10 employees	2-5 trucks
Small Company	11-30 employees	6-15 trucks
Medium Company	31-60 employees	16-30 trucks
Large Company	61+ employees	31+ trucks

Figure 15

Number of Respondents according to Company Size



The data from Figure 15 indicates that among both types of stakeholders, namely C&F agents and trucking companies, the researcher did not find any participants from either solo companies or large companies. Instead, all respondents belonged to micro, small, or medium-sized companies, with a notable prevalence of small company representatives.

However, the majority of participants in this study visit CPA on a daily basis to collect containers. The prevailing method for truck rental is on a per-trip basis. Over half of the C&F agent respondents indicated that they request trucks from trucking companies at CPA in the morning. In contrast, a significant portion of trucking company respondents stated that they do not have any fixed schedule for dispatching their trucks to CPA. Table 2 shows the number of respondents according to their arrival frequency at CPA, truck renting methods, and truck calling/dispatching time.

Table 2

Number of Respondents According to Arrival Frequency at CPA, Truck Renting Method, and Truck Calling/Dispatching Time

		C&F Agents	Trucking company
Respondent's Arrival Frequency at CPA	Daily	13	12
	2-4 times a week	6	9
	Weekly	9	6
	Rarely or Less than once a week	2	3
Truck Renting Method	Hourly rental	0	0
	Per trip rental	22	19
	Daily rental	8	11
	I don't rent trucks	0	0
Truck Calling/Dispatching Time	Morning	19	9
	Evening	0	0
	Night	0	0
	No fixed schedule	11	21

5.2. Factors influencing truck arriving at peak hour:

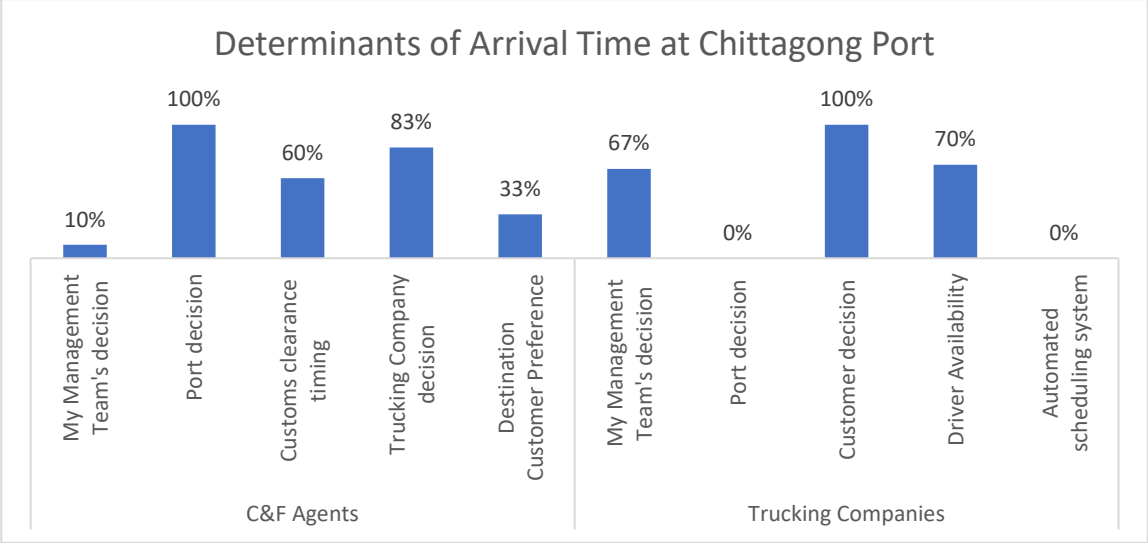
5.2.1. Factors determining the Arrival timing:

Among the group of C&F agent respondents, comprising 30 individuals, a common consensus emerged regarding the significance of port-related decisions in influencing the timing of their arrivals at CPA for receive the container. Furthermore, a substantial 83% of these respondents emphasized the pivotal role played by trucking company decisions, while 60% underscored the importance of customs clearance timing as an important factor dictating their arrival schedules. In contrast, only 33% of C&F agents cited destination customer preferences as a determinant and merely 10% indicated that their management team's decisions influenced their arrival timing at CPA.

Conversely, within the group of trucking company respondents, consisting of 30 individuals, it was uniformly indicated that customer decisions were the principal determinants of their arrival times at the port. Furthermore, a substantial 70% of these respondents emphasized the importance of driver availability, while 67% noted that decisions made by their company's management team played a key role in determining their port arrival times. Remarkably, none of the respondents mentioned the utilization of automated scheduling systems as a factor influencing their arrival times (Figure 16).

Figure 16

Determinants of Arrival Time at Chittagong Port



However, in the words of the C&F agent respondent factors of arrival timing,

> After clearing customs, I applied to the port to take delivery of my container. After application, I don't even know when my container will be ready for delivery. Mainly, the decision of the port is the determining factor for us; customs is not as important in this context because I am applying to the port with customs clearance. I will call the truck to the port at the time the port informs me. If the port provides me with the exact time and location of my container, I will instruct my truck to arrive at that specified location. I don't want to create congestion by keeping the truck at the port all day inside the terminal. (C&F Agents company respondent, 2023).

Trucking companies play a vital role in determining the arrival time at port. The Assistant Terminal Manager of CPA emphasizes this point. According to this respondent's statement,

> At our port, the peak hour spans between 2 p.m. to 8 p.m. This timeframe aligns with the arrival of trucks, which is linked to the fact that C&F agents don't pre-book trucks due to the fluctuating truck fares that change daily. The truck market assembles every day at 11 a.m., and during these market sessions, C&Fs mainly secure trucks through a sort of auction process. As a result, it's only around noon, after these market activities conclude, that C&Fs can start arranging trucks for port operations. (Assistant Terminal Manager, CPA, 2023).

5.2.2. Issues at nighttime Operations:

When survey respondents were presented with multiple options regarding the challenges they might encounter when receiving deliveries at Chittagong port during nighttime, notable patterns emerged. Among the C&F agent respondents, 100% of respondents identified the unavailability of customs staff as the predominant issue.

Moreover, 90% of respondents indicated the necessity of bearing additional transportation costs, while 87% cited delays in cargo loading onto trucks at night as a significant concern. The unavailability of port staff at nighttime was mentioned by 77% of respondents, and 67% highlighted the perception of reduced port operational efficiency during nighttime operations.

Notably, none of the respondents mentioned regulatory restrictions or difficulties in finding parking spaces at the destination as issues.

The interviewed C&F agent respondent highlighted nighttime arrival issues in the following manner:

> ….we want to come at night; we loaded the containerized cargo onto the covered van. This cargo-loading process typically takes more than 5-6 hours. In fact, arriving at midnight is convenient for us because it allows our trucks to commence their journey to the destination in the morning. It is safe for us. But we cannot come to the port at night because, before exiting the port, we require a signature from the customs officer, and unfortunately, no customs officers are available after 10 p.m. Additionally, the port's cargo-loading staff is also unavailable during these late hours. (C&F Agents company respondent, 2023).

In contrast, among the trucking company respondents, 100% expressed concerns about increased driver costs, and 73% highlighted the anticipation of additional expenses for staff overtime and utility bills associated with keeping their businesses open at night. Loading delays at the port during nighttime operations were mentioned by 63% of respondents, while 60% mentioned higher fuel and maintenance costs during nighttime operations.

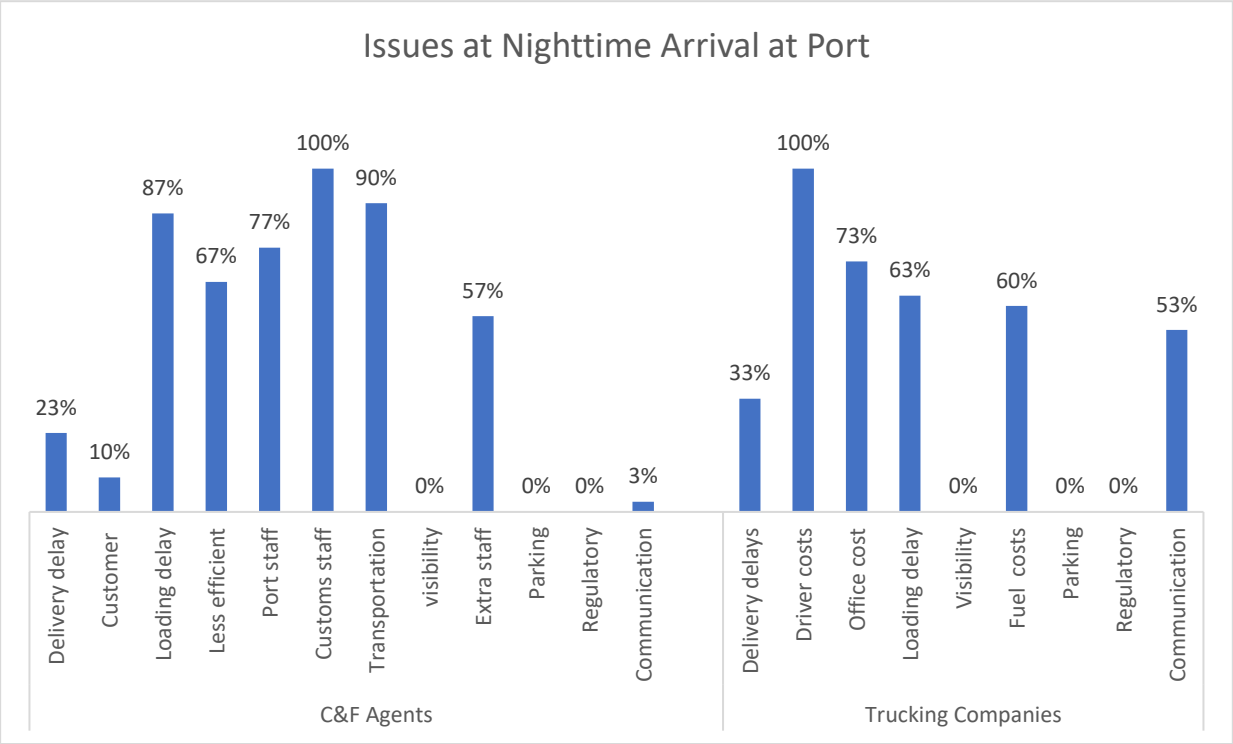
The trucking company interviewed respondent mentioned, *"For night shifts, we have to pay extra for the drivers, but the night is still the best time for us to pick up import containers, but our customers call us during the day."* (Trucking company respondent, 2023).

