

Ecole Des Hautes Etudes Commerciales d'Alger



End-of-Cycle Dissertation for the Master's Degree in Commercial Sciences

Option: distribution and Supply Chain management

Thème :

**The Agricultural Supply Chain: The Role of Port Logistics in
Optimizing the Export of Fresh Products.**

The Case of Algiers Port (EPAL).

Developed by :

AGOUNE Mahdi Dhaia Eddine

SAHRAOUI Ferdaous

supervisor:

PR. BOUBAKOUR Farés

Professor at HEC, Algiers

11ème promotion

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Abstract:

The agricultural supply chain is essential for delivering fresh products from farmers to consumers across borders. This research investigates how optimizing the agricultural supply chain can improve the efficiency and quality of fresh product handling in Algiers Harbor, focusing on storage, and logistical complexities.

This study employs qualitative methods, including interviews with key partners and direct observations. Data were gathered from field observations and in-depth interviews to understand the current inefficiencies and identify potential areas for improvement within the supply chain.

The findings reveal several critical areas for enhancement in the agricultural supply chain affecting Algiers Harbor. Key issues include the adoption of advanced tracking technologies, improved scheduling and container handling protocols.

Optimizing the agricultural supply chain has significant implications for improving the handling of fresh products in Algiers Harbor. The study recommends investing in technology-driven solutions and fostering closer collaboration among partners. These measures are expected to enhance the efficiency of logistics operations, minimize product loss, and ensure the delivery of fresher goods to reception countries, thereby bolstering the region's agricultural export capacity.

Key words: Agricultural Supply Chain- Storage Optimization- Container Handling- Perishable Goods- Harbor Operations- Agricultural Exports.

Résumé

La chaîne d'approvisionnement agricole est essentielle pour la livraison de produits frais des agriculteurs aux consommateurs à travers les frontières. Cette recherche examine comment l'optimisation de la chaîne d'approvisionnement agricole peut améliorer l'efficacité et la qualité de la gestion des produits frais dans le port d'Alger, en se concentrant sur le stockage et les complexités logistiques.

Cette étude utilise des méthodes qualitatives, incluant des entretiens avec des partenaires clés et des observations directes. Les données ont été recueillies à partir d'observations sur le terrain et d'entretiens approfondis pour comprendre les inefficacités actuelles et identifier les domaines potentiels d'amélioration au sein de la chaîne d'approvisionnement.

Les résultats révèlent plusieurs domaines critiques à améliorer dans la chaîne d'approvisionnement agricole affectant le port d'Alger. Les problèmes clés incluent l'adoption de technologies de suivi avancées, l'amélioration des protocoles de planification et de manutention des conteneurs.

L'optimisation de la chaîne d'approvisionnement agricole a des implications significatives pour améliorer la gestion des produits frais dans le port d'Alger. L'étude recommande d'investir dans des solutions technologiques et de favoriser une collaboration plus étroite entre les partenaires. Ces mesures devraient améliorer l'efficacité des opérations logistiques, minimiser les pertes de produits et assurer la livraison de produits plus frais aux pays de réception, renforçant ainsi la capacité d'exportation agricole de la région.

Mots-clés : Chaîne d'approvisionnement agricole - Optimisation du stockage - Manutention des conteneurs - Produits périssables - Opérations portuaires - Exportations agricoles.

ملخص

تعتبر سلسلة التوريد الزراعي أمرًا أساسيًا لتوصيل المنتجات الطازجة من المزارعين إلى المستهلكين عبر الحدود. تهدف هذه الدراسة إلى استكشاف كيفية تحسين سلسلة التوريد الزراعي من خلال تحسين الكفاءة وجودة التعامل مع المنتجات الطازجة في ميناء الجزائر، مع التركيز على التخزين والتعقيدات اللوجستية.

تعتمد هذه الدراسة على أساليب نوعية، بما في ذلك مقابلات مع الشركاء الرئيسيين والمراقبات المباشرة. من خلال جمع البيانات من المراقبات الميدانية والمقابلات العميقة، نهدف إلى فهم العيوب الحالية وتحديد مجالات الاستفادة داخل سلسلة التوريد.

تظهر النتائج عدة مجالات حرجية للتحسين في سلسلة التوريد الزراعي التي تؤثر على ميناء الجزائر. من بين المشكلات الرئيسية، اعتماد تقنيات التتبع المتقدمة وتحسين جداول الأعمال وبروتوكولات التعامل مع الحاويات.

يحمل تحسين سلسلة التوريد الزراعي آثارًا كبيرة على تحسين التعامل مع المنتجات الطازجة في ميناء الجزائر. نوصي بالاستثمار في حلول مدفوعة بالتكنولوجيا وتعزيز التعاون الأقرب بين الشركاء. من المتوقع أن تعزز هذه التدابير كفاءة العمليات اللوجستية، وتقلل من فقدان المنتجات، وتضمن تسليم السلع الأكثر طازجة إلى البلدان المستقبلة، مما يعزز قدرة الجزائر على تصدير المنتجات الزراعية في المنطقة.

الكلمات المفتاحية: سلسلة التوريد الزراعية - تحسين التخزين - مناولة الحاويات - البضائع القابلة للتلف - العمليات المينائية

- الصادرات الزراعية

Dedication

I DEDICATE THIS HUMBLE WORK TO:

MY PARENTS, WHO HAVE ALWAYS SACRIFICED EVERYTHING, SUPPORTED, AND ENCOURAGED ME IN ALL MY ENDEAVORS;

TO MY DEAR BROTHER AND SISTERS, HUSSAIN, MARIA AND ROKAIA, FOR THEIR ENCOURAGEMENT AND MORAL SUPPORT;

AND A SPECIAL MENTION TO MY FRIENDS, YOUSUF, ANIS, IMAD, ILYES, RIAD;

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MY DEAREST PARENTS, WHOSE UNWAVERING SACRIFICES, ENDLESS SUPPORT, AND CONSTANT ENCOURAGEMENT HAVE FUELED MY EVERY ENDEAVOR. THANK YOU FOR BELIEVING IN ME ALWAYS.

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FERDAOUS

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list of abbreviations

Abbreviation	Signification
AD	Administration Departments
AI	Artificial Intelligence
ASLOG	Association Française pour la Logistique (French Logistics Association)
BRCGS	Brand Reputation Compliance Global Standards
CDAO	Chief Director Administration Officer
CCTV	Closed-Circuit Television
CDOO	Chief Director Operations Officer
CLD	Central Logistics Department (Central Logistics Directorate)
COVID	Coronavirus Disease
CU	Communication Unit
DPW	Djazair Port World
EDI	Electronic Data Interchange
EFSA	European Food Safety Authority
EPAL	Entreprise portuaire d'Alger (Algiers Port Company)
ERENAV	Entreprise De Réparation Navale (Ship Repair Company)
EU	European Union
FAD	Finance and Accounting Department
FAO	Food and Agriculture Organization
FSSC	Food Safety System Certification
GAP	Good Agricultural Practice
GEC	Gestion Electronique Des Courriers (Electronic Mail Management)
GED	Gestion Electronique Des Documents (Electronic Document Management)

GESPORT	Gestion Portuaire (Port Management)
GMAO	Gestion De Maintenance Assistée Par Ordinateur (Computer-Aided Maintenance Management)
GMS	General Marketing Standard
GPS	Global Positioning System
HACCP	Hazard Analysis of Critical Control Points
HRD	Human Resources Department
IDE	Integrated Development Environment
IFS	International Featured Standards
IoT	Internet of Things
IPM	Integrated Pest Management
ISD	Information Systems Department
ISO	International Organization for Standardization
KPI	Key Performance Indicator
LALD	Legal Affairs and Legislations Department
MDR	Medical Device Regulation
MRL	Maximum Residue Levels
MVC	Model-View-Controller
NCPDM	National Council of Physical Distribution Management
NOAA	National Oceanic and Atmospheric Administration
OD	Operations Departments
OECD	Organisation for Economic Co-operation and Development
OMCD	Organization and Management Control Department
ONP	Office National Des Ports (National Ports Office)
ORAD	Operations and Regulatory Affairs Department
PDA	Personal Digital Assistant
PHP	Hypertext Preprocessor
QR	Quick Response
RFID	Radio-Frequency Identification
RORO	Roll On Roll Off
SERPORT	Services Portuaires (Port Services)
SNAN	Société Nationale Algérienne De Navigation (National Algerian Navigation Company)
SNM	Société Nationale De Manutention (National Handling Company)

