

# Special handling and container terminals operations productivity: An exploratory study of a large container terminal in Morocco.

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## Abstract

Utilizing an action research methodology, the present paper aims to offer insights into the matter of special handling and its impact on the productivity of container terminals. Through an exploratory qualitative empirical phase, we seek to establish an empirical model that elucidates the factors that influence the utilization of special handling by container terminals. Based on the research findings, it can be concluded that achieving favorable productivity outcomes is dependent on various critical factors such as safety, the category of the container (Transshipment or Export), training of handling agents, as well as the experience and coordination of the team, all of which require robust managerial support.

**Keywords:** *Container terminals, Maritime operations, Special handling, Ports productivity.*

## 1. Introduction

Nowadays, scientific work on performance measurement in ports and terminals has attracted researchers. The study of port performance and terminals productivity can be considered as a segment well established in the relative academic literature to ports in terms of number of publications (Mary R. Brooks ,Tony Schellinck & Athanasios A. Pallis 2011).

Following the development of technological tools oriented logistics of container terminals, the growth of port development has been exponential in recent years. Thus, actors of logistics operations within container terminals interrogate the relevance of these investments, which affect the modernization of the ports logistics services in particular.

In Morocco, container terminals within Tangier Med Port are aligning with this trend and continue to handle containers with high-tech means. Also the same terminals can handle some type of operations as the break bulks, out-of-gauge containers (OOG), damaged containers..., by using several special handling tools. This observation leads

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us to formulate our general research problem question as follows: How does special handling affect the level of productivity in a container terminal?

This paper presents the results of an exploratory qualitative study of a container terminal at Tangier Med Port in Morocco, which focuses on the contribution of special handling to the productivity of container terminals. Therefore, we begin with a synthesis of the literature, which studies means of handling management in general, container terminal productivity and logistics performance also we will present the empirical framework, as well as the main results achieved and finally, we will reveal some contributions and perspectives of this research.

## 2. Theoretical and conceptual framework

Research works confirm that the means of handling in general contribute to the productivity of companies and organisations. Otherwise, our research mobilizes as a frame of reference the works relating to the use of the means of handling, as well as the works that have treated the issue of port and terminal productivity.

### 2.1 Management of special handling

During our documentary investigations, we noticed that in some books the activity of handling is essentially approached from a technical and operational approach. This approach requires divergent methods and processes that are applicable and specific to this field.

Patrick MIANI, Nadine VENTURELLI (2021), in his book "Transport logistics" as well as Lionel AMODEO et Farouk YALAOUI (2005) in his book "Internal logistics of warehousing and handling" and Joël SOHIER, Devan SOHIER (2017) in his book "Logistics", the activities of handling are defined and studied under this name. These books also talk about the issues relating to materials by taking into account the technical characteristics of each piece of equipment and the modes of handling.

So we can give the below definition to the handling operation according to above authors : It is all loading and discharging operations from the arrival of goods to the stowage on board of the vessel or the storage on the container terminals yard.

## 2.2 Container terminals productivity measuring

As per an economic point of view, *“The measuring of the productivity of seaports should involves the measuring of the relationship between inputs and outputs in the production cycle using empirical data. By measuring current production levels in relation to theoretical potential return. This is usually measured by calculating the optimal level of technical performance of the seaport”* (W. K. Talley, 1994).

Moreover, CNUCED (1976) proposed that productivity indicators and efficiency have been widely adopted as measures of port performance by researchers. Furthermore, port performance indicators are classified into two main categories: financial and operational.

Financial indicators measure the quantitative contribution of a port to the economic activity, while operational indicators assess the efficiency of port operations, such as service time, arrival time, and tons per hour of vessels at berth.