However, interestingly, none of the trucking company respondents mentioned issues related to limited visibility, safety concerns, difficulties in finding parking at the destination, or nighttime regulatory restrictions.

Figure 17 provides a graphical illustration of the statistical data pertaining to the issues related to nighttime port arrivals as reported by the survey respondents.

Figure 17

Issues at Nighttime Arrival at Port



Note: Code explanation

C&F Agents	
Delivery delay	Delivery delays to the destination
Customer	Destination customer's preference at daytime
Loading delay	Port cargo loading delays
Less efficient	Less efficient port operation at nighttime
Port staff	Port staff unavailability
Customs staff	Customs staff unavailability
Transportation	Increased transportation costs
visibility	Limited visibility and safety concerns
Extra staff	Allocation of extra office staff
Parking	Difficulty in finding parking at the destination
Communication	Communication challenges with partners and clients
Regulatory	Regulatory restrictions during nighttime hours

Trucking Companies	
Delivery delays	Delivery delays to destinations
Driver costs	
Office cost	Extra costs for staff overtime and utility bills at night
Loading delay	Cargo loading delays due to the unavailability of port staff
Visibility	Limited visibility and safety concerns
Fuel costs	Higher fuel and maintenance costs
Parking	Difficulty in finding parking at the destination
Regulatory	Regulatory restrictions during nighttime hours
Communication	Communication challenges with partners and clients

5.2.3. TAS slot booking decision:

When surveying both C&F agents and trucking companies regarding their preferences for slot booking within the truck appointment system, distinct patterns emerged. Within the C&F agent group, 100% of respondents unanimously identified "Readiness of cargo" and "Customs clearance and procedure" as the primary considerations. Furthermore, 87% of these respondents indicated consideration for peak traffic hours at the port when making slot bookings, while 47% acknowledged the importance of transport/truck availability in their decision-making process.

Regarding the slot booking decision, the C&F Agent respondent stated,

> "If CPA provides this facility, we will be very happy, and before booking my slot, my first priority will be whether my container is ready or not, and I will try to avoid this peak time. I will book my slot at night. But CPA has to ensure that all their facilities are fully available." (C&F Agents company respondent, 2023).

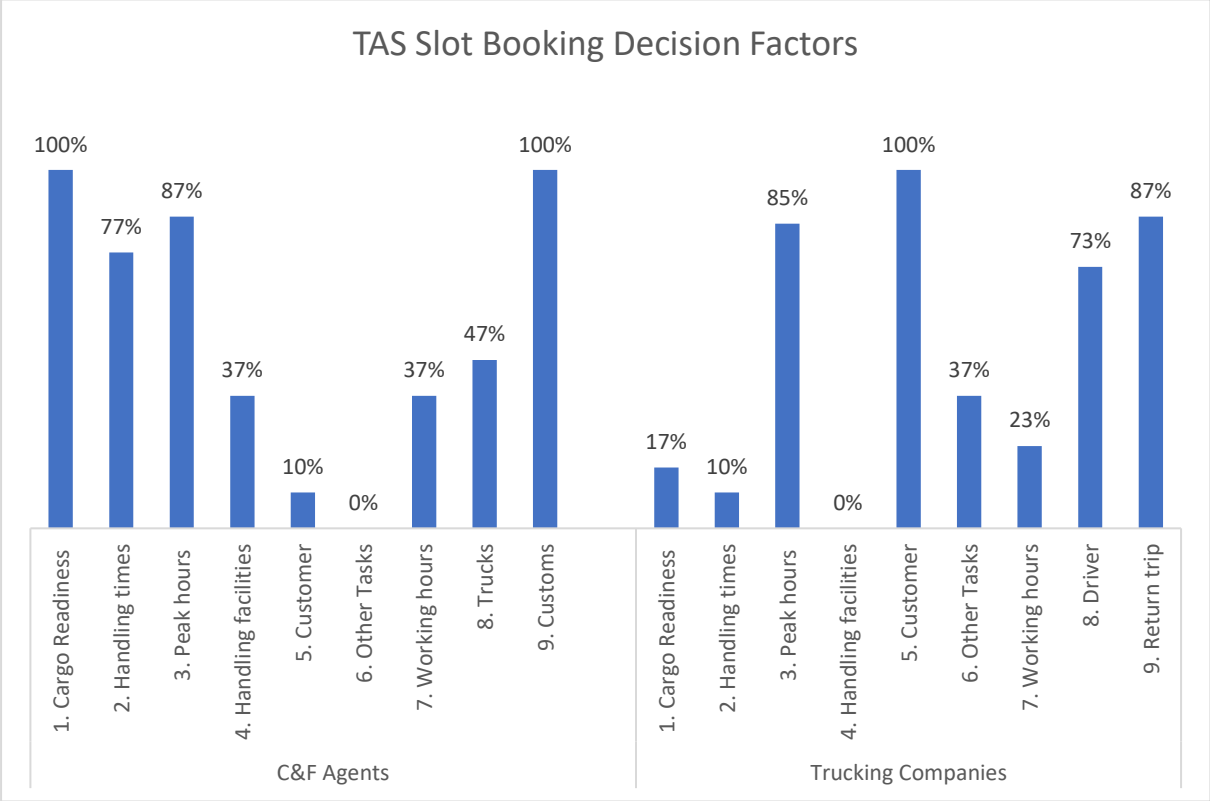
Conversely, among the trucking company respondents, 100% emphasized that "Customer requirements and preferences" were their foremost consideration when engaging in slot booking. Additionally, 87% of these respondents expressed their intent to calculate slot bookings based on return trip schedules, and 85% stated that they would factor in the port's peak hours when booking slots.

The trucking company interviewed respondent emphasized on the return trip, according to the respondent, *"Return trip calculations will be our first priority because we need to drop off the export container and pick up the import. We cannot leave our trucks idle, but our customers' preferences are also important."* (Trucking company respondent, 2023).

Figure 18 presents a visual representation of the statistical data related to TAS slot booking decision factors based on the responses from survey participants.

Figure 18

TAS Slot Booking Decision Factors



Note 1: Codes for item number 1-7 is the same for both groups. Only item number 8 and 9 are different for C&F agents and the Trucking companies.

Note 2: Code Explanation

Same for both groups

1. Cargo Readiness	Readiness of Cargo	5. Customer	Customer requirements and preferences
2. Handling times	Cargo handling and processing times	6. Other Tasks	Coordination with other scheduled tasks
3. Peak hours	Peak traffic hours at the port	7. Working hours	Company staff working hours
4. Handling facilities	Availability of loading/unloading facilities		

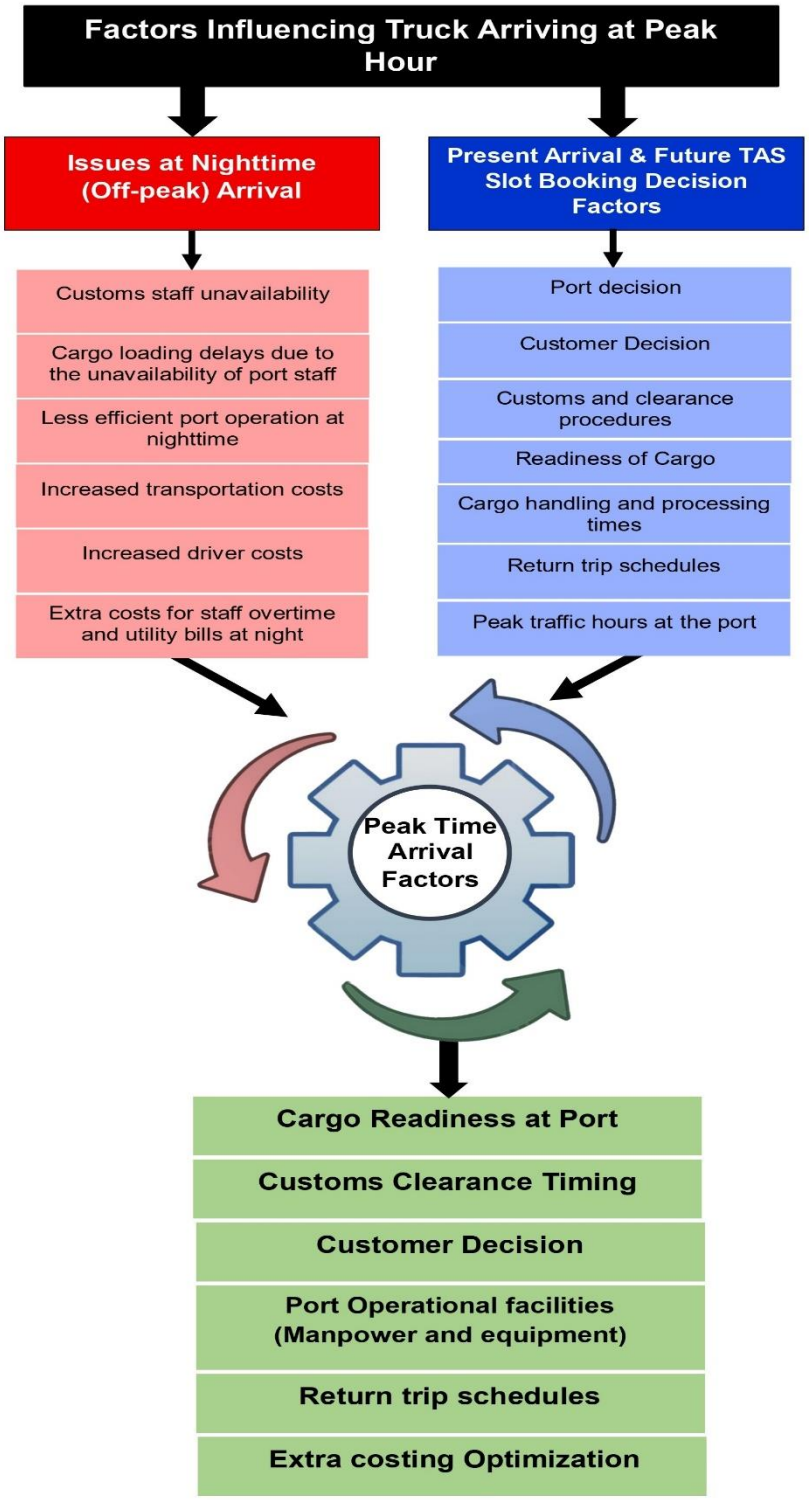
C&F Agents		**Trucking Companies**	
8. Trucks	Transport/truck availability	8. Driver	Driver availability and work hours
9. Customs	Customs and clearance procedures	9. Return trip	Return trip schedules

5.2.4. Summary of Key Findings:

The investigation into the determinants of stakeholder arrivals during peak times at the port involved a multilayered analysis. This analysis encompassed their existing arrival decision factors, their prospective prioritization for slot booking if TAS were to be implemented, and the potential challenges associated with nighttime cargo deliveries at the port. In summary, the key influencing factors for stakeholders to arrive during peak hours include cargo readiness at the port, customs clearance procedures, stakeholder customer preferences, the availability of port operational facilities, cost-saving considerations, and, for trucking companies, considerations related to return trip schedule. A visual representation of this summary is presented in Figure 19.