SMS	Specific Marketing Standard
SOP	Standardized Operating Procedures
SPA	Société par actions (Joint-Stock Company)
SQL	Structured Query Language
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TP	Terminal Portuaire (Port Terminal)
UNECE	United Nations Economic Commission for Europe
UNCTAD	United Nations Conference on Trade and
US	United States
USDA	United States Department of Agriculture
VGM	Verified Gross Mass
WDD	Works and Development Department
WHO	World Health Organization
WTO	World Trade Organization

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General conclusion

General introduction

In recent years, global trade has been conducted through four main means: shipping by sea, air transport, road transportation, and rail transportation, with the first of these four accounting for up to 90% of total trade. For Algeria in particular, shipping by sea is the method used for 95% of its trade with the rest of the world. The main products exported by Algeria are mineral fuels, mineral oils and products of their distillation, bituminous substances, and mineral waxes, all of which represent 89% of Algeria's exports. However, the current export policy aims to reduce dependence on these products by diversifying exports to include fertilizers, inorganic chemicals, sugar and confectionery, meat, fish, fruits, and vegetables. The export value of these products has been on the rise for the past seven years, increasing from 62 million dollars in 2015 to close to 0.2 billion in 2022.

The transit of these fresh products can sea, as it is the most cost-effective mode of transport. The problem, however, is the time taken for such transit, especially considering the short shelf life of these products. The main reason for selecting this topic is that it will help implement the current export policy and support the future development of the fresh agricultural products sector. By reducing costs related to shipping fresh products by sea, it will encourage more exports of these products, thereby reducing Algeria's reliance on mineral oils.

This raises an important issue: How can the optimization of the agricultural supply chain improve the efficiency and quality of handling fresh products in Algiers Harbor, considering the complexities of transportation, storage, and logistical processes involved?

To delve deeper into this overarching question, let's break it down into several key sub-questions:

- What are the principal logistics defects encountered during the exportation of fresh food products from Algeria to international markets?
- How does logistical cost impact the competitiveness of Algerian products in the global market?

- How can the speed of the supply chain be increased to ensure the freshness of products during transit?

Having examined these key sub-questions surrounding the optimization of the agricultural supply chain and its impact on fresh product handling in Algiers Harbor, we can now formulate hypotheses to guide further investigation and analysis. Based on the insights gathered, let's propose some hypotheses:

1. The principal logistic defects encountered during the exportation of fresh food products from Algeria to international markets include mismanagement of temperature conditions, non-adherence to international sanitary norms, and missed deadlines.
2. Logistical costs directly impact the competitiveness of Algerian products in the international market, and reducing these costs would make the products more attractive compared to competitors.
3. Shipping by sea provides the most cost-effective method for exporting products, but the process is relatively slow. An alternative is air transport, which is much faster but more costly.

In order to develop our strategic analysis, we will use the SWOT tool to identify strengths, weaknesses, opportunities, and threats to the company EPAL. To collect the data needed for this analysis, we employed both interviews and observations. A range of partners, including port officials, workers, and freight forwarders who rely on port services, were interviewed for this study. These interviews focused on the operational processes in the port and the difficulties faced. Additionally, on-site observations were conducted, along with the collection and analysis of EPAL's internal documents. This combined approach enabled the collection of both qualitative data and experiential insights, enhancing our examination with varied perspectives and firsthand accounts. After removing inconsistencies and comparing the situation from different viewpoints, we confirmed some of our hypotheses and refuted others, as well as providing practical action plans for EPAL based on the data analysis.

The study faced significant challenges, including limited details on exports, with only container counts and quantities available, and a lack of responses to our questionnaire. These issues restricted the depth of our data and research.

Chapter 01: Agricultural Supply chain: the specificities of fresh products

Introduction to chapter 01:

In this chapter, we delve into the intricate world of agricultural supply chains and the logistics involved in transporting fresh produce from farm to table. We begin by exploring the fundamental definitions and concepts that underpin agricultural supply chains, shedding light on the intricate network of processes and stakeholders involved in bringing food from the field to consumers' plates.

Understanding the components of agricultural supply chains is crucial for grasping the challenges that arise within this dynamic system. From farmers and suppliers to distributors and retailers, each player in the supply chain must navigate various hurdles, including transportation, storage, and quality control, to ensure the seamless flow of goods.

As we transition to the realm of agricultural fresh products, we categorize these goods and examine their specific requirements for exportation. From fruits and vegetables to meat and dairy products, each category presents its own set of challenges, ranging from perishability to regulatory compliance.

The supply chain of fresh agricultural products introduces a myriad of complexities, encompassing diverse actors, technologies, and standards. We delve into the roles of farmers, packers, shippers, and retailers, exploring the technologies utilized to optimize efficiency and minimize waste along the supply chain.

Furthermore, we explore key standards and certifications that govern the handling and transportation of fresh produce, ensuring compliance with food safety regulations and meeting consumer expectations for quality and sustainability.

Throughout this chapter, we aim to provide a comprehensive overview of agricultural supply chains and the logistics involved in the transportation of fresh produce. By unraveling the intricacies of this essential industry, we seek to shed light on the challenges and opportunities that shape the global food system.

1.1.Agricultural supply chain :

1.1.1. Definitions of agricultural supply chain:

According to Sunil: "A supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request. The supply chain not only includes the manufacturer and suppliers, but also transporters, warehouses, retailers, and even customers themselves."¹ From the parties mentioned in the definition we can infer that this supply chain is local, if we were to enlarge it and add more actors to it, it would become:

The international supply chain encompasses the flow of materials, information, and money between and among stages in a supply chain that exists in multiple countries. Here, the scope of the supply chain is expanded to include exportation and importation. But these products are numerous, so if we were to focus on one sector:

The agricultural supply chain encompasses all the stages involved in bringing agricultural products from the farm to the consumer, including input supply, production, processing, distribution, and consumption. This definition introduces to us the "farm to fork" concept, which is the subject of this chapter, but these definitions only included the processes involved and nothing else.

The agricultural supply chain represents the interconnected system of actors, activities, and infrastructure involved in the production, processing, marketing, and distribution of agricultural products from farm to fork. This definition includes all processes and actors in the "farm to fork" which truly defines the agricultural supply chain.¹

1.1.2. Notions of the agricultural supply chain:

1.1.2.1. Input supply:

This involves the provision of agricultural inputs such as seeds, fertilizers, pesticides, and machinery to farmers.

A. Seeds: selecting suitable seed varieties is one of the most important steps in this process, and it is based on factors like climate, soil type, and desired crop traits. Research and development is dedicated to creating high-yielding, disease-resistant, or drought-tolerant varieties by seed suppliers.

¹ Chopra, S., & Meindl, P. (2000). Supply Chain Management: Strategy, Planning, and Operation (6th ed.). Pearson Education India. ISBN: 1292093560,9781292093567. Page [13-15]

-
- B. Fertilizers:** Fertilizers are used by farmers to supplement soil nutrients to lessen the gap between each harvest and enhance crop growth. Common types include nitrogen, phosphorus, and potassium fertilizers. Sustainable farming practices aim to optimize fertilizer use to minimize environmental impact.
 - C. Pesticides:** such substances are used to control weeds, pests, and diseases that can damage crops. However, they do present dangers to consumers, so Integrated Pest Management (IPM) was put in place to promote the judicious use of pesticides alongside other pest control methods to minimize risks to human health and the environment.
 - D. Machinery:** Examples of farm machinery include, but are not limited to: tractors, harvesters, and irrigation tools. These equipments play a crucial role in modern agriculture because they increase efficiency and productivity. We reached a stage where we have a suitable machine for each role in the farm that varies for each farm's size, with a growing emphasis on precision agriculture technologies.

These are the inputs of the agricultural supply chain, and they each have a method or methods to upscale their quality, an example of which is “hybrid selection” for seeds.