## 2.3 Logistics performance

Many researchers have been interested by the subject of logistics management within enterprises. At the time being it's very difficult to give one definition of logistic accepted by all and in all countries, but it is important to evaluate all definitions suggested for example RAMA RAO (2000-2001) shows that from the end of the 19th century until the Second World War, *“The term logistics is little used and it is mainly used by the military. It refers to the art of combining all means of transport, supply and accommodation of troops”*. For MASOZERA (2003), *“Logistics is all technics, management and optimization of the flow of supply, storage and transport of goods”*. And for MANSILLON (2001) *“Logistics is all tasks that contribute to regulating physical flows within the company: raw materials, components, work-in-process, finished products”*. So according to above definitions, we can define the term logistic as follows: It is all the means (materials, machines), resources (human, financial), with the aim of satisfying orders that relate to material management (Transport, packaging ...).

Moreover, researchers have been defined the supply chain but we didn't have an universal definition that's why we

should consider the following definitions found in the literature:

*“The supply chain is a network of facilities that provides the functions of sourcing raw materials, transforming these raw materials into components and then finished products, and distributing the finished product to the customer.”* Lee et al, (1993). However, as per Tsay et al, (1999) *“A supply chain is a collection of two or more companies linked by flows of goods, information and finance.”* In addition, Rota-Franz et al, (2001) *“The supply chain of a finished product is defined as the set of companies involved in the processes of component supply, manufacturing, distribution and sale of the product, from the first supplier to the ultimate customer”*.

It should be noted that three dimensions are mandatory to achieve logistics goals according to FUGATE and al (2010): logistic effectiveness, efficiency and differentiation. While MENTZER and KONRAD (1991) confirm that only one standard related to the degree of achievement of logistical goals is enough. In addition, LANGLEY and HOLCOMB (1992), propose two dimensions: effectiveness and logistical efficiency.

## 3. Empirical research framework

In this section, we will present the empirical research framework. Indeed, we will present the general characteristics of our exploration. As well as we will justify the choice of each method of collecting and processing qualitative data.

### 3.1 Methodology

We have chosen to orient our evaluation towards an organizational perspective, which means that it will be contextualized to a container terminal of Tangier Med Port in Morocco. This terminal contribute strongly to the performance of Tangier Med port, the choice of this terminal is explained by the fact that it use the special handling tools in order to satisfy the logistics needs of its customers. Thus, leaders and container terminals actors are becoming more and more interested in the question of evaluating the contribution of special handling on the container terminals productivity.

#### 3.2.1 Exploration type

“Exploring in management consists of discovering or deepening a structure or functioning to serve two objectives: the search for explanation and the search for understanding. Explore responds to the initial intention of the researcher to purpose innovative theoretical results” CHARREIRE PETIT et DURIEUX (2014).

In line with this, our study aims to comprehend the impact of special handling on container terminal operations productivity, thus necessitating an exploration of the underlying processes.

In our study, we choose to undertake an exploratory qualitative empirical phase to ground our conceptualization in the actualities of the context.

### 3.2.2 Sampling selection and analysis

Below are the key decision-makers involved in special handling operations within the container terminal chosen: Operations Managers, Execution Managers, Shift Managers, Operations Shift Supervisor (Foremans), Gate Responsible, Purchasing Managers, Buyers, HSSE Managers, HSSE Supervisors, Technical Managers, Technical Workshop Supervisors, Handling Agent, Equipment Planners.

“The determination of sample size involves estimating the minimum size necessary to obtain reliable results with a satisfactory level of confidence”, as described by ROYER and ZARLOWSKI (2014). Accordingly, our research entailed conducting interviews with key actors at a container terminal located in the Tangier Med port in Morocco between the months of August and October 2022.

The selection of the container terminal was based on established professional connections. The chosen container terminal was deemed sufficient for the purpose of examining the impact of special handling on productivity levels.

The tabulated data presented below encompasses all individuals who were interviewed during the empirical phase. The criteria for inclusion were based on the interviewee's position title, gender, experience, and department.