Figure 19

Peak Time Arrival Factors



5.3. Stakeholder Perception of Financial Incentive in TAS:

To assess the perception of the effectiveness of financial incentives in the TAS for mitigating peak-time arrivals at the CPA gate among various stakeholder groups, a five-point Likert scale questionnaire was constructed. The questionnaire featured three statements:

i. Financial incentives would contribute to reducing congestion and wait times at the CPA gate.
ii. Financial incentives would enhance the efficiency and overall performance of our operations.
iii. Financial incentives would assist in managing our off-peak operational costs.

Respondents were instructed to rate each statement on the Likert scale. The collected responses were analyzed with a focus on differentiating stakeholder groups by their company sizes. This analytical approach allowed the researcher to explore potential variations in the perceptions of the effectiveness of financial incentives across different company size categories. In addition to the quantitative analysis, the researcher complemented the findings with qualitative insights gathered through stakeholder interviews for each of the aforementioned statements. The ensuing section presents a detailed analysis of each statement.

5.3.1. Effectiveness of Financial Incentives for CPA Congestion Reduction:

The findings from the analysis of the five-point Likert scale responses regarding the statement, "Financial incentives would help reduce congestion and wait times at the CPA gate," reveal distinct trends among different stakeholder groups and company sizes. Among the total pool of 60 respondents (comprising 30 C&F agents and 30 trucking companies), 58% expressed agreement with the statement, indicating that they believe financial incentives would be effective in reducing congestion at the CPA gate. In contrast, 32% of respondents disagree with this statement.

The Assistant Terminal Manager of CPA cited past instances of the slot booking system's ineffectiveness and expressed optimism about the potentiality of financial incentives.

> In the past, we attempted to implement slot booking, but it didn't work out as planned. Port users predominantly wanted to reserve slots for the afternoon, aligning with their customary arrival times. As a result, we had to discontinue the system because of these difficulties. However, I believe that introducing an extra fee for peak-hour bookings, along with offering free slots during off-peak times, might encourage users to choose the off-peak hours. In my view, the implementation of peak-time booking fees would certainly contribute to the reduction of congestion during peak hours. (Assistant Terminal Manager, CPA, 2023).

When examining responses by company size, micro-companies stand out with the highest disagreement rate, as 59% of respondents from this category express disagreement with the statement.

Conversely, respondents from medium-sized companies exhibit the highest level of agreement, with 83% endorsing the idea that financial incentives could alleviate congestion. Additionally, 11% of medium-sized company respondents strongly agree with the statement.

The attitude of respondents from small-sized companies appears to be more balanced, with 60% expressing agreement, 32% disagreement, and 8% remaining neutral on the topic.

C&F agent interviewed respondent mentioned that financial incentives would discourage their peak-time arrival at the port, *“If there were an extra fee for arriving during peak hours, it would make it much simpler to explain to our customers. Consequently, they would be less likely to request container collection during peak times.”* (C&F Agents company respondent, 2023).

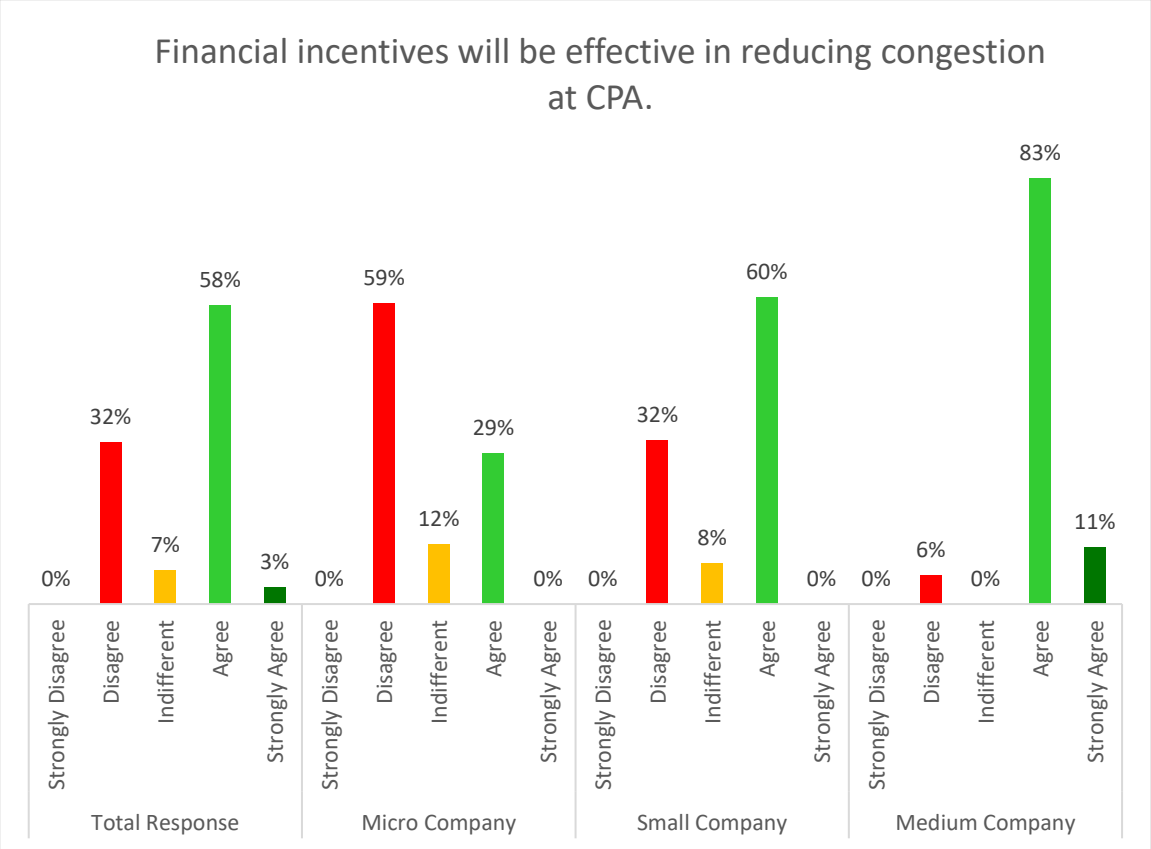
Trucking company interviewed respondent expressed the same notion that financial incentives definitely will help to reduce peak congestion, but the respondent especially emphasized the unavailability of truck parking inside the port, which is creating huge truck traffic in front of the port gate. According to the respondent,

> This kind of incentive system is likely to reduce the frequency of peak-time truck arrivals, although it's essential to acknowledge that we often struggle to stick to schedules due to unpredictable road traffic conditions. So, it is crucial for the port authority to allocate parking space, either within or outside the terminal. Only with such provisions can we ensure that congestion does not disrupt port operations. (Trucking company respondent, 2023).

However, a visual representation of quantitative data analysis is presented in Figure 20.

Figure 20

Financial incentives will be effective in reducing congestion at CPA



5.3.2. Financial Incentives' Effectiveness on Stakeholders' Company Performance

The analysis of responses to the five-point Likert scale statement, "Financial incentives would benefit our overall operations and efficiency," reveals varying viewpoints among the 60 respondents. A majority, constituting 57% of the respondents, express agreement with the notion that financial incentives would enhance their overall operational efficiency.

However, 33% of respondents disagree with this statement. Notably, among respondents from small-sized companies, the highest percentage (48%) disagrees with the statement, with a mix of 40% in agreement, and interestingly, only from this group, 4% strongly disagree.

Conversely, respondents from medium-sized companies exhibit the highest level of agreement, with 78% indicating that financial incentives would be beneficial, while 17% strongly agree.

Among micro-sized companies, 53% agree with the statement, but 35% disagree.

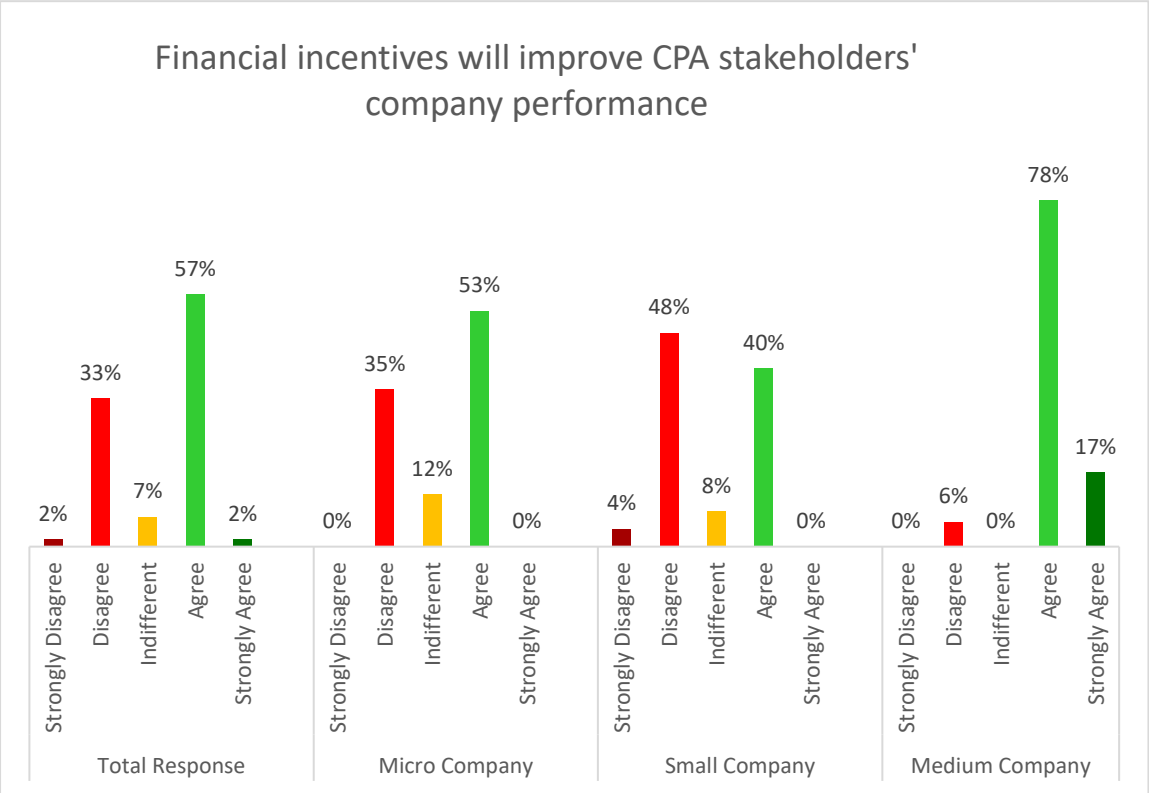
Figure 21 visually represents survey findings.