1.1.2.2. **Production:**

An alternate name for cultivation of crops or raising of sprinklers, and the process includes the following steps:

- A. Crop selection and planning:** Factors such as soil type, climate, market demand, and rotation considerations help farmers decide when, where, and how to plant their crops, this step is called crop planning, and it also involves selecting suitable varieties, determining planting schedules, and allocating land and resources effectively.
- B. Land preparation:** This includes activities like plowing, tilling, and leveling the soil to create a suitable seedbed for planting. Farmers may also implement conservation tillage practices to minimize soil erosion and preserve soil health.
- C. Planting and seeding:** Once the land is prepared, seeds are sown or transplanted into the soil according to recommended spacing and depth. Techniques such as precision planting and seed treatment help optimize germination rates and early crop establishment.
- D. Crop management:** Throughout the growing season, farmers monitor and manage various factors that affect crop growth and development. This includes tasks such as irrigation, fertilization, weed control, pest and disease management, and crop protection measures.

-
- E. Irrigation:** in the case of being in a dehydrated region where rainfall is insufficient or inconsistent, farmers would then use an irrigation system to supply water to crops. There are different irrigation Technologies such as drip, sprinkler, and flood irrigation, and all are utilized factoring water availability, crop variety, and geography.
 - F. Nutrient management:** in order to have optimal needs with up to standard crops, proper nutrition management is needed. Soil nutrient levels must be monitored, and fertilizers or organic amendments need to be applied as needed to ensure balanced nutrition for crops.
 - G. Integrated pest management (IPM):** The IPM approach emphasizes the use of multiple strategies to get rid of pests, diseases, and weeds while minimizing reliance on chemical pesticides. This is achievable by using substitutes and less chemically reliant methods such as crop rotation, habitat manipulation, biological control, and the use of resistant crop varieties.
 - H. Labor management:** Depending on the scale and type of farming operation, labor may be required for various tasks throughout the production process, from planting and maintenance to harvesting and post-harvest handling. Labor availability, training, and safety are important considerations for farm management.
 - I. Recordkeeping and documentation:** Keeping accurate records of production activities, inputs used, and crop performance is essential for farm management, decision-making, and regulatory compliance. Recordkeeping may include data on planting dates, yields, pest pressure, and input applications.

The main focus on this stage is quantity, and the old solution here was green houses. However late studies show that this method was detrimental to quality so currently they opted to incorporate drones and management systems into this stage, it is a very recent solution, therefore there is a lack of data to show its impact on production.

1.1.2.3. Harvesting:

The process of gathering mature crops from the fields is called harvesting. Appropriate machinery and techniques are used for harvesting once the crops are grown to maturity. According to farmers, factors such as crop moisture content, market demands, and weather conditions must be considered when harvesting in order to achieve the best yield and quality.

1.1.2.4. Post-harvest handling:

It is a general term for post-harvest activities like cleaning and sorting, grading, and packaging, among other things.

-
- A. Cleaning and sorting:** After harvesting, the process of cleaning, including eliminating debris and dirt from crops, is necessary. This is aimed at getting rid of any foreign materials before they can be stored for another purpose.
 - B. Grading and quality control:** Grading is the practice of grouping agricultural produce into several quality grades, determinable through particular standards like size, shape, color, and blemishes. By adhering to predetermined standards, quality control procedures guarantee that only those products that meet specified requirements are chosen for subsequent processing or distribution purposes.
 - C. Processing:** Some agricultural products undergo processing or value-added activities after harvesting in order to either make new products or extend the shelf life of the inputs. Processing has many techniques, such as drying, milling, canning, freezing, juicing, or fermenting, depending on the type of product and market demands.

The thing that sets agricultural production apart from industrial production is the lack of defects. In agriculture, no matter how low the quality, it's still usable and therefore sellable. So this step can be summarized as knowing which crops to send to which customer.

1.1.2.5. Storage and warehousing:

Places and methods aimed at storing crops in a manner that avoids spoiling and preserves their quality.

- A. Storage:** Proper storage of crops through the creation of appropriate facilities is quite paramount when it comes to maintaining their quality and avoiding rotting even after the post-harvest. Spoiling, deterioration, and losses can be avoided when preventive measures such as temperature regulation, humidity control, proper ventilation, and the use of pest control mechanisms are taken into consideration.

1.1.2.6. Transportation and logistics:

Moving agricultural products from farms or storage facilities to processing facilities, markets, or consumers using various modes of transportation such as trucks, trains, ships, or airplanes. Efficient logistics and transportation systems are critical to ensuring timely delivery and minimizing product losses.

- A. Packaging:** packing ensures that goods remain in good condition during the entire shipping process and while they are stored. Packaging performs more roles than just protecting items from harm, with the extension of their shelf lives being one of such functions. Besides, a

label will be attached to an envelope in order to give some details about its content or direction for where it should go.

- B. Cold chain management:** To maintain quality standards as well as ensure safety measures are adhered to, items that go bad quickly should be kept in cold rooms or refrigerated trucks as they are ferried from one place to another.

1.1.2.7. Processing and value addition:

Transformation of raw agricultural products into processed goods, such as milling wheat into flour or pressing olives into oil.

- A. Processing:** Some agricultural products undergo processing or value-added activities after harvesting to create new products or extend their shelf life. Processing may involve techniques such as drying, milling, canning, freezing, juicing, or fermenting, depending on the type of product and market demands.
- B. Value Addition:** Adding value is what processing does best for agricultural products, it makes them of better quality, more convenient, or more appealing to consumers. Product differentiation, the introduction of specialty and gourmet products or incorporating other things into them, such as new ingredients, are some of the things that can be used for this purpose among others, including packaging innovations, which may also include other things.

1.1.2.8. Distribution and marketing:

Distributing agricultural products to retailers, wholesalers, or consumers by using various methods.

1.1.2.9. Retail:

This is the stage where the final consumer buys agricultural products from supermarkets, farmers' markets, or online platforms.

1.1.2.10. Waste management:

Environmentally sustainable management of agricultural waste and by-products. Every waste that is produced during post-harvest handling like agricultural residues, packaging materials, and spoiled products should be handled effectively to avoid any environmental impact. Possible ways for waste management may include recycling, composting, or energy recovery through biofuel production.

1.1.2.11. Traceability and quality control:

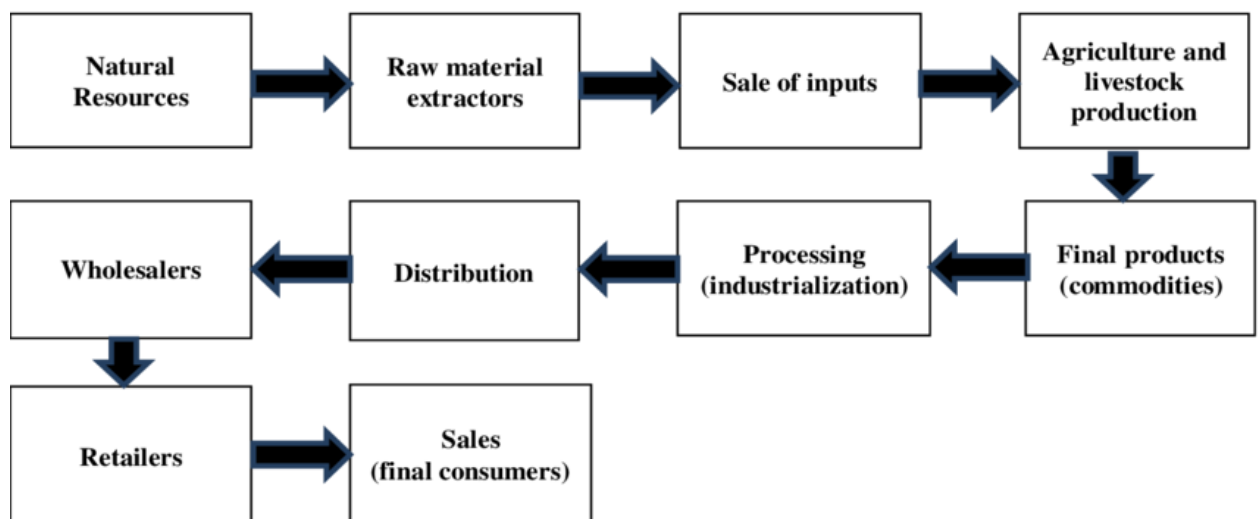
Throughout the supply chain, systems have been developed to trace the origin and ensures quality of agricultural products. This ensures their safety and that they meet certain standards.