Table 1: Exploratory study sample

POSITIONS	GENDER	EXPERIENCE
EXECUTION MANAGER	MALE	12 YEARS
SHIFT MANAGER	MALE	08 YEARS
FOREMAN	MALE	06 YEARS
FOREMAN	MALE	02 YEARS
HSSE SUPERVISOR	MALE	05 YEARS
GATE SUPERVISOR	MALE	14 YEARS
HANDLING AGENT	MALE	03 YEARS
HANDLING AGENT	FEMALE	02 YEARS
TECHNICAL RESPONSIBLE	MALE	12 YEARS
TECHNICAL SUPERVISOR	MALE	06 YEARS
BUYER	FEMALE	03 YEARS

Source: Personnel development.

### 3.2 Data Collection

“In qualitative research, we have several modes of data collection: individual interview, group interview, participant or non-participant observation, and files collection” GAVARDS-PERRET (2009).

The semi-structured individual interview is the mode of data collection that we have favored in our research. Thus, we conducted Eleven semi-structured interviews lasting between 30 minutes and 55 minutes. Eight of Eleven interviews took place face-to-face and the rest took place via Emails and LinkedIn. We proceeded by taking notes for the eight face-to-face interviews and the others we already have written answers.

## 4. Research findings

Herewith the different results obtained from our qualitative data processing.

### 4.1 Sample analysis

The main objective of this this analysis is to describe the general structure of the sample according to some characteristics of the selected actors (Table 02):

Table 2: Interlocutors characteristics

	CAT	FREQUE	PERCEN
GENDRE	MALE	9	81,81%
	FEMALE	2	18,18%
EXPERIENCE	02-05 Years	5	45,45%
	06-10 Years	3	27,27%
	11-14 Years	3	27,27%
DEPT	OPERATIONS	7	63,63%
	HSSE	1	9,09%
	PURCHASING	1	9,09%
	TECHNICAL	2	18,18%
POSITIONS	EXECUTION MANAGER	1	9,09%
	SHIFT MANAGER	1	9,09%
	FOREMAN	2	18,18%
	HSSE SUPERVISOR	1	9,09%
	GATE SUPERVISOR	1	9,09%
	HANDLING AGENT	2	18,18%
	TECHNICAL RESPONSIBLE	1	9,09%
	TECHNICAL SUPERVISOR	1	9,09%
	BUYER	1	9,09%

Source: Personnal development.

As mentioned in table above, we note that the interlocutors belong to different directions in the container terminal structure, Furthermore the most of interlocutors occupy positions of responsibility.

#### 4.2 Special handling description

To execute such special handling operation, the container terminal takes into consideration a lot of recommendations. This includes following the work instructions, which are particularly important for ensuring the safe and efficient handling of cargo.

As per an Execution Manager “Special handling is an operation very critical for each container terminal because this can impact the terminal safety that’s why the

terminal should prepare such case before, in order to avoid such problem”.

The terminal can turns to the special handling when its discharge or load include a break bulk cargo wich is a cargo that can’t be stored and transported in a container, OOG (Out Of Gaudge container) which is a cargo carrying over dimetional cargo beyond the normal size as a standdard container and finally a heavy damaged container.

As per an Operations Shift Supervisor (Foreman) “When the terminal have to handle OOG containers (Out of Gauge) which have specific height that the normal spreader can’t handle, the terminal forced to use the OHF (Over high frame) to make the discharge or load possible. And when the terminal have to handle damage in a container’s corner casting, it uses the chains according to the container's weight. Thirdly, the terminal also has types of belts that can help with chains through the handling of break bulk containers, it’s a very critical handling that should have a specific treatment and needs concentration work”.

The container terminal customer (Shipping lines) communicate yearly or (monthly sometimes) the count of break bulks, OOG containers that will be discharged or loaded from the terminal.

As per an Execution Manager “Every year and sometimes every month we receive from our customer all necessary details relating to the transshipment or export of break bulk cargo and OOG containers”.

The terminal takes into consideration a set of criteria before choosing the appropriate special handling tool.

As per an Operations Shift Supervisor (Foreman) “We have different special handling tools in our terminal as:

**Overheight frame**, this tool is used for the handling of open top containers, flat racks and especially out of gaudge containers (OOG), this tool help the terminal to improve productivity, reduce slow operations and increases significantly the security of the stevedores in those operations.