On the other hand, the interviewed respondent from the trucking company expressed strong alignment with this statement, mentioning that,

> "….we always needed to play the hide-and-seek games with import and export cargo customers. Both parties want us in the daytime. A financial incentive program will give us a platform to negotiate with our clients, and we will able to schedule our operation properly." (Trucking company respondent, 2023).

Figure 21

Financial incentives will improve CPA stakeholders' company performance



5.3.3. Financial Incentives: Influencing Stakeholders' Off-Peak Operational Cost Adjustment:

In the analysis of responses to the five-point Likert scale statement, "Financial incentives would help in managing our off-peak operational costs," a majority, constituting 55% of the respondents, express agreement with the view that financial incentives would be beneficial in the management of off-peak operational costs. In contrast, 32% of respondents disagree with this assertion.

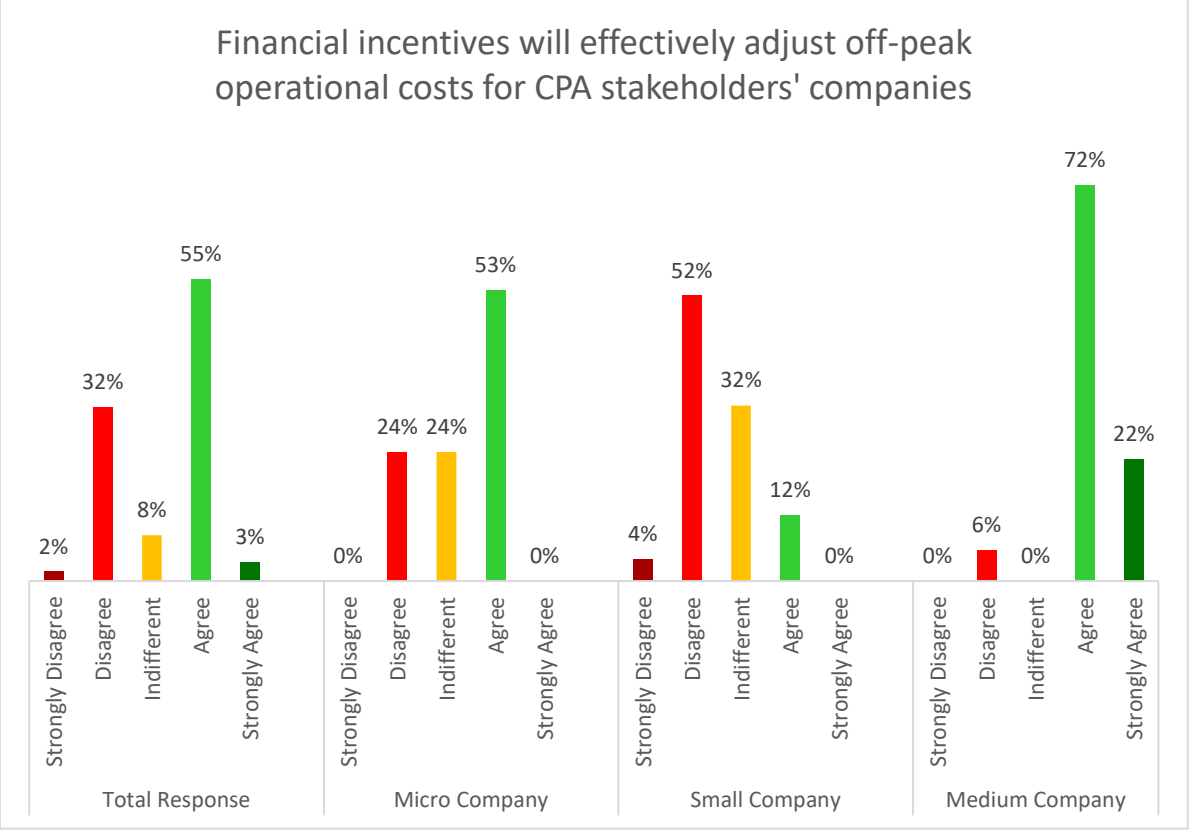
Among respondents from small-sized companies, the highest percentage (52%) disagree with the statement, while only 12% agree. Notably, 4% of the respondents from

this group strongly disagreed with this statement, a unique response not seen in any other group. Respondents from medium-sized companies exhibit the highest level of agreement, with 72% indicating that financial incentives would assist in managing off-peak operational costs, and 22% strongly agree. Within the micro-sized company group, 53% agree, while 24% express disagreement or indifference.

Nevertheless, the trucking company and the C&F Agent interviewed respondents both wholeheartedly concurred with this assertion that financial incentives would help to adjust their off-peak operation cost.
The statistics of findings are visually represented in Figure 22 for clarity and reference.

Figure 22

Financial incentives will effectively adjust off-peak operational costs for CPA stakeholders' companies



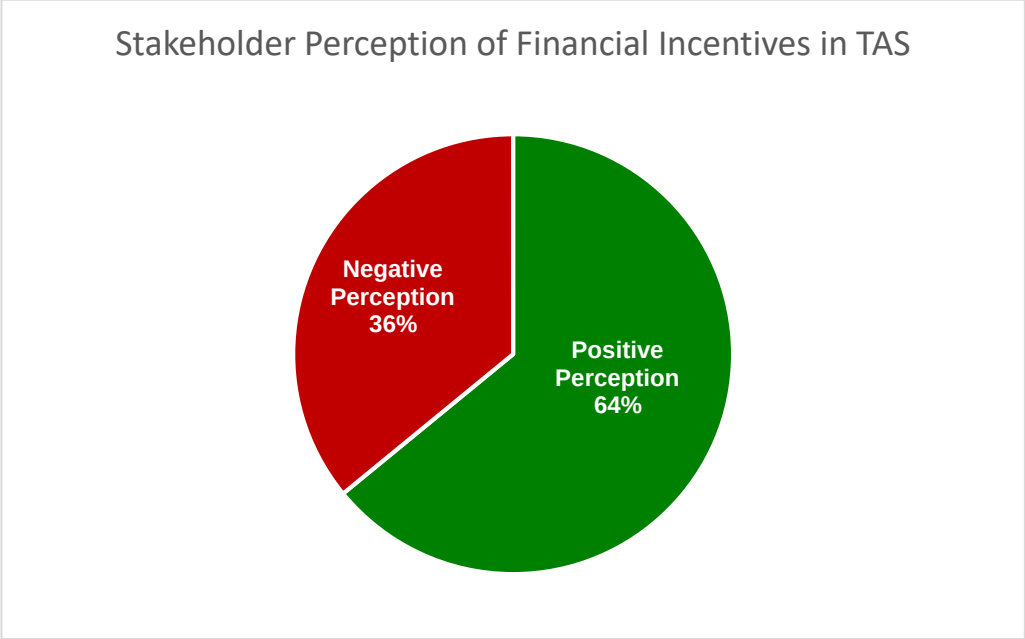
5.3.4. Perception of Financial Incentives in TAS: Statistical Summary:

The analysis of stakeholders' responses to the three Likert scale statements regarding financial incentives reveals significant insights. A combined average of the "agree" and "strongly agree" responses compared to the "disagree" and "strongly disagree" responses for all three statements demonstrates that 64% of stakeholders hold a favorable view toward financial incentives, while 36% maintain a less positive stance (as illustrated in Figure 23).

These findings illuminate the prevailing attitudes within the stakeholder community regarding the potential impact of financial incentives, underlining a notable level of optimism among the majority.

Figure 23

Stakeholder Perception of Financial Incentives in TAS



Note: This calculation of Positive Perception has been derived by adding up the total “agreed” and “Strongly Agreed" percentage for three statement and the same process has been applied to determine the Negative Perception percentage weight. “Indifferent” responses have not included.

5.4. Financial Incentives Acceptance/Resistance Factors:

The examination of factors influencing the acceptance and resistance to financial incentives within the TAS framework provides notable insights. Among the stakeholders surveyed, a significant 83% highlighted "potential benefits on company operations and scheduling" as primary acceptance factors for financial incentives. Additionally, 73% of respondents acknowledged that the feasibility of an increased number of trips will play a pivotal role in their acceptance of financial incentives.

Notably, the option related to "financial benefits for the company" received the least mention as a rationale for embracing financial incentives, and none of the respondents cited the company's sustainability goals as a motivating factor.

C&F agent interviewed respondent mentioned that *"there is no reason to deny this incentive, although there are potential drawbacks lying, but I think this initiative will be beneficial for our company's overall productivity."* (C&F Agents company respondent, 2023). The trucking company interviewed respondent stated the benefits of scheduling their operation, which will allow them to make more trips.