A. Traceability and documentation: Traceability systems follow the movement of agricultural products from farm to fork, facilitating honesty and answerability. Product integrity and observance of regulations is enhanced through documentation: for instance, shipping records, invoices, quality certificates among others.

1.1.2.12. Regulatory compliance:

Adherence to laws and regulations governing production, processing, and distribution.

Figure 1: Agribusiness Supply Chain



Source: Kureski, R., Moreira, V. R., Veiga, C. P., & Rodrigues, J. A. (2015). *Agribusiness gross domestic product (GDP) in the Brazilian region of Paraná and the economic development of its agricultural cooperatives*. African Journal of Agricultural Research, 10(48), DOI:10.5897/AJAR2015.10208, Page[4384-4394]

1.1.3. components of the agricultural supply chain

1.1.3.1. Procurement or sourcing:

Procurement means purchasing the items needed for carrying out operations in farming processes like seeds, fertilizers, machinery etc., while sourcing involves the finding out of appropriate suppliers for these inputs within the set prices. This means evaluating supplier dependability, quality of goods, implementable practices in agriculture, as well as logistic strength so as to ensure continued availability of goods for food production. By doing so, it

ensures that agricultural activities are profitable in the long run thus fostering sustainable agricultural production.

1.1.3.2. Logistic management:

This includes planning how to transport and store farm produce from the farm through processing to consumer or retailer.

- A. Transportation:** Transporting farm produce from farms to processing or distribution centers and finally to markets or consumers.
- B. Material management:** Management of items like seeds, fertilizer and tools required when doing agriculture.
- C. On the premise of supplying mostly from production not stock:** In order to reduce the inventory level, there is a need to have an approach that relies on a just-in-time method of delivery as all products required are sourced from farms.
- D. Warehousing:** These are facilities for storing agricultural products before they are taken to processing plants or places where they can be distributed.
- E. Logistics Network modeling:** It is meant for enhancing the moving paths and distribution avenues through which agricultural products pass in a bid to cut down on expenses and escalate productivity.

1.1.3.3. Organizational management:

- A. Contracting:** Negotiating contracts with farmers, suppliers, and other stakeholders involved in the agricultural supply chain.
- B. Strategic alliances and partnerships:** Collaborating with agricultural organizations, research institutions, and government agencies to improve production practices, access new markets, or develop new technologies.
- C. Vertical integration:** Vertical integration is to combine different steps in the agricultural supply chain like owning farms, processing facilities and distribution channels.
- D. Long term storage:** Long term storage involves having facilities where agricultural products are stored over a long time for example: grain silos or cold storage units.
- E. Packaging technology:** Packaging technology includes coming up with solutions for packaging that will help in keeping agricultural produce fresh during transportation as well as storage.

- F. Cold chain management:** It is important to maintain the quality and safety of temperature-sensitive agricultural products during transportation and storage by ensuring that appropriate temperature conditions are maintained for them.
- G. Energy efficient transport:** In order to cut down on greenhouse gases emitted from operations in agricultural supply chain, the use of fuel-efficient vehicles and other means of transport is recommended..
- H. Quality and safety:** Adoption of quality assurance tools together with adherence to food safety laws guarantees that agro-related goods conform to stipulated requirements in the sector and are used up by consumers.

1.1.3.4. Application of Efficient Consumer Response (ECR) System:

- A. Electronic scanning of price and product at the point of sale:** Using barcode technology to track sales of agricultural products at retail outlets and analyze consumer purchasing patterns.
- B. Streamline the entire distribution chain:** Optimizing processes and reducing inefficiencies in the agricultural supply chain to ensure timely delivery of fresh, high-quality products to consumers while minimizing waste and costs.¹

1.1.4. Challenges of agricultural supply chain:

1.1.4.1. Seasonality and perishability:

- A. Seasonality:** The crops that are available at only specific times of the year have their production determined by the seasons, which means that some of them can only be grown during certain periods of the year. This requires proper planning to make sure there is a continuous stream of produce throughout the twelve months of the year. Ways of dealing with seasonality include:
 - **Crop diversification:** Planting a variety of crops with different harvesting times can help ensure a continuous supply.
 - **Preservation techniques:** Canning, freezing, and drying can extend the shelf life of seasonal produce.
 - **Demand forecasting:** Forecasting correctly enables preparing the required plant output.

¹ National Institute of Agricultural Extension Management (MANAGE). (n.d.). Training programme on Supply Chain Management in Agriculture.

Figure 2: Seasonality of fruits and vegetables



Source: Louisec. (2023, September 18). Why you should be eating seasonally - Everyone Health. Everyone Health. <https://everyonehealth.co.uk/why-you-should-be-eating-seasonally/>, Consulted 17/3/2024 at 20:42.

B. Perishability: Many agricultural products spoil quickly and cannot be stored for long. The ways in which they can be preserved from spoiling includes:

- **Cold chain management:** This significantly reduces losses through damage by pests or spoilage from microbial activities.
- **Efficient logistics:** Streamlining transportation to reduce the time from farm to consumer is crucial.
- **Packaging innovations:** The application of packages that either increase expiry dates or show signs of freshness aids in decreasing amounts left unused thus minimizing the deposition of residues on farmlands that pollute them.
- **Peak Harvesting Seasons:** Harvesting times come with their fair share of challenges given the high volumes of agricultural produce gathered within periods that could be

too much for storage and transportation means to handle easily; available remedies include:

- **Scalable infrastructure:** Investing in storage facilities that can handle peak season volumes.
- **Collaborative distribution:** It can help manage excess produce by having farmers share transportation and store resources.
- **Market expansion:** Finding more markets could distribute produce more widely but in lower volumes.

1.1.4.2. Infrastructure limitations:

- A. Transportation:** Roads in poor condition can cause the movement of farm produce to market to be delayed, leading to increased numbers of perishable goods. There is also the possibility that if there isn't an effective transport network, it may become costly to distribute these items, thus making it impossible for farmers to trade competitively.
- B. Storage:** Most places particularly within developing nations do not have enough storage rooms, such as cold storage, or warehouse facilities at all. This has resulted in much spoilage and wastage of farm produce. Farmers might have to sell their perishables soon after they are harvested if they have no proper storage facilities and doing so means that they are likely to do it at reduced prices. Dealing with these obstacles calls for critical spending on physical structures such as road maintenance, warehousing establishments, and efficient market outlets. In addition, promoting the construction of agricultural infrastructure is beneficial for enhancing the durability and efficiency of this field. Nonetheless, these countries, such as Algeria, face deficit for this purpose since they lack funds or due to poor management's strategy.¹

1.1.4.3. Fragmented supply chains:

- A. Inefficiencies:** Each intermediary in the supply chain adds time and cost to the distribution process. The more steps there are, the greater the chance for delays and increased costs, which can ultimately affect the final price of the products and their freshness upon reaching consumers.
- B. Lack of transparency:** With so many players involved, it becomes difficult to maintain visibility over the entire chain. This lack of transparency can lead to issues with food safety, quality control, and can make it harder to identify the source of problems when they arise.

¹ Penn State Extension. (2021, November 16). Agriculture and Infrastructure: What's the Connection?

C. Difficulty in tracking: When products change hands multiple times, tracking their journey becomes more complex. This can pose challenges in ensuring the quality and safety of food products, as well as in recalling products if necessary. To address these issues, some strategies include:

- **Supply chain integration:** Making fewer middlemen is possible if more straightforward connections between farmers and their clients are created. It is possible to do so via means like direct sales, farmers' markets, or community-supported agriculture.
- **Technology implementation:** Digitalization can boost traceability and transparency in the whole supply chain. Tools such as blockchain are considered helpful to improve transparency and traceability throughout the whole supply chain. For instance, there are digital twin tools that can be used to simulate and optimize supply chains, leading to lower costs and more efficient operations.
- **Policy and infrastructure development:** Governments play their part by investing in infrastructure that enhances more efficient supply chains and adopting laws that support integration as well as transparency.
- **Collaborative networks:** Processes will be facilitated and resources shared efficiently through prompting collaboration amongst diverse players within the chains of supplies.