**Heavy hook** is used to replace the spreader in order to discharge or load Break Bulk or containers that exceed the normal weight.

**Lifting beam** is used for the handling of break bulk and it should be noted that this tool is used for two cases orizontal with the spreader (height exceed) vertical with the spreader (large exceed).

**BUS and truck lifter sling** is used for lifting Break Bulks or tugging some heavy equipment (Break Down).

**Manual chains hoist Terglift** is used to lift vertically some unit or equipment.

**Chain sling 19T 4MTS with connecting link on both ends** is used to handle damage containers or damage flat-racks.

**Top container lifting lugs** is doing the same role of spreader twist locks, to handle containers that not accessible for normal spreader to lift or the spreader can not lock the container due to the damage in the upper corner casting (Are used mainly in the under deck).

**Hook** is doing the same role of spreader twist locks, to handle containers that not accessible for normal spreader to lift or the spreader can not lock the container due to the damage in the upper corner casting (Are used mainly in the upper deck).

**Stell wire rope sling with thimble on both ends** is used to be connected with lifting beam or heavy hook to handle the break bulks.

**Oval lifting master link** is a closed loop which serves as a connection point in sling assemblies.

**OMEGA type shackles** is used to connect various elements of rigging to each other, including when towing cargo. This tool help the terminal to increase the reliability of the structure, since the bolt-type connection is not sensitive to torque.

**Top Lock** is used to discharge containers that can not been handled by normal spreader due to damage or over height.

**Side Lock** is used to handle containers that have damage in the upper corner castings or some flat racks that have damage in the twist locks in case of bundle.

**Slings** are used in the handling of break bulks, to be connected with lifting beam or heavy hooks”.

#### 4.3 Special handling tools purchase

The terminal should choose carefully the suppliers of these tools to avoid such kind of malfunction or use complexity.

As per a buyer “The suppliers and the services providers are always carefully chosen depends on their main activity, they must be capable to respond to the need expressing taking into consideration the requirements of the requesting department led to the buyers contact directly the suppliers”.

As per an Execution Manager, “The suppliers are chosen based on the price, the lead time of delivery and references if available”.

The container terminal consider the supplier’s reability in order to receive a good quality as requested.

As per a buyer, “The suppliers reliability is always ensured by the quality receiving, the timeless, and the competitiveness. A good supplier is a supplier who give the good quality in a short time. Furthermore, the quality offered by the supplier must be the same as requested or even better”.

#### 4.4 Special handling safety and quality

The quality and safety of these tools are very important for the container terminal and such missing of use information can impact all the terminal operations, that’s why the container terminal give more importance to the control of these tools.

As per an HSSE Supervisor “Over time, the collection of lifting equipment is going to degrade and become slightly dated. With continued use, we may start to see and experience abrasions, corrosion and deteriorations in performance, which is completely natural and expected. Inspections aim to help identify these things before they have the opportunity to become a real issue. Led to a professional inspection is conducted by a qualified person, should be completed once every six to twelve months. Once the inspection is complete, we will receive a certificate that confirms the equipment is suitable for use until its next inspection”.

While employing these tools, it is imperative for the container terminal, particularly the HSSE department, to meticulously scrutinize the use of each tool, identify any unsafe use, and guarantee seamless communication among the entire team.

As per an HSSE Supervisor “Read and ensure that we understand the lifting plan, pre-use checks are to be carried out on all lifting tools before its use, ensuring that the load to be lifted is well distributed and that the tools used fits its weight and shape. Also checking that the tools are sufficiently robust, stable, and suitable for the proposed use. Proper communication between the team members and prevent access to dangerous parts”.

HSSE department should ensure the inspection and maintenance of the tools also prepare the work instruction with the collaboration of the whole team.