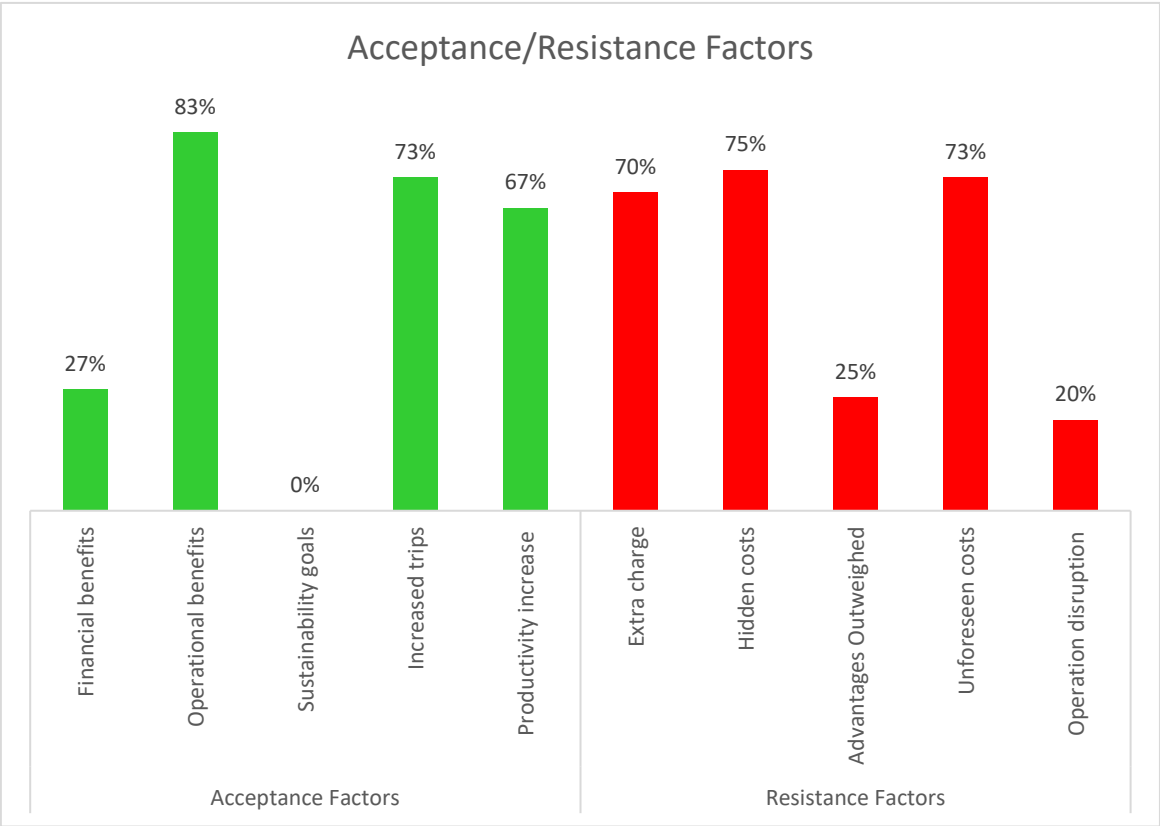
Conversely, resistance factors were also identified, with 75% expressing concerns about "potential drawbacks or hidden costs" and 73% mentioned they are concern about unforeseen expenses.

It is important that the item "Transport company will charge for extra costing", which was dedicated solely for C&F agent respondents, emerged as a specific resistance factor, with 70% of them identifying it as a significant concern.

Figure 24 offers a graphical illustration of the calculation.

Figure 24

Financial Incentives Acceptance/Resistance Factors



Note 1: Code Explanation

	Acceptance factors		Resistance Factors
Financial benefits	Financial benefits for the company	Extra charge	The transport company will charge for extra costing
Operational benefits	Potential benefits on company operations and scheduling	Hidden costs	Concerns about potential drawbacks or hidden costs
Sustainability goals	Alignment with company sustainability goals	Advantages Outweighed	Hidden costs could exceed the advantages of incentives
Increased trips	An increased number of trips will become feasible.	Unforeseen costs	Concerns that unforeseen costs may arise.
Productivity increase	Company productivity will be increased	Operation disruption	Concerns about disruptions affecting operations

Note 2: "Extra Charge" item was only for C&F Agents Respondents

However, the examination of responses related to the influence of company size on the acceptance and resistance factors of financial incentives in TAS offers valuable insights.

Among participants from micro-sized companies, the primary drivers for accepting financial incentives were operational benefits and the potential for an increased number of trips, both holding equal weight at 53%. In contrast, various resistance factors exhibited almost similar importance, with hidden costs and concerns regarding the distribution of operations standing out at 47% and 41%, respectively.

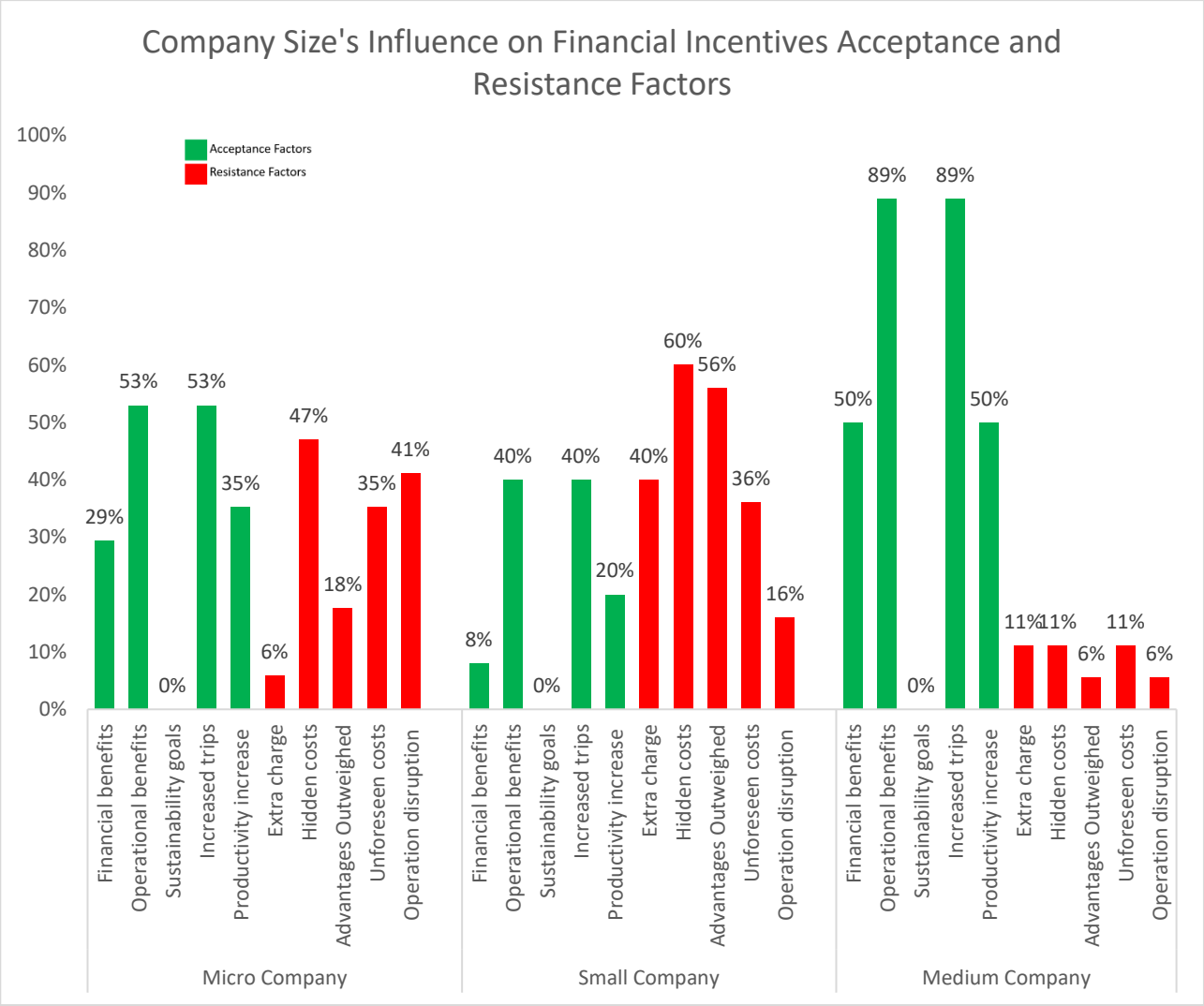
Notably, respondents from small-sized companies displayed the highest resistance levels, with 60% expressing concern about hidden costs and 56% expressing concerns that these hidden costs might outweigh the advantages of the incentives. This group showed the lowest inclination towards acceptance factors, with only 40% acknowledging the potential benefits of financial incentives for their company's operations, scheduling, and trip numbers.

On the other hand, respondents from medium-sized companies favored acceptance factors, earning this group the highest acceptance score. Operational benefits and the prospect of increased trips were the predominant acceptance factors, with 89% of respondents marking these as influential. This group also exhibited the fewest respondents who cited resistance factors.

Figure 25 provides a statistical overview of the influence of company size on the acceptance and resistance factors.

Figure 25

Company Size's Influence on Financial Incentives Acceptance and Resistance Factors



Note 1: Code Explanation

	Acceptance factors		Resistance Factors
Financial benefits	Financial benefits for the company	Extra charge	The transport company will charge for extra costing
Operational benefits	Potential benefits on company operations and scheduling	Hidden costs	Concerns about potential drawbacks or hidden costs
Sustainability goals	Alignment with company sustainability goals	Advantages Outweighed	Hidden costs could exceed the advantages of incentives
Increased trips	An increased number of trips will become feasible.	Unforeseen costs	Concerns that unforeseen costs may arise.
Productivity increase	Company productivity will be increased	Operation disruption	Concerns about disruptions affecting operations

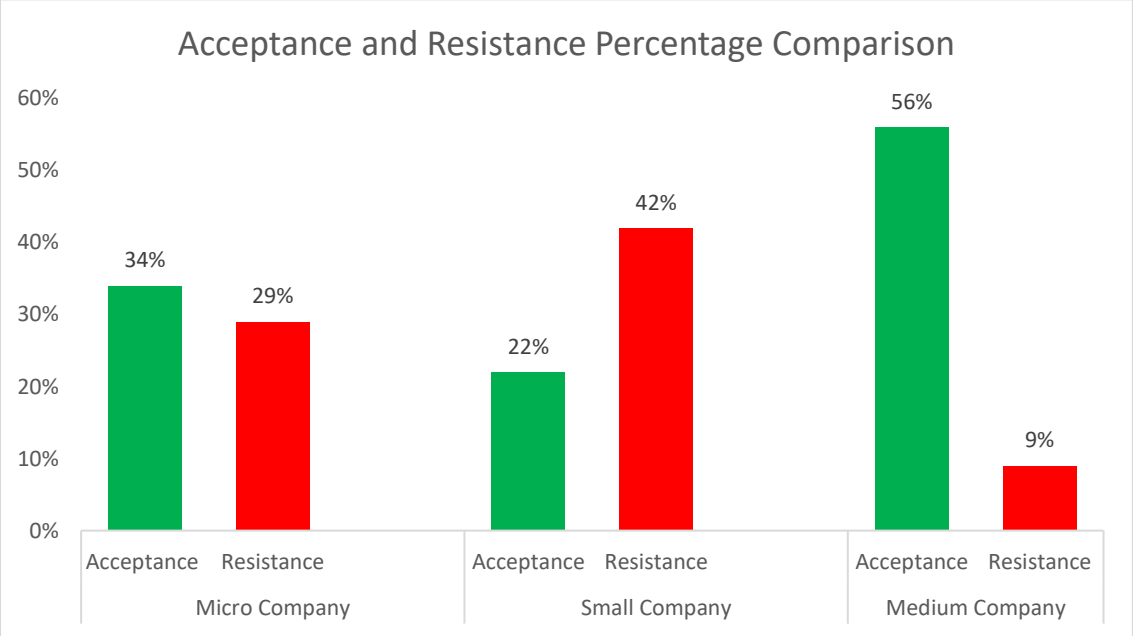
Note 2: "Extra Charge" item was only for C&F Agents Respondents

To further evaluate the differences in acceptance and resistance factors among respondents of varying company sizes, a comprehensive comparison was conducted. This involved summing and averaging the percentages of all acceptance and resistance factors. Figure 26 illustrates the findings, indicating that medium-sized company respondents had the highest acceptance percentage at 56% and the lowest resistance percentage, standing at only 9%.