This can be considered the main challenge because solving it would contribute immensely to involving the other challenges.¹

1.1.4.4. Market access and trade barriers:

A. Market access: This refers to the ability of a country to sell its agricultural products in foreign markets. It is influenced by a range of factors, including trade agreements, tariffs, and non-tariff barriers. The World Trade Organization (WTO) has worked on reforming agricultural trade by converting non-tariff measures to bound tariffs, which are tariffs with a maximum level set in international agreements¹.

B. Trade barriers: These are restrictions imposed by countries to control the amount of trade across their borders. Trade barriers can take the form of tariffs, which are taxes on imports, or non-tariff barriers, such as quotas, embargoes, sanctions, and levies. These barriers can

¹ Denis, N., Dilda, V., Kalouche, R., & Sabah, R. (2020, May 12). Agriculture supply-chain optimization and value creation. McKinsey & Company.

protect domestic industries from foreign competition but can also lead to retaliation and trade wars.

- C. Regulations:** Agricultural products are often subject to stringent regulations for health, safety, and environmental standards. While these regulations are important for protecting consumers and ecosystems, they can also act as barriers to trade if they differ significantly between countries or if they are used as a form of protectionism.
- D. Tariffs:** Tariffs are taxes imposed on imported goods and can significantly affect the price and competitiveness of agricultural products. High tariffs can make it difficult for exporters to penetrate new markets and can lead to increased costs for consumers.
- E. Impact on trade:** Trade barriers, regulations, and tariffs can all increase the cost of agricultural products, reduce their competitiveness, and limit the variety available to consumers. They can also lead to inefficiencies in the global agricultural market and affect the food security of nations.

Efforts to reduce trade barriers and improve market access are ongoing. International organizations like the WTO and regional trade agreements aim to lower tariffs and create a more open and fair trading system. The Agreement on Agriculture under the WTO, for example, aims to increase market access and reduce trade-distorting policies in agriculture.

Depending on the type of product comes the importance and level of detail of the trade barriers which are the most detailed with fresh agricultural products as compared to industrial agricultural products.¹

1.1.4.5. Quality and standardization:

- A. Diverse agricultural practices:** Farming techniques, climatic conditions and technological adoption levels might differ from one region to another thus affecting commodity quality consistency across the board. As a result, it becomes almost impossible to standardize commodities in different markets.
- B. Quality requirements:** Markets in differing parts of the world have dissimilar sets of regulations governing the quality of products and safety issues. Producers must ensure their products meet these varying requirements to avoid rejection.

¹ WTO | Agriculture - explanation of the agreement - market access.

(n.d.). https://www.wto.org/english/tratop_e/agric_e/ag_intro02_access_e.htm, consulted 07/03/2024 at 12:32.

C. Standardization: International standards aim to make products of the same quality. However, these standards are difficult to achieve especially by manufacturers in developing countries who may require expertise as well as resources.

D. Financial impact: Unmet demands may bring about rejected imports causing financial loss on one end while interfering with the supply chain leading to market price fluctuation. Ways out of this include:

- **Investment in technology:** It can play a vital role in the improvement of the quality and consistency of products.
- **Training and education:** Training farmers on best practices and common standards can boost adherence.
- **Policy support:** This can be done by aligning national standards to international levels and allowing trading. Joining certification programs can help producers show that they are able to meet quality standards accurately.
- **Certification programs:** Participating in certification programs can help producers demonstrate compliance with quality standards.¹

“Challenges Relating to Complying with Product Standard An Agricultural Product” by Tefera Nigussie.

1.1.4.6. Climate change and biodiversity loss:

A. Climate Change:

- **Rising Temperatures:** Increased heat can reduce yields, and alter the optimal growing conditions for various food staples².
- **Extreme weather events:** Floods, droughts, and storms can destroy crops, disrupt planting and harvest times, and degrade soil quality.
- **Water scarcity:** Changes in precipitation patterns can lead to water shortages, affecting irrigation and reducing agricultural productivity.³

B. Biodiversity loss:

- **Pollination:** Pollinators such as bees are important for crop production.
- **Soil fertility:** Soil biodiversity is related to its microorganisms presence, which perform functions in the absence of which no life would exist here.

¹ Climate change impacts on agriculture and food supply | US EPA. (2024, June 4). US EPA.

² Idem.

³ World Bank Group. (2022, October 19). What you need to know about food security and climate change. World Bank.

- **Pest and disease control:** Biodiversity plays a crucial role in controlling pests and diseases; its loss can lead to increased vulnerability of crops to these threats.

C. Impact on Agricultural Supply Chains:

- **Productivity:** Both climate change and biodiversity loss can lead to decreased agricultural productivity, threatening food availability¹.
- **Food quality:** The nutritional value of foods may decline as a result of decreased levels of essential macronutrients and micronutrients.
- **Economic costs:** Farmers and producers may face increased costs due to the need for adaptation measures, such as new crop varieties or irrigation systems².

These conditions were, are still, and will continue to deteriorate in the future, posing an everlasting challenge, the only viable solution for them is to mitigate their effects as much as possible in order to continue a sustainable agricultural supply chain.

1.1.4.7. Geopolitical uncertainties:³

A. Economic and geopolitical uncertainties:

- **Conflicts:** Wars and conflicts can lead to the destruction of agricultural infrastructure, displacement of farming communities, and disruption of food distribution channels¹.
- **Trade tensions:** Disputes between countries can result in tariffs and trade barriers, affecting the flow of food commodities and leading to price volatility.
- **Trade policies:** Protectionist policies, such as export bans during crises, can exacerbate food shortages and lead to global market instability.

B. Impact on global food stability and security:

- **Supply chain disruptions:** Geopolitical events can cause immediate disruptions in the supply chain, leading to food shortages and increased prices.
- **Access to resources:** Competition for agricultural resources can be both a cause and a consequence of geopolitical rivalry, affecting food production and distribution².
- **Armed conflict:** Armed conflict is a significant driver of food insecurity, which can feed into social unrest and violence, further destabilizing regions.

C. Long-term implications:

¹ Ibid.

² Ibid.

³ Aminetzah, D., Baroyan, A., Kravchenko, O., Denis, N., Dewilde, S., Ferreira, N., Revellat, J., & Verlan, I. (2022, August 17). A reflection on global food security challenges amid the war in Ukraine and the early impact of climate change. McKinsey & Company. Published in: 17/06/2022.

- **Food insecurity:** Prolonged geopolitical uncertainties can lead to chronic food insecurity, affecting the most vulnerable populations.
- **Economic impact:** The cost of food can rise, impacting the affordability of food and leading to increased hunger and malnutrition¹.

D. Policy challenges: Addressing the root causes of geopolitical uncertainties requires coordinated international efforts and policies that promote food security¹.

A most recent proof of this challenge is the Russian-Ukraine war which caused, among other complications to international commerce, a distinct lack in wheat, corn and sunflower oil... etc.

1.1.4.8. Demand for healthier food:

A. Consumer preferences:

- **Health awareness:** Increased awareness of health and wellness has led consumers to seek out organic, natural, and additive-free products².
- **Safety concerns:** Food safety scandals have heightened consumer demand for transparency and traceability in food sourcing.

B. Agricultural production:

- **Organic farming:** There's a shift towards organic farming practices, that avoid synthetic pesticides and fertilizers, to meet consumer demand¹.
- **Sustainable practices:** Farmers are adopting more sustainable practices, such as crop rotation and reduced water usage, to appeal to environmentally conscious consumers.

C. Supply chain dynamics:

- **Local sourcing:** There's a trend towards local sourcing to reduce carbon footprints and support local economies¹.
- **Certification and labeling:** The need for certifications like 'organic' or 'non-GMO' has become more prevalent, adding layers to the supply chain process³.