As per an HSSE Supervisor “Always we check the tools before we use it, performs periodic inspection and maintenance tasks, ensure our training is up to date, the weight of the load must fit the tools, use high-quality monitoring and overload protection systems, and use the necessary safety equipment limited the operation area (safety signages -Never stand under the load). To prolong the life of lifting tools it’s important to keep it in good working order. Here are some things that can do to ensure lifting gear maintains a longer service life: Ensure the lifting gear is stored and used safely in the correct conditions. Always follow the correct procedures and guidelines before, throughout and after the use. Ensure you never exceed the Safe Working Load (SWL) of your equipment. Only trained and qualified personnel use the equipment. All equipment is handled with care and patience”.

#### 4.5 Use and productivity of special handling tools

It depends of the volume forecast, the container terminal can evaluate the need of special handling tools. Therefore as per an Execution Manager the need can be evaluated as follows: “Based on the volume forecast provided by the customers, the terminal can evaluate the need of special handling tools, and so on this forecast volume can be provided monthly or yearly by shipping lines that have a contract with the terminal.” In addition, the container terminal can select the appropriate tool based of some informations that must be provided by its customer as explained by an Execution Manager & a Shift Manager “Based on the kind of cargo to be handled and the weight and the dimensions, the terminal can select the adequate tools. Indeed, the terminal consider all details regarding the cargo to be handled (Break Bulk, Damaged container, Out of gaudge container) before the operation starts, after knowing the cargo to be handled the terminal must know the weight and the dimensions of the cargo in order to select the good tools and ensure it flexibility using the right tools in the right situations, and by respecting the norms of operation handling in order to achieve good results”.

As per an Execution Manager & a Shift Manager: “Between decembre 2021 and decembre 2022 we performed 1097 special handling moves” (Fig.1).

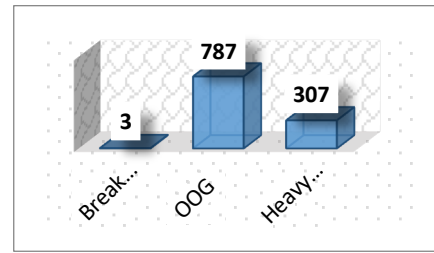


Fig. 1 Total special handling moves 2021-2022 (Source: Personal development).

The analysis of the data presented in the above figure reveals that a substantial proportion of the cargo moves carried out during the period spanning from December 2021 to December 2022 involved Out-of-Gauge (OOG) cargo, with a total of 787 moves recorded. Additionally, the data indicates that there were 307 moves involving heavy damaged containers, suggesting a potential need for specialized handling and transportation services. In contrast, the number of break bulk cargo moves during the same period was notably lower, with only three such moves recorded.

As per an Execution Manager & a Shift Manager: “Between decembre 2021 and decembre 2022 we performed 96 Export and 1001 Transshipment special handling moves” (Fig.2).

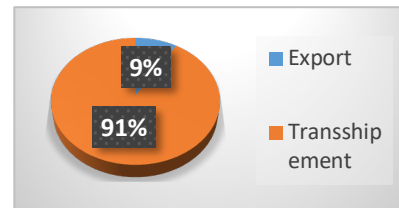


Fig. 2 Total special handling moves per category 2021-2022 (Source: Personal development).

The majority of moves are transshipments, accounting for a significant portion of 91% of total moves. Conversely, exports make up a mere 9% of the total moves.

Special handling capabilities are critical for container terminals to successfully execute specific operations. According to an Execution Manager and Shift Manager, the absence of these specialized tools would impede the terminal's ability to proceed with certain operations. “The benefits of special handling tools are represented in the control of any special handling (discharge or load) on the vessel or yard operation, realizing the good performance in such type of the handling, they are the used tools for the specific operations. Indeed, the Special Handling can take

from 10 to 20 min to handle one container in general, and it can take more time according to the handled situation for example handling of OOG take 10 min by using Over High Frame and 20 min by chains”.

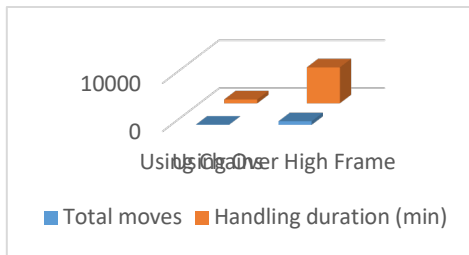


Fig. 3 OOG handling duration average 2021-2022 (Source: Personal development).