Conversely, micro-sized companies demonstrated nearly equivalent percentages for acceptance and resistance, at 34% and 29%, respectively. Small-sized companies, on the other hand, showcased a notably higher resistance percentage, nearly double that of their acceptance percentage. This suggests that resistance factors related to financial incentives were more prevalent among respondents from small-sized companies.

Figure 26

Acceptance and Resistance Percentage Comparison

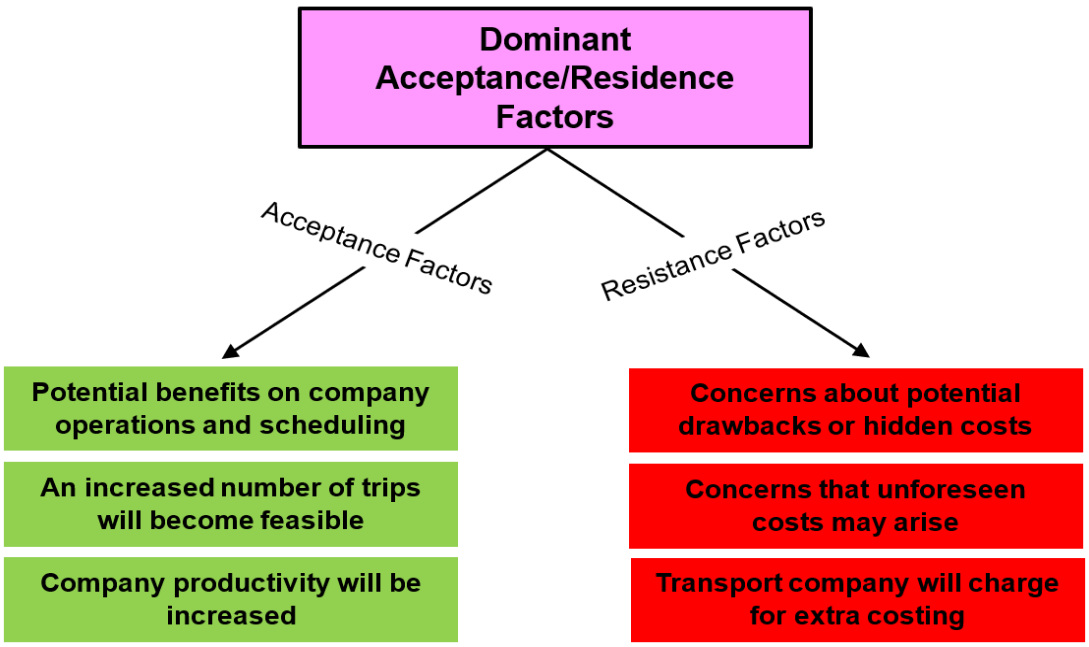


Note: This calculation for Acceptance percentage weight has been derived by adding up the total acceptance percentage and averaging it based on the number of factors, and the same process has been applied to determine the resistance factors' percentage weight.

To provide a clear visual representation, Figure 27 presents a concise overview of the dominant acceptance and resistance factors. These insights shed light on the complex dynamics surrounding the acceptance and resistance to financial incentives in the TAS context.

Figure 27

Dominant Acceptance/Resistance Factors



The concise overview of acceptance and resistance factors, as shown in Figure 25, indicates that dominant acceptance factors include the potential benefits of enhancing company operations and scheduling, the feasibility of increasing the number of trips, and the expectation of increased company productivity. Dominant resistance factors encompass concerns about potential drawbacks or hidden costs, worries regarding unforeseen expenses, and, specifically for C&F agents, the concern that transport companies will charge extra cost.

Chapter 6

Discussion and Implications

6.1. Factors influencing truck arriving at peak hour:

- The findings of this study indicated that C&F agents prioritize port-related decisions and emphasize the importance of timely information from the port. Phan & Kim (2015) mentioned the primary cause of port congestion is the inefficient exchange of real-time information with port stakeholders.

  On the other hand, the result shows that trucking companies are predominantly influenced by customer preferences and driver availability. Holguin-Veras et al. (2005) found that customer preference is the dominant factor, according to their study, due to the delivery deadlines set by receivers, who often do not care about the challenges faced by trucking firms to complete deliveries on time, truckers must operate throughout the day.

  Schulte et al. (2017) also point out that peak-time congestion at ports is primarily caused by a lack of coordination among truckers. Terminal Operators have little control and typically do not impose constraints on truck arrival times (Chen & Jiang, 2016), and port stakeholders want to optimize their schedule based on their opening hours (Davies & Davies, 2009), which is causing peak congestion. The insights from the Assistant Terminal Manager of CPA further underscore the intricate challenges faced by both groups, highlighting the need for enhanced coordination and communication to optimize port operations and alleviate congestion. For this study context, there is a lack of coordination among various stakeholders, which is putting pressure on port operations. However, these results emphasize the complexity of the supply chain ecosystem and the varying priorities of its key stakeholders in shaping arrival time dynamics at the port.

- The findings from the survey on nighttime deliveries at Chittagong port also highlight several key challenges and priorities for stakeholders. For C&F agents, the unavailability of customs staff stands out as the foremost issue, leading to delays in obtaining essential signatures for cargo clearance. Additional transportation costs and cargo loading delays weighed heavily on their operations, with concerns about port staff availability and perceived reduced efficiency during nighttime operations. In contrast, trucking companies express worries about increased driver costs and additional expenses for staff overtime and utilities during nighttime shifts. Despite these challenges, they recognize the advantages of nighttime operations but face the hurdle of customer expectations for daytime deliveries.

  A comprehensive review of several research studies on the perspectives and difficulties experienced by private stakeholders with respect to off-peak operations was presented by Holgun-Veras et al. in 2005, such as customer requirements, workforce scheduling, infrastructure limitations, noise pollution, retailer resistance, regulatory restrictions, increased security risks. In addition, extra costs for staff overtime utility bills were also issues to restrain stakeholders from doing nighttime operations.
  Interestingly, none of the trucking companies mention safety concerns, limited visibility, parking difficulties, or regulatory restrictions, suggesting that these specific issues may not be prevalent in their experiences at Chittagong port during nighttime hours. In contrast to previous research, this distinct conclusion may have resulted from variations in national regulatory laws.

- Survey findings on slot booking preferences at Chittagong Port reveal distinct priorities for C&F agents and trucking companies. Trucking companies prioritize customer requirements and efficient return trip calculations, factoring in peak hours. In contrast, C&F agents prioritize cargo readiness and customs clearance, with consideration for peak traffic hours and transport availability.

The arrival decisions of Chittagong Port stakeholders during peak hours are shaped by distinct factors. C&F agents prioritize timely information from the port and efficient coordination to optimize operations, while trucking companies are primarily influenced by customer preferences and driver availability. The lack of coordination among stakeholders contributes to port congestion, underscoring the need for enhanced communication. Nighttime deliveries pose challenges such as the unavailability of customs staff for C&F agents and increased driver costs for trucking companies.

These preferences highlight the need for the CPA to streamline cargo readiness and customs procedures, manage peak traffic hours, and facilitate efficient scheduling for both stakeholder groups. Additionally, maintaining a customer-centric approach and providing scheduling flexibility can enhance overall service satisfaction and logistics efficiency.

6.2. Stakeholder Perception of Financial Incentive in TAS:

- The findings of this study highlight that a majority of stakeholders believe financial incentives could effectively alleviate congestion at the CPA gate. This includes implementing premium fees for peak-hour bookings and offering complimentary slots during off-peak times. The perspective of the Assistant Terminal Manager of CPA also underscores the potential of this approach.

  PierPASS OffPeak, an incentive program aimed at alleviating peak congestion in the USA, proved to be highly effective. Initially targeting a rerouting of approximately 15% to 20% of freight transportation to off-peak time slots in its first year, the program exceeded expectations by successfully diverting 30% to 35% of cargo to off-peak hours within the same period. (Giuliano & O'brien, 2008a; Giuliano & O'brien, 2008b; Mani & Fischer, 2009). On the other hand, Israel achieved favorable outcomes through the introduction of the "Good Night" incentive program, which encouraged off-peak activities. Prior to its implementation, nighttime container transfers stood at 3.7%, but after the program's launch, this figure rose significantly to 7.9% (Bentolila et al., 2016).

However, micro-companies are more skeptical, with a higher rate of disagreement. Interviewed C&F agents and trucking companies see financial incentives as a way to encourage off-peak arrivals, but they stress the importance of addressing issues like truck parking and unpredictable road conditions. To successfully reduce congestion, the CPA should consider a balanced approach that accommodates varying stakeholder viewpoints while addressing practical challenges.

According to José Holguín-Veras et al. (2005), effective policy formulation starts with precisely describing the policy objective, specifically referring to the specific subset of the population or economy that policymakers want to influence and alter their conduct. It is of utmost importance to ascertain the potential difficulties or challenges that stakeholders may encounter when considering adopting an off-peak cargo pick-up system from the port from their perspective.
Although the findings of this study indicate that financial incentives hold promise for congestion reduction at the CPA gate, but their effectiveness depends on a carefully tailored approach that considers stakeholder diversity, addresses operational issues, and aligns customer expectations. Such an approach can lead to improved port efficiency and customer satisfaction.

- The findings on the perception of financial incentives and their impact on overall operational efficiency reveal a diverse range of viewpoints among the respondents. While a significant portion believes that financial incentives could enhance operational efficiency, a notable portion disagrees.

  Holguín-Veras et al. (2007) discovered in their study that companies engaged in primary lines of business, such as shippers, third-party logistics providers, trucking companies, larger carriers with a greater number of employees, and carriers who utilize their own vehicles, exhibit a notable inclination towards engaging in off-peak operations.