D. Economic impact:

- **Cost implications:** Organic and natural products often have higher production costs, which can translate to higher prices for consumers⁴.

¹ Zhou, J., Dellmuth, L. M., Adams, K. M., Neset, T.-S., & von Uexkull, N. (2020). The geopolitics of food security: Barriers to the sustainable development goal of zero hunger. SIPRI Insights on Peace and Security, (No. 2020/11), November 2020.

² USDA announces framework for shoring up the food supply chain and transforming the food system to be fairer, more competitive, more resilient. (2022, June 1). USDA.

³ USDA announces framework for shoring up the food supply chain and transforming the food system to be fairer, more competitive, more resilient. (2022, June 1). USDA.

⁴ Shrotriya, D. K. (2023, August 24). Challenges & Solutions of Agri supply chain.

- **Market opportunities:** This shift opens new market opportunities for producers specializing in these products.

With the evolution of consumers, the demands became more and more detailed, with the industrial products to industrial agricultural products to finally fresh agricultural products. These details of the demand all enter the product under the name “quality”

In conclusion, the agricultural supply chain represents a complex network of interconnected activities and stakeholders involved in the production, processing, distribution, and marketing of agricultural products. Defined by various scholars and institutions, the agricultural supply chain encompasses input supply, production, harvesting, post-harvest handling, transportation, processing, distribution, and waste management, among other components. However, this intricate system faces numerous challenges, including seasonality and perishability, infrastructure limitations, fragmented supply chains, market access and trade barriers, quality and standardization issues, climate change and biodiversity loss, geopolitical uncertainties, and evolving consumer preferences for healthier food options. Addressing these challenges requires collaborative efforts, technological innovations, policy support, and investments in infrastructure to ensure the resilience, efficiency, and sustainability of the agricultural supply chain in meeting the demands of a growing global population.

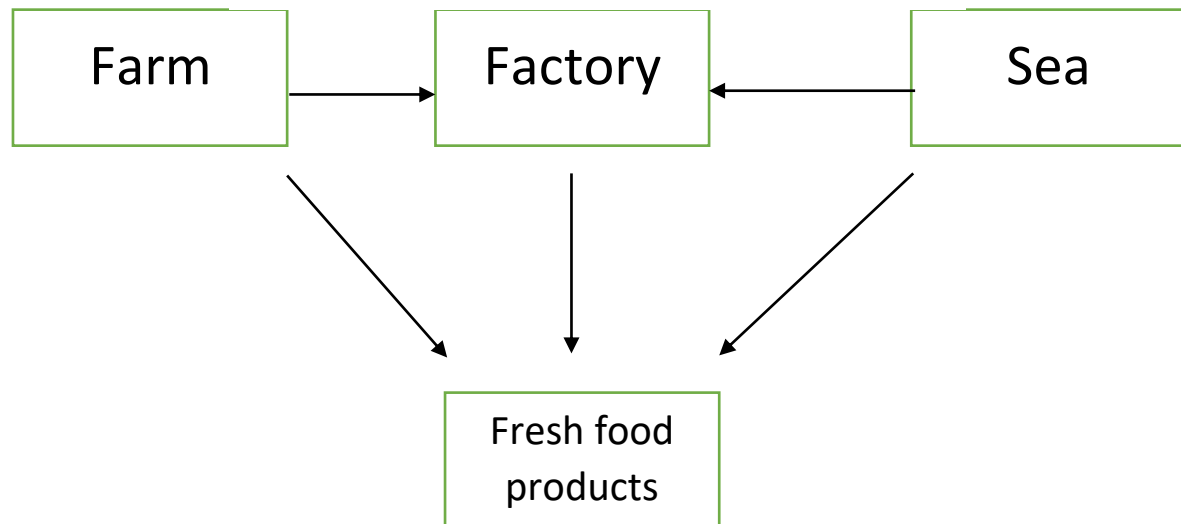
1.2.Agricultural fresh products

1.2.1. Categories of fresh products:

- **Fruits:** Such as Apple, Banana, Orange, Mango, Grape, dates. (Farm)
- **Vegetables:** Including carrots, lettuce, tomatoes, and broccoli. (Farm)
- **Meat:** Such as beef, chicken, pork, and lamb. (Farm)
- **Seafood:** Including fish, shrimp, mussels, and crab. (Sea)
- **Dairy:** Such as milk, cheese, yogurt, and eggs. (Farm/ Factory)
- **Herbs:** Including basil, parsley, cilantro, and mint. (Farm)
- **Nuts and seeds:** Such as almonds, walnuts, sunflower seeds, and pumpkin seeds. (Farm)
- **Bakery items:** Such as bread, pastries, and cakes, if made fresh daily. (Factory)
- **Specialty items:** Such as tofu, tempeh, and sprouts. (Faculty)
- **Exotic fruits and vegetables:** Depending on the region, these can include dragon fruit, passion fruit, kale, and bok choy. (Farm)

Of this list of Fresh Products we are only interested in agricultural ones, so that means seafood and bakery items are off the list of research in this study. The rest of these categories are procured either through farming of breathing land livestock. The following scheme portrays the main three sources of All Fresh Products.

Figure 3: Sources of the fresh products



Source: elaborated by students with the above mentioned information.

From this diagram we see that fruits, vegetables (most exotic and non exotic), herbs, nuts and seeds are all obtained from farms, dairy products are a special case since depending on the product it's maybe from the farm like eggs and milk or from the factory like yogurt. In addition to yogurts the factories are the source of bakery items. Which leaves us with seafood that comes directly from the sea.

1.2.2. Specificities of their state in the case of exportation:

1.2.2.1. Fruits and vegetables:

Fruits and vegetables need to be in good condition, free from pests, diseases, and physical damage. This is to ensure the quality and safety of the products and to prevent any health risks for consumers¹.

Depending on the destination, they may need to be washed, treated, or packaged according to specific requirements. For example, the EU has a Maximum Residue Levels (MRLs) system

¹ What requirements must fresh fruit or vegetables comply with to be allowed on the European market? | CBI. (2023, December 12).

that regulates the use of pesticides in food products¹. The EU also has a phytosanitary certificate system that requires most fresh fruit and vegetables to be inspected and certified before shipping².

Some countries have restrictions on certain types of fruits and vegetables due to pest or disease concerns. These restrictions may vary depending on the origin, season, or variety of the products. More information about the international standards for fruit and vegetables can be found on the OECD Library² or the UNECE website³.

1.2.2.2. Meat and seafood:

Meat and seafood need to be fresh and properly refrigerated to maintain quality and safety. Exporting meat and seafood often involves complying with strict sanitary and hygiene standards, including proper handling, processing, and packaging³.

Documentation such as health certificates and import permits may be required. The type and format of the documentation may vary depending on the destination country and the product category⁴. For example, the EU has a Maximum Residue Levels (MRLs) system that regulates the use of pesticides in food products³. The EU also has a phytosanitary certificate system that requires most fresh fruit and vegetables to be inspected and certified before shipping⁵.

Some countries have restrictions on certain types of meat and seafood due to pest or disease concerns. These restrictions may vary depending on the origin, season, or variety of the products. More information about the international standards for meat and seafood can be found on the NOAA Fisheries Seafood Commerce & Trade or the Canadian Food Inspection Agency websites.

¹ International standards for fruit and vegetables. (n.d.). OECD iLibrary. https://www.oecd-ilibrary.org/agriculture-and-food/international-standards-for-fruit-and-vegetables_19935668#wrapper, Consulted 04/03/2024 at 14:58.

² United Nations Economic Commission for Europe. (2021). Standard Layout for UNECE Standards on Fresh Fruit and Vegetables-2021.

³ Canadian Food Inspection Agency. (2019, December 11). Exporting food: a step-by-step guide. [inspection.canada.ca. https://inspection.canada.ca/en/exporting-food-plants-animals/food-exports/step-step-guide](https://inspection.canada.ca/en/exporting-food-plants-animals/food-exports/step-step-guide), Consulted 07/03/2024 at 20:00.

⁴ Canadian Food Inspection Agency. (2019, December 11). Exporting food: a step-by-step guide. [inspection.canada.ca. https://inspection.canada.ca/en/exporting-food-plants-animals/food-exports/step-step-guide](https://inspection.canada.ca/en/exporting-food-plants-animals/food-exports/step-step-guide), Consulted 07/03/2024 at 20:00.