Over the course of the period between December 2021 and December 2022, the handling of 40 out-of-gauge (OOG) containers was executed through chains, while 747 moves were performed by using the over high frame, this trend can be attributed to several factors, including the highly efficient nature of over high frame as a handling tool, which has been found to enhance productivity, streamline operations, and ensure optimal safety measures are in place.

According to a Terminal Operations Supervisor, specific protocols must be adhered to by the container terminal to facilitate the loading or discharging of a heavy damaged container. “A distinction must be made between discharging and loading a heavy damaged container, to load it is easy some times because we know the kind of the damage as well as we know the tools that will be used, thus we can share all the information that we have with the chief officer in order to coordinate with him and make the load easy, all this require us as an average 10 minutes against 02 minutes (sometimes less) for a normal container without any damage. But to discharge a heavy damaged container some steps must be followed, for example we must know the kind of the damage, check if our tools can handle it, prepare a damage report signed and stamped by the chief officer of the vessel, ensure the yard location and the smooth communication with the whole team, all this can require us as an average 30 minutes against only 02 (sometimes less) for a normal container without any damage” (Fig.4).

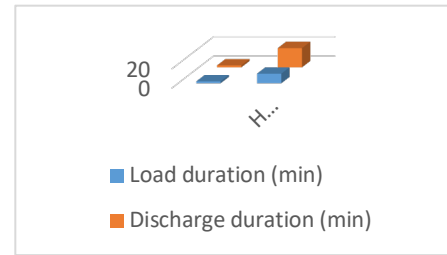


Fig. 4 Heavy damaged & normal container discharge and load duration average (Source: Personal development).

As depicted in the figure above, the time required for the loading or discharging of a normal container (without any kind of damage or slightly damaged) is exceedingly brief, with an average duration of approximately two minutes, or even less in some instances. However, the handling of heavy damaged container necessitates considerably more time, with the discharging process taking an average of 30 minutes and the loading process requiring 10 minutes. The underlying reasons for these disparities can be attributed to the collective experience and expertise of the team members, as well as the utilization of appropriate handling tools.

The significance and criticality of special handling capabilities have been underscored and validated by the final users in the container terminal. It has been duly noted that users of specialized handling tools are obligated to undergo comprehensive training and adhere to prescribed procedures in order to prevent any possible issues or untoward incidents. The importance of these measures has been emphasized by an Execution Manager, Shift Manager, and Terminal Operations Supervisor: “The Special Handling Tools are practical ways to control and master the performance operation but it use requires an additional effort for checker, deck man and especially for the crane driver, also for the operations supervisor because it needs concentration and more control than the other types of handling. So to prepare, to supervise, to oversee and to follow up are the main tasks to execute through the using of these Handling Tools to avoid the damages, incidents and to get the best performance which is the fundamental aim. Furthermore, through the training planning of the crane and reach stacker drivers, it is ensured to be trained in the use of special handling tools”.

As per an Execution Manager, Shift Manager and Terminal Operations Supervisor “In the operations, the performance tools begin from the technical team which should confirm that we can use the tool for the handling, then our role as an operations supervisors or shift

managers to decide which tool is going to be used; So the checker start registering the time from the crane spreader

hooks the Tool until the operation finish including the technical obstacles or others. The Special Handling Tools

performance is measured by the fluency of the tool used, and the time duration through the operation, and it's communicated by the checker or the operations supervisor to the shift manager as a report and also in the system we can find delays of special handling tools which give us an idea about the performance of each tool”, according to a Terminal Shift Supervisor, the primary sources of delay that may impede the successful execution of special handling operations include deductible delays, operational delays, and technical delays. “Such kind of special handling may impact the smoothness of our operations, for example during the discharge or load of an OOG, we can face some deductible delays as wrong measurements declaration, some operational delays as the OOGs to handle are more than the tools that the terminal has, and some technical delays as the break downs. For the break bulk during load may we face some deductible delays as load of flat-raks before the break bulk load, such flat-rack require us an average of 02 minutes, also we can face some operational delays as stuff and tools preparation,...and for the technical delays may we face break downs. About the heavy damaged containers we can face some deductible delays also it depends of the case, as well as some operational delays as the handling duration