For this study, the responses from different-sized companies also varied, with small-sized companies showing the highest level of disagreement and medium-sized companies expressing strong agreement. Interestingly, the interviewed trucking company respondent strongly supports the idea of financial incentives, citing their potential to facilitate better scheduling and negotiation with clients. These diverse opinions underscore the importance of considering the specific needs and challenges of different companies when designing incentive programs and fostering effective communication channels.

- The findings of this study also reveal diverse perspectives among stakeholders regarding the effectiveness of financial incentives in managing their off-peak operational costs. While a majority see the potential benefits, especially medium-sized companies, others, particularly small-sized companies, express disagreement. Notably, the interviewed trucking company and C&F Agent respondents strongly support the idea of financial incentives as a practical means to adjust off-peak operational costs.

  In their research on Israel's "Good Night" program, Bentolila et al. (2016) discovered that the incentive is nearly equivalent to the external utility of the market and is only feasible for large-scale exporters. This economic model was not feasible for small and medium-scale customers.
  However, for this study context, the possible explanation for strong supportive view of the interviewed respondents is that they both are from medium-sized companies.

  In this circumstance, these findings underscore the importance of a flexible and customized approach, acknowledging the varying viewpoints of different-sized companies and the need for further exploration and evaluation of incentive programs to ensure they effectively address off-peak operational cost management within the port ecosystem.

Nevertheless, the stakeholders' responses and perceptions of financial incentives provide a clear picture of prevailing attitudes within the Chittagong Port community. A significant majority of stakeholders hold a positive view of financial incentives, demonstrating a notable level of optimism about their potential impact on port operations and efficiency. This widespread optimism suggests that stakeholders believe financial incentives can yield favorable outcomes.

From a global perspective, in the case of Sweden, prior to the trial of the Stockholm congestion cordon pricing, the approval rate was less than 30%, but it rose to over 52% at the conclusion of the trial, and pre-implementation of Congestion pricing (VPPP) in the USA, public opinion studies have shown that around 70% of the population has a negative stance toward congestion pricing. Nevertheless, with the implementation and execution of congestion pricing, the rejection rate decreases to around 30% (Federal Highway Administration, 2008).

On the other hand, the people of Norway initially showed a 37% positive attitude toward the Norwegian Trondheim toll cordon program, but later on, only 19% showed a positive attitude, and this potential traffic management system was removed because the project lost public support (Tretvik, 2006).

Lessons learned from Norway, it is essential for the Chittagong Port Authority also to acknowledge the 36% who maintain a less positive stance or express reservations, emphasizing the importance of addressing their concerns and providing a balanced approach when implementing financial incentive programs.

6.3. Acceptance/Resistance Factors of Financial Incentives in TAS:

The analysis of acceptance and resistance factors reveals that prominent acceptance factors comprise the potential for improved company operations, increased trip feasibility, and expectations of enhanced productivity. Key resistance factors involve concerns about potential downsides, unexpected expenses, and, notably among C&F agents, apprehensions about additional charges by transport companies.

In the study conducted by Holguín-Veras et al. (2007), it was found that companies in the transportation industry prefer off-peak deliveries primarily due to the potential for increased productivity within their organizations. They also recognize the benefits of realizing economies of scale, conducting a greater number of trips, and effectively meeting customer demands through off-peak operations.

This study also produced comparable results and these findings hold significant implications for the design and implementation of financial incentive programs at Chittagong Port. Stakeholders clearly prioritize the enhancement of operational efficiency and schedule when considering the acceptance of incentives, emphasizing their practical outlook. The importance placed on the feasibility of increasing trips underscores the need for incentives to directly contribute to optimizing transport logistics. Notably, the least emphasized factor was direct financial benefits for the company, suggesting that stakeholders prioritize operational enhancements over monetary gains. To ensure the successful adoption of incentive programs, Chittagong Port Authority should structure incentives to align with operational needs, address concerns about potential drawbacks, and communicate how the incentives will enhance day-to-day operations, all while recognizing the varying priorities and concerns of different stakeholders.

On the other hand, Company size appears to influence these factors, with micro-sized companies prioritizing operational benefits and the possibility of increased trips in their acceptance of financial incentives. Small-sized companies show higher levels of resistance, with concerns about hidden costs outweighing potential advantages. In contrast, medium-sized companies show the highest acceptance levels, emphasizing operational benefits, the potentiality of increased trips, and the least resistance.

These findings suggest that the effectiveness of financial incentives in influencing stakeholder behavior may vary according to the size of the companies involved. Medium-sized companies, with their higher acceptance levels, may be more amenable to adopting incentive programs, potentially leading to more successful implementation. Smaller companies may require additional reassurances or tailored approaches to address their concerns about hidden costs. Understanding these dynamics is crucial for designing incentive programs that cater to the specific needs and concerns of different-sized companies.

Chapter 7

Recommendations and Conclusion

Conclusion:

In conclusion, this dissertation has comprehensively examined a pressing concern at Chittagong Port: the way stakeholders perceive and interact with financial incentives within the Truck Appointment Systems (TAS) to mitigate peak-time truck arrival congestions.

As the largest seaport in Bangladesh, Chittagong Port plays an essential role in the nation's economy by handling the lion's share of import-export trade and serving as a vital link to global markets. However, its exponential growth in cargo volume has brought both opportunities and challenges, most notably, the escalating problem of congestion at the port gate and inside the terminals.

This study has effectively untangled the complex web of factors influencing truck arrival patterns during peak hours at Chittagong Port. Among C&F agents, port-related decisions and customs clearance timing emerged as key determinants of arrival timing. For trucking companies, customer decisions and driver availability took priority. These insights underscore the multifaceted nature of the decision-making process, indicating that cargo readiness at the port, customs clearance procedures, stakeholder customer preferences, and the availability of port operational facilities all play pivotal roles in dictating arrival times. The challenges faced during nighttime operations, as identified by stakeholders, highlighted the necessity for a thorough strategy to address operational issues and customer expectations effectively.

The research findings have shed light on stakeholders' perspectives regarding the effectiveness of financial incentives in reducing congestion at Chittagong Port. The

majority of respondents believed that financial incentives could indeed alleviate congestion, with particular optimism among medium-sized companies. However, micro-companies showed a higher degree of cynicism, emphasizing the importance of addressing practical challenges. Furthermore, the study uncovered diverse viewpoints on the potential impact of financial incentives on stakeholders' company performance and off-peak operational costs. While a majority anticipated benefits, the complex responses of small-sized companies highlighted the need for tailored incentive programs that consider the specific needs of different-sized companies.

The statistical analysis provided a compelling picture of stakeholder attitudes, revealing that a significant majority (64%) hold a favorable view of financial incentives. These findings suggest that stakeholders perceive financial incentives as a promising solution to address port congestion and improve efficiency.

Lastly, the examination of financial incentives acceptance and resistance factors explained the motivations behind stakeholders' views. Key acceptance factors included the potential benefits of enhancing company operations and scheduling, the feasibility of increasing the number of trips, and the expectation of improved company productivity. On the other hand, resistance factors encompassed concerns about potential drawbacks or hidden costs, worries regarding unforeseen expenses, and, uniquely among C&F agents, the fear of transport companies charging extra costs.

Future Study Recommendations:

- The scope of this study was limited to trucks related to import containers. Future research could expand its focus by incorporating export-related trucks and representatives from bulk cargo trucking.

- The interview participants in this study were primarily from medium-sized companies. To gain a more comprehensive perspective, it can be suggested for future research to engage representatives from companies of diverse sizes.

- This study's findings indicate that the majority of port stakeholders are perceiving financial incentives positively. So, future studies can be conducted to investigate the strategy of technical implementation of financial incentives in TAS.

- As the findings of this study showed, stakeholders' company size impacts their decision-making on financial incentives acceptance/resistance; future studies can be conducted to investigate what type of incentives will meet all groups of stakeholders' expectations.

- The study's findings highlight the diversity in priorities and concerns among companies of different sizes. By forming strategic alliances, trucking companies can yield numerous benefits. So, future studies can investigate the perception of logistics companies, especially trucking companies, on forming strategic alliances. Moreover, future studies can further investigate the barriers behind the formation of strategic alliances of logistics companies.

- Further study can be done by evaluating the economic impact of reduced congestion and improved efficiency at CPA from a financial incentive program. This could involve a cost-benefit analysis to quantify the financial benefits for the port, trucking companies, and other stakeholders.

Recommendations for CPA:

Pilot Financial Incentive Program:

As the majority of stakeholders of this study hold a positive attitude towards financial incentives in TAS, CPA can consider launching a pilot financial incentive program to test its effectiveness in reducing congestion. This allows for testing, gathering real-world data, and fine-tuning program elements based on practical experience.

Data-Driven Decision Making:

CPA should Collect and analyze data on nighttime operations to identify bottlenecks and areas for improvement. Data-driven decision-making can lead to more effective solutions and resource allocation.

Improve Port Staff Availability:

Efforts should be made to ensure that essential port staff, including cargo loaders, are available during nighttime operations. This can help reduce delays and improve the overall efficiency of cargo handling at the port.

Establish Feedback Mechanism:

Implement a robust feedback mechanism and dedicated feedback channels for both C&F agents and trucking companies to share their experiences that enable stakeholders to report issues and provide input on improving nighttime operations. This continuous feedback loop will facilitate ongoing problem-solving and enhancement.

Address Infrastructure Issues:

CPA should work on addressing practical issues mentioned by C&F agents and trucking companies, such as truck parking and road conditions. Allocating adequate parking space and improving road infrastructure can complement the incentive program and further reduce congestion.

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Appendix-1

Survey Questionnaire for Customs Clearing & Forwarding Agents Company

Dear Respondent,

I sincerely appreciate your willingness to participate in this research study. Your participation is highly valuable for my study project. Your valuable insights will play a crucial role in contributing to the enhancement of port operations and addressing the challenges posed by high truck arrival frequency at Chittagong Port during peak hours.

I kindly request you to respond to the following questionnaire to the best of your knowledge and experience.