⁵ What requirements must fish and seafood comply with to be allowed on the European market? | CBI. (2022, November 16).

1.2.2.3. Dairy products:

Dairy products like milk, cheese, and yogurt need to be pasteurized and properly packaged to prevent spoilage during transport. Pasteurization is a process that kills harmful bacteria and extends the shelf life of dairy products¹. Packaging should also protect the dairy products from contamination, damage, and temperature fluctuations.

Exporting dairy products often involves meeting stringent regulations related to food safety and hygiene. Some countries may have specific requirements for dairy product labeling and documentation. For example, Australia has a Biosecurity Act that regulates the export of controlled goods, such as dairy products, to prevent the introduction of pests and diseases¹. Australia also has a step-by-step guide to exporting dairy products that outlines the steps and requirements for different types of dairy products.¹

According to Statista, global dairy product exports were valued at about 68 billion U.S. dollars in 2022, up from around 66.56 billion dollars in the previous year². The leading market for U.S. dairy products is Mexico, which accounted for nearly a quarter of all exports in 2013. U.S. dairy exports have grown consistently since 2017, reflecting an annual average growth rate of 9 percent³.

1.2.2.4. Herbs, nuts, and seeds:

These products need to be clean, dry, and free from contamination¹. Exporters may need to provide documentation certifying the origin, quality, and safety of the products. Packaging requirements may vary depending on the type of product and destination.⁴

Some examples of herbs, nuts, and seeds that are commonly exported are dried fruits, nuts, spices, cocoa, coconuts, superfoods, and more. These products may require different certifications and procedures depending on the importing country's regulations and standards¹. For example, Australia has a Biosecurity Act that regulates the export of controlled goods, such as plants and plant products, to prevent the introduction of pests and diseases⁵.

¹ Australian Government Department of Agriculture, Water and the Environment. (n.d.). Step by step guide to exporting dairy products. (30 May 2023).

² Topic: Dairy industry worldwide. (2023, December 18). Statista. <https://www.statista.com/topics/4649/dairy-industry/>, Consulted 08/03/2024 at 16:24.

³ Dairy 2021 Export Highlights. (n.d.). USDA Foreign Agricultural Service.

⁴ Australian Government Department of Agriculture, Water and the Environment. (25 March 2023.). Step by step guide to exporting plants and plant products.

⁵ Batafoodwp. (2024, January 30). BATA FOOD - Supplier of Organic Dried fruits, Nuts, Seeds and more. BATA FOOD. <https://www.batafood.com/> , consulted 05/03/2024 at 8:40.

1.2.2.5. Bakery items:

Bakery items, such as bread and pastries, are popular products to export worldwide. However, exporting them may require proper packaging to prevent damage during transit and compliance with regulations related to food labeling, ingredient declarations, and allergen information¹. These regulations may vary depending on the destination country, including customs, quarantine, and food safety regulations. Therefore, exporters should research and comply with the specific requirements of the destination country before exporting fresh products. Working with experienced exporters, freight forwarders, and regulatory agencies can help ensure the smooth and compliant export of fresh products. Additionally, exporters should be aware of global trends and opportunities in the bakery product market, such as the growth of sweet biscuits, waffles, and gingerbread. Exporting bakery items can be a rewarding and profitable venture if done correctly and strategically.”

1.2.3. Requirements needed:

The requirements for exporting can be divided into two parts: on site requirements and administrative requirements, delving into the first one which encompasses all that needs to be present in the product so that it can be considered fit to export. The administrative requirements could be considered the badge of approval for the product's exportation. Both parts of the requirements are made by key regulatory bodies and they may change depending on the demands of recipient countries.

1.2.3.1. Mandatory requirements:

Mandatory requirements cover food safety and quality, and they change regularly¹. For example, you must document the sources of your product and provide proof of origin for all fruits and vegetables. This is necessary for importers to benefit from the tariff program². Additionally, you must comply with the European Food Safety Authority (EFSA)'s regulations and frameworks, such as the Hazard Analysis of Critical Control Points (HACCP) system. You must also be aware of the limits on various contaminants, such as pesticide residues and mycotoxins, and keep records of the products you use and your spraying records.¹

Limited use of pesticides refers to the restriction of pesticide applications to certain situations or products, such as public health pest control, state-limited-use pesticides, or restricted-use

¹ What requirements must fresh fruit or vegetables comply with to be allowed on the European market? | CBI. (2023, December 12).

products. The aim of limiting pesticide use is to reduce the potential for adverse effects on humans, animals, or the environment as a result of wide area public health pest control.

General Marketing Standard (GMS) is a quality and labeling standard for fresh fruit and vegetables, including nuts, herbs, salad crops and mushrooms. The GMS applies to most other fresh produce, except for 10 types of produce that have a Specific Marketing Standard (SMS). The GMS defines the minimum quality and maturity requirements for produce, as well as the marking and documentation requirements for marketing purposes.

A maximum residue limit (MRL) is the maximum concentration of a pesticide residue (expressed as mg/kg), to be legally permitted in or in food commodities and animal feeds¹. MRLs are based on Good Agricultural Practice (GAP) data and foods derived from commodities that comply with the respective MRLs are intended to be toxicologically acceptable.

The main principal international source of MRLs is the Codex Alimentarius, which is a collection of internationally accepted standards, guidelines, and codes of practice for food safety, animal health, and plant health. MRLs can be found in the Codex pesticides in food online database.

The European Union sets its MRLs applicable in the EU (referred to as maximum residue levels), which are not always the same as Codex MRLs. EU legislation harmonizes and simplifies pesticide MRLs, and sets a common EU assessment scheme for all agricultural products for food or animal feed. MRLs apply to 315 fresh products and to the same products after processing, adjusted to take account of dilution or concentration during the process.¹

1.2.3.2. Private requirements:

The private requirements are referred to as certifications. Almost all the certifications on the European market are social and environmental in nature. Their main goal is to protect European consumers. Some of the private requirements are:

Organic certifications are voluntary labels that indicate that a product or a farm has been produced or processed according to organic principles. Organic principles include avoiding the use of synthetic pesticides, fertilizers, hormones, and antibiotics, and promoting biodiversity, soil health, and animal welfare. Organic certifications are issued by accredited certifying agents,

¹ Export, V. F., & Babaei, Z. (2021, October 17). All about exporting fruits and vegetables. Vira Fruits Export.

which can be either public or private organizations. The EU has a common organic regulation that sets out the minimum standards and requirements for organic products and farms.

Private standards are voluntary specifications that go beyond the mandatory requirements and aim to enhance the quality, safety, and sustainability of products and services. Private standards can be related to social and environmental aspects, such as fair trade, organic farming, animal welfare, or climate change mitigation. Private standards can help you differentiate your products and services from competitors and meet the expectations of your target market.

1.2.3.3. Phytosanitary regulations:

A phytosanitary certificate is a document that guarantees that certain plants, plant products and other objects entering the EU are properly inspected, free from quarantine pests, and in line with the plant health requirements of the EU. The exporting country's national plant protection authorities issue the phytosanitary certificates.¹

The EU has established plant health rules to protect its agricultural sector and public health from the risks posed by pests and diseases that may be introduced through trade in plants and plant products. From December 14th, 2019, all plants (including living parts of plants) will need to be accompanied by a phytosanitary certificate to enter the EU.²

The limited use of pesticides refers to the restriction of pesticide applications to certain situations or products, such as public health pest control, state-limited-use pesticides, or restricted-use products². The aim of limiting pesticide use is to reduce the potential for adverse effects to humans, animals, or the environment as the result of wide area public health pest control.³

1.2.3.4. Traceability and documentation:

Traceability refers to the ability to trace the origin, movement, and status of a product or a product component throughout the supply chain¹. Traceability is essential to ensure food safety, quality, and transparency, as well as to facilitate market surveillance, product recall, and risk management.

Documentation refers to the information and records that support the traceability process and demonstrate compliance with the applicable requirements. Documentation can include

¹ Trade in plants & plant products from non-EU countries. (2021). Food Safety.