and break downs for the technical delays”. It should be noted that each operations stoppage is recorded by the handling agent via system (Tablet) and special handling form”. As relayed by the Shift Supervisor, presented below are the average durations of the primary delays encountered during each special handling operation (Table 3 ).

Table 3: Delays duration average

Main delays	OOG	Break bulk	Heavy damaged container
Deductible	7min	05min	15min
Operational	5min	40min	10min
Technical	15min	15min	15min
Total	27min	60min	40min

(Source: Personnal development).

The prevalence of delays in the Break Bulk category is readily apparent, followed by heavy damaged containers and out-of-gauge (OOG) containers, as can be inferred from the table 3.

This finding sheds light on the underlying factors contributing to the delays, which can be further explained as follows (Fig 5).

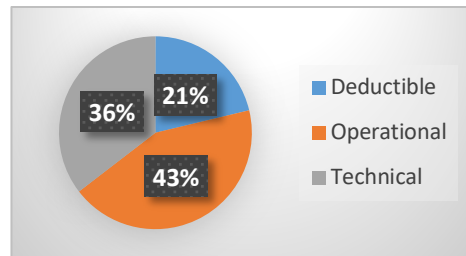


Fig. 5 Main delays duration average (Source: Personnal development).

A comprehensive analysis of the causes of delays indicates that 43% of these delays are attributable to operational factors, 36% are attributable to technical factors, and 21% can be attributed to deductible causes. This trend can be explained by the nature of the handling process and the use of specialized tools that necessitate more time, as is the case with chains (requiring preparation, fixation, etc.). Additionally, delays may also arise from breakdowns or inadequate lashing, leading to poorly fixed containers.

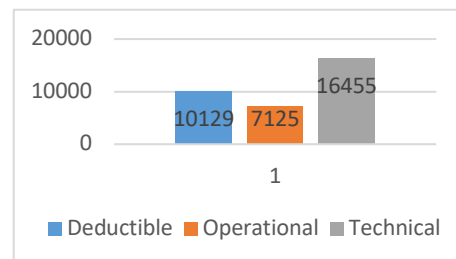


Fig. 6 Total delays by minutes 2021-2022 (Source: Personnal development).

Between December 2021 and December 2023, a total of 16,455 minutes of technical delays were registred, followed by deductible delays which amounted to 10,129 minutes, and operational delays that accounted for 7,125 minutes. The underlying reasons behind this trend can be attributed to several factors, including the relatively low number of break bulks handled during this period (only three), occurrences of breakdowns, issues related to the hydraulic hatch cover of vessels, incorrect measurement declarations, and insufficient lashing of containers onboard.



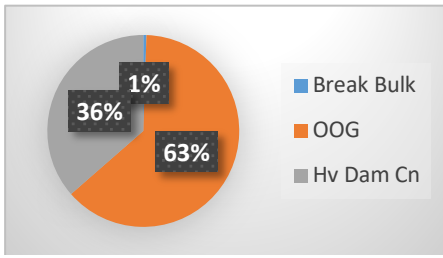


Fig. 7 Total delays per kind of handling 2021-2022 (Source: Personnal development).

During the period spanning December 2021 to December 2023, the delays attributable to out-of-gauge containers accounted for 63% of the total, while heavy damaged containers accounted for 36%, with break bulks contributing only 1% to the overall delay statistics.

Based on the findings of this study, it is apparent that delays related to specialized handling operations constitute a significant proportion of the total delays experienced within the terminal, as depicted in (Figure 8).