Section 1: Company Information

1. Do you have your own transportation to take delivery from CPA?

1. Yes
2. No

If Yes, please respond to the question no. 2

2. How many trucks does your company have?

1. 1 truck
2. 2-5 trucks
3. 6-15 trucks
4. 16-30 trucks
5. 31+ trucks

3. How many employees are in your company?

1. 1 employee (Owner/staff)
2. 2-10 employees
3. 11-30 employees
4. 31-60 employees
5. 61+ employees

Section 2: Truck Arrival Patterns and Challenges

4. How frequently do you take cargo delivery at Chittagong Port?

1. Daily
2. 2-4 times a week
3. Weekly
4. Rarely or Less than once a week

5. When you are renting a truck from a trucking company, which method do you use for the rental?

1. Hourly rental
2. Per trip rental
3. Daily rental
4. I don't rent trucks

6. What is the typical time of day for calling the trucks to come to Chittagong Port?

1. Morning
2. Evening
3. Night
4. No fixed schedule

7. What factors determine the timing for calling the trucks to Chittagong Port?
Please select all that apply:
1. My Management Team's decision
2. Port decision
3. Customs clearance timing
4. Trucking Company decision
5. Destination Customer Preference

8. Are you familiar with the peak congestion hours at Chittagong Port?
1. Yes, I am well aware of the peak congestion hours.
2. I have some knowledge about the peak congestion hours.
3. I am not sure about the peak congestion hours.
4. No, I am not aware of the peak congestion hours.

9. What potential issues could arise if your company takes nighttime (off-peak time) delivery from the port? Please select all that apply:

1. Delivery delays to the destination
2. Destination customer's preference at daytime
3. Port cargo loading delays
4. Less efficient port operation at nighttime
5. Port staff unavailability
6. Customs staff unavailability
7. Increased transportation costs
8. Limited visibility and safety concerns
9. Allocation of extra office staff
10. Difficulty in finding parking at the destination
11. Communication challenges with partners and clients
12. Regulatory restrictions during nighttime hours
13. Other (please specify)_____

Section 3: Truck Appointment System (TAS) and Financial Incentives

10. Currently, you are providing detailed information about your truck's arrival in the Port Community System (PCS) of Chittagong Port, especially on which day your truck will arrive. But PCS does not have any information about arrival time and how long you will stay inside the port. If there is a time slot at PCS, and you have to make an appointment at a specific time slot, what do you keep in mind when making an appointment? Please select all that apply:

1. Customs and clearance procedures
2. Readiness of Cargo
3. Cargo handling and processing times
4. Peak traffic hours at the port
5. Availability of loading/unloading facilities
6. Transport/trucks availability
7. Company staff working hours
8. Customer requirements and preferences
9. Coordination with other scheduled tasks
10. Other (please specify) _____

11. What is your perception regarding this financial incentive policy?
Please rate each statement:

	(1) Strongly Disagree	(2) Disagree	(3) Indifferent	(4) Agree	(5) Strongly Agree
Financial incentives would help reduce congestion and wait times at the CPA gate.					
Financial incentives would benefit our overall operations and efficiency.					
Financial incentives would help to adjust our off-peak operation cost					

12. What factors would influence your company's acceptance or resistance towards financial incentives in the Truck Appointment System? Please select all that apply:

1. Financial benefits for the company
2. Potential benefits on company operations and scheduling
3. Alignment with company sustainability goals
4. An increased number of trips will become feasible
5. Company productivity will be increased
6. The transport company will charge for extra costing
7. Concerns about potential drawbacks or hidden costs
8. Hidden costs could exceed the advantages of incentives
9. Concerns that unforeseen costs may arise
10. Concerns about disruptions affecting operations
11. Other (please specify) _____

Thank you for your time and participation.

Appendix-2

Survey Questionnaire for Trucking Company

Dear Respondent,
I sincerely appreciate your willingness to participate in this research study. Your participation is highly valuable for my study project. Your valuable insights will play a crucial role in contributing to the enhancement of port operations and addressing the challenges posed by high truck arrival frequency at Chittagong Port during peak hours.
I kindly request you to respond to the following questionnaire to the best of your knowledge and experience.

Section 1: Company Information

1. How many trucks does your company have?
1. 1 truck
2. 2-5 trucks
3. 6-15 trucks
4. 16-30 trucks
5. 31+ trucks

2. How many employees are in your company?
1. 1 employee (Owner/Driver)
2. 2-10 employees
3. 11-30 employees
4. 31-60 employees
5. 61+ employees

Section 2: Truck Arrival Patterns and Challenges

1. How frequently do your trucks arrive at Chittagong Port?
1. Daily
2. 2-4 times a week
3. Weekly
4. Rarely or Less than once a week

2. Which rental method do you offer for trucks to customers?
1. Hourly rental
2. Per trip rental
3. Daily rental

3. What is the typical time of day for dispatching trucks to Chittagong Port?
1. Morning
2. Evening
3. Night
4. No fixed schedule

4. What factors determine the time to arrive at Chittagong port to pick up the cargo?
Please select all that apply:
1. My Management Team's decision
2. Port decision
3. Customer decision

4. Driver Availability
5. Automated scheduling system

5. Are you familiar with the peak congestion hours at Chittagong Port?
1. Yes, I am well aware of the peak congestion hours.
2. I have some knowledge about the peak congestion hours.
3. I am not sure about the peak congestion hours.
4. No, I am not aware of the peak congestion hours.

6. What potential issues could arise if trucks are dispatched during the night shift (off-peak time)? Please select all that apply:

1. Delivery delays to destinations
2. Increased driver costs
3. Extra costing for staff overtime and utility bill at night
4. Port cargo loading delays due to the unavailability of enough port staff
5. Limited visibility and safety concerns
6. Higher fuel and maintenance costs
7. Difficulty in finding parking at the destination
8. Regulatory restrictions during nighttime hours
9. Communication challenges with partners and clients
10. Other (please specify)_____

Section 3: Truck Appointment System (TAS) and Financial Incentives

7. Currently, you are providing detailed information about your truck's arrival in the Port Community System (PCS) of Chittagong Port, especially on which day your truck will arrive. But PCS does not have any information about arrival time and how long you will stay inside the port. If there is a time slot at PCS, and you have to make an appointment at a specific time slot, what do you keep in mind when making an appointment? Please select all that apply:

1. Customer requirements and preferences
2. Availability of loading/unloading facilities
3. Peak traffic hours at the port
4. Driver availability and work hours
5. Readiness of Cargo
6. Cargo handling and processing times
7. Return trip schedules
8. Coordination with other scheduled tasks
9. Other (please specify) _____

9. What is your perception regarding this financial incentive policy?
Please rate each statement:

	(1) Strongly Disagree	(2) Disagree	(3) Indifferent	(4) Agree	(5) Strongly Agree
Financial incentives would help reduce congestion and wait times at the CPA gate.					
Financial incentives would benefit our overall operations and efficiency.					
Financial incentives would help to adjust our off-peak operation cost					

10. What factors would influence your company's acceptance or resistance towards financial incentives in the Truck Appointment System? Please select all that apply:

1. Financial benefits for the company
2. Potential benefits on company operations and scheduling
3. Alignment with company sustainability goals
4. An increased number of trips will become feasible.
5. Company productivity will be increased
6. Concerns about potential drawbacks or hidden costs
7. Hidden costs could exceed the advantages of incentives
8. Concerns that unforeseen costs may arise.
9. Concerns about disruptions affecting operations
10. Other (please specify) _____

Thank you for your time and participation.

Appendix-3

Interview Questions Guidelines for Port Authority Respondent

RQ. 1

1. What is the reason for the highest number of truck arrival frequency at a particular time of the day? What factors influence the stakeholders to come to the port at peak time?

2. Trucking companies and C&F provide their truck arrival information in advance via the port community system (PCS). But who decides at what specific time they will arrive at the port?

RQ. 2

3. *Various studies have shown that even after the truck appointment system is in operation, trucking companies book their slots at peak time and the demand for booking at off-peak time is less. This causes port resources to be underutilized during off-peak time and peak time congestion as well. To face this challenge, if a financial incentive program is introduced along with the truck appointment system, e.g, gate fees are free for bookings during off-peak hours and extra fees for peak-hour bookings.*
   Could this type of financial incentive program influence the port stakeholders coming to the port at off-peak time?

4. Could you share your insights on how port stakeholders might respond to introducing such financial incentives in the truck appointment system?

RQ. 3

5. What are the key factors that influence stakeholder acceptance and resistance to financial incentives in truck appointment systems?

Appendix-4

Interview Questions Guidelines for Customs Clearing & Forwarding Agent Company Respondent

RQ. 1

1. What is the reason for the highest number of truck arrival frequency at a particular time of the day? What factors are influencing your company's decision to come to the port at peak time?

2. Trucking companies and C&F provide their truck arrival information in advance via the port community system (PCS). But who decides at what specific time trucks should arrive at the port?

3. If there is a time slot at Port Community System (PCS), and you have to make an appointment at a specific time slot, what do you keep in mind when making an appointment?

RQ. 2

Presently, there is an entrance fee required to access the port. If Chittagong Port introduces a financial incentives policy to reduce peak time truck arrival frequency, where gate fees are free for bookings during off-peak hours and extra fees for peak-hour bookings. The purpose of this extra charge is not to generate additional revenue for the Chittagong Port Authority (CPA) but solely to encourage bookings during the free off-peak hours.

4. What is your perception regarding this financial incentives policy?
    - I. From your point of view, how likely do financial incentives help reduce congestion and wait times at the CPA gate?
    - II. Could you share your insights on the potential advantages or drawbacks financial incentives might bring to your overall operations and efficiency?
    - III. From your understanding, how do you think financial incentives might impact the adjustment of your operational costs during off-peak periods?

RQ. 3

5. What factors would influence your company's acceptance or resistance towards financial incentives in the Truck Appointment System?

Appendix-5

Interview Questions Guidelines for Trucking Company Respondent

RQ. 1

1. What is the reason for the highest number of truck arrival frequency at a particular time of the day? What factors are influencing your company's decision to come to the port at peak time?

2. Trucking companies and C&F provide their truck arrival information in advance via the port community system (PCS). But who decides at what specific time trucks should arrive at the port?

3. If there is a time slot at Port Community System (PCS), and you have to make an appointment at a specific time slot, what do you keep in mind when making an appointment?

RQ. 2

Presently, there is an entrance fee required to access the port. If Chittagong Port introduces a financial incentives policy to reduce peak time truck arrival frequency, where gate fees are free for bookings during off-peak hours and extra fees for peak-hour bookings. The purpose of this extra charge is not to generate additional revenue for the Chittagong Port Authority (CPA) but solely to encourage bookings during the free off-peak hours.

4. What is your perception regarding this financial incentives policy?
    - I. From your point of view, how likely do financial incentives help reduce congestion and wait times at the CPA gate?
    - II. Could you share your insights on the potential advantages or drawbacks that financial incentives might bring to your overall operations and efficiency?
    - III. From your understanding, how do you think financial incentives might impact the adjustment of your operational costs during off-peak periods?

RQ. 3

5. What factors would influence your company's acceptance or resistance towards financial incentives in the Truck Appointment System?