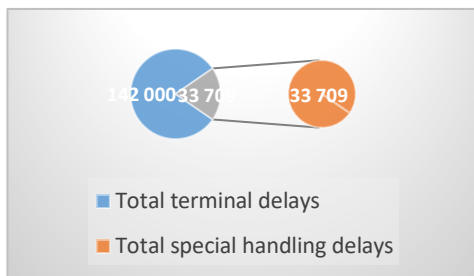


Fig. 8 Special handling delays part in the total terminal delays by minutes 2021-2022 (Source: Personnal development).

These results underscore the importance of effective management and coordination of special handling operations to optimize terminal efficiency and minimize delays, ultimately contributing to enhanced container terminal productivity.

## 5. Conclusion

Upon conclusion of this paper, a number of observations were formulated, leading to a collection of highly intriguing results. It was determined that managerial support remains a paramount factor for the achievement of success in special handling operations. Conversely, container terminals are not fond of these operations due to the significant delays they cause and the need for concentrated effort, ultimately affecting subsequent port stay of vessels. Nonetheless, it must be acknowledged that these operations bring about considerable benefits for the

terminals, contributing to their impressive positioning within international ports.

Therefore, the conceptual model employed in this study synthesizes a range of key variables that were identified through a qualitative exploratory research approach. These variables are multifaceted in nature, incorporating critical elements such as the quality and safety of special handling tools and services, user attitude (including adoption and satisfaction), managerial considerations (including training and support), as well as key user characteristics such as position and experience. By integrating these variables into a cohesive framework, the model offers a nuanced and comprehensive understanding of the complex interdependencies and dynamics that underlie effective special handling tool implementation and user adoption.

The model presented below serves to visually depict the interconnections and interdependencies between a range of variables that were identified through the adaptation of **EL KHARRAZ Ouail** and **ELKHARMALI Zakaria** model to the Moroccan context, utilizing a rigorous exploratory qualitative research approach. Through its depiction of these complex relationships, the model provides a valuable analytical tool for understanding the unique contextual factors that are integral to the successful implementation and adoption of this model within the Moroccan context.

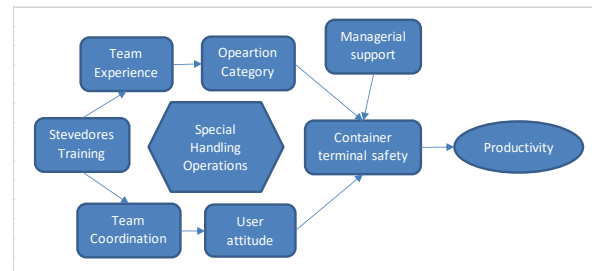


Fig. 9 Our research conceptual model.

As an elaboration of the present study, scholars who possess an interest in this domain could explore the issue of special handling in container terminals and evaluate its effect on the operational efficiency of maritime activities within a container terminal.

An additional pathway of inquiry into the distinctive handling methods employed in container terminals that warrants exploration is conducting a comparative analysis between the container terminals situated at Tangier Med, and those situated within the ports of China and the United Arab Emirates.

## APPENDIX

**Zakaria ELKHARMAL:** He completed higher technician preparatory classes (BTS) ERRAZI El Jadida in 2017 and earned a professional bachelor's degree in Management and Logistics Techniques of International Trade from FP Beni Mellal, class of 2018. He graduated from the National School of Business and Management of Casablanca and earned his master degree in Management Logistic and transports, class of 2020. Now, he holds the esteemed position of a Junior Operations Planner since October 2020, while concurrently pursuing a Doctoral degree in their third year of study, as a PhD student of the prestigious Management and Information Systems research team at the National School of Business and Management of Tangier of Abdelmalek Essaadi University - Morocco.

**Ouail EL KHARRAZ:** He has held the esteemed position of a professor of higher education in Economics and Management at the Faculty of Economic, Social and Legal Sciences of Tangier since 2014 and certified as a Professor Habilitation (PH) on 2018. Additionally, he is an esteemed member of the distinguished Management and Information Systems research team at the National School of Business and Management of Tangier of Abdelmalek Essaadi University - Morocco.

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