² European Commission. (2021). Directorate-General for Health and Food Safety. Plant health rules.

³ Idem.

technical documentation, an EU declaration of conformity, a Phytosanitary certificate, product traceability labeling, and more.

The EU has established various legislation and regulations that govern the traceability and documentation of food products and plants, such as the Framework Regulation for Food Safety, the Codex Alimentarius, the Plant Health Rules, and the Medical Device Regulation (MDR). These legislation and regulations aim to protect the health and safety of consumers, animals, and the environment, as well as to ensure fair trade practices and market access for EU producers.¹

1.2.3.5. Additional requirements and certificates:

European buyers often have specific requirements, such as BRCGS and IFS certifications based on HACCP principles. For pre-packed products, additional requirements in Regulation (EU) No.1169/2011 on the provision of food information to consumers must be met.

BRCGS stands for British Retail Consortium Global Standard, and it is a certification scheme that covers various aspects of food safety, such as production, processing, storage, distribution, and retail.

IFS stands for International Food Safety System, and it is a certification scheme that focuses on the prevention of foodborne hazards and the promotion of good hygiene practices in food businesses.

Regulation (EU) No.1169/2011 is a regulation that aims to improve the transparency and accuracy of food information provided to consumers, especially for pre-packed products. It requires food businesses to provide clear and concise information on the composition, origin, allergens, nutrition, and shelf life of their products, as well as to use standardized formats and methods for communication.

1.2.3.6. Cold chain compliance:

For pre-cut fruit and vegetables, it is essential to respect the cold chain. Any power cuts during storage must be communicated to the buyer.

Cold chain compliance refers to the ability of food businesses to maintain the temperature and quality of their products throughout the supply chain, from production to consumption. The low temperatures from the cold chain are important for stopping foodborne dangers like bacteria,

¹ Mo, C. (2023, March 7). Product Traceability Requirements in the European Union: An Overview. Compliance Gate.

viruses, and fungi and maintaining the dietary and sensory characteristics of products. The observation of the cold chain is especially important for pre-cut fruit and vegetables since they are much easier to spoil and contaminate than whole ones. Power outages are a potential hazard in storage that could lead to oscillations in temperature hence spoilage or loss of foodstuffs due to infestations by pathogens. Hence, any electricity interruption while goods are still being held should be reported to a purchaser promptly by means that are known to work like telephone calls, e-mails among others. The buyer should also be informed of any contingency plans or alternative arrangements that can be made in case of a power cut.¹

1.2.4. Challenges related to fresh agricultural products:

1.2.4.1. Shelf-life:

The shelf life of food refers to how long they remain fresh before going bad; hence, perishability concerns fresh agricultural outputs like fruits, vegetables, and dairy products. Agricultural commodities like fruits, vegetables and dairy have a declining shelf-life because they easily go off by decaying quickly as a result of natural or chemical factors. The issue of maintaining high levels of these characteristics when moving them from one place to another or storing them is quite complex. Shelf-life is the duration within which a food item can be stored and eaten without losing its worth, safety, or nutritional content.

1.2.4.2. Temperature control:

In food businesses, a thermometer has the capacity to retain specific temperature conditions required to prevent food spoilage and retain its quality for many fresh agricultural products. Though these conditions can vary with the type, stage, and processing of the food product, they always involve cold chain integrity; meaning that food product should always remain at the right quality and temperature throughout the supply chain, from farm to fork. Preserving the fresh agricultural products' nutritional and sensory attributes as well as preventing bacteria, viruses, and fungi that may cause foodborne hazards require maintaining cold chain integrity. However, sometimes it is not easy to achieve this especially in regions without enough infrastructure or during long distance transportation. These problems could range from temperature variations through power outages to packaging difficulties including monitoring complexities.

¹Special documents. (n.d.). International Trade Administration | Trade.gov. <https://www.trade.gov/special-documents> , Consulted 12/03/2024 at 22:19.

1.2.4.3. Quality preservation:

Quality preservation is the capability of food enterprises to retain in their fresh agricultural commodities' entire supply chain, from its start to when consumed, product quality, look and nutrition. This is central to fulfilling consumer aspirations, ensuring market compatibility averting the possibility of food poisoning or damage. There are different ways in which handling practices, packaging, and storage conditions can influence product quality and shelf life. Handling practices, for instance, have an impact on microbial contamination, chemical degradation, or physical damage to the food product; packaging can affect the moisture loss, oxygen exposure, or temperature regulation of the food product, and storage conditions can affect temperature fluctuations, humidity levels, or light exposure.

1.2.4.4. Seasonality and variability:

Seasonality and variability are two key aspects of agricultural production that can affect food security, nutrition, and livelihoods of farmers and consumers, especially in tropical and rural areas.

Seasonality refers to the cyclical fluctuations in food availability and access that are influenced by weather conditions, pests, and other factors¹. For example, rainfall patterns can affect crop yields, harvest times, and food consumption patterns¹. Seasonality can also create challenges for market access, as farmers may face difficulties in selling their produce at optimal prices and times².

Variability is the existence of diverse and unpredictable agricultural production and consumption influenced by natural disasters, climate change and other shocks. One way through which this can happen is by altering rainfall patterns due to climatic variations leading to more frequent and severe cases of drought or flooding thus affecting crops' resistance and adjusting mechanisms. Nonetheless, variability presents agricultural systems with chances for creativity, robustness, and perpetuity.

1.2.4.5. Transportation logistics:

Transportation logistics are critical to ensure timely delivery of fresh agricultural products to markets or consumers. Transportation logistics is the process that ensures the optimal and continuous flow of agro-goods from manufacturers/suppliers to producers and, eventually, to consumers. It involves

¹ Pardoe, J., Kloos, J., & Assogba, N. P. (2016). Seasonal variability: Impacts, adaptations and the sustainability challenge. In Springer eBooks DOI:10.1007/978-3-319-31499-0_4 ,(pp. 41–57).

² Bonuedi, I., Kornher, L., & Gerber, N. (2021). Agricultural seasonality, market access, and food security in Sierra Leone. Food Security, 14(2), DOI: 10.1007/s12571-021-01242-z, Pages 471–494.

activities such as agricultural production, acquisition, storage, handling, transportation, and distribution.¹

Challenges such as transportation delays, congestion, and inadequate infrastructure can impact product quality and increase costs³. For example, transportation delays can affect crop yields, harvest times, and food consumption patterns. Congestion can increase the risk of spoilage, contamination, and loss of products. Inadequate infrastructure can limit the accessibility and affordability of transportation services.²

Therefore, efficient transportation logistics are essential for ensuring food security, nutrition, and livelihoods of farmers and consumers, especially in tropical and rural areas. They can also create opportunities for innovation, resilience, and sustainability in agricultural systems.³

1.2.4.6. Post-harvest losses:⁴

They can be caused by improper handling, storage, or transportation of crops, which can lead to spoilage, infestation, or damage. Post-harvest losses contribute to food insecurity, economic losses, and environmental degradation.

Minimizing post-harvest losses requires improved handling practices, such as assessing maturity, avoiding injury, keeping produce cool, and using appropriate packaging. It also requires infrastructure investment, such as cold storage facilities, refrigerated cars, and moisture-resistant packaging. Moreover, it requires technology adoption, such as using sensors, drones, or artificial intelligence to monitor and optimize post-harvest processes.

1.2.4.7. Market access:

Market access: Accessing markets, especially for small-scale producers or those in remote areas, can be challenging due to factors such as limited infrastructure, transportation costs, and market barriers. Improving market access and market information can help farmers reach wider markets and obtain better prices for their products⁵. This can also help them add value to their agricultural products, effectively manage post-harvest processes, and strengthen farmer groups. Improving market access and value chains can contribute to reducing poverty and hunger, increasing productivity and incomes, and strengthening food security for producing families and their communities.

¹ Magill, P. (2022, May 25). The role of logistics management in the agricultural industry. Transportation Management Solutions.

² Matuszak, J. (2024, April 12). The role of transport in agriculture. KnowHow.

³ Transportation Research & Analysis | Agricultural Marketing Service. (n.d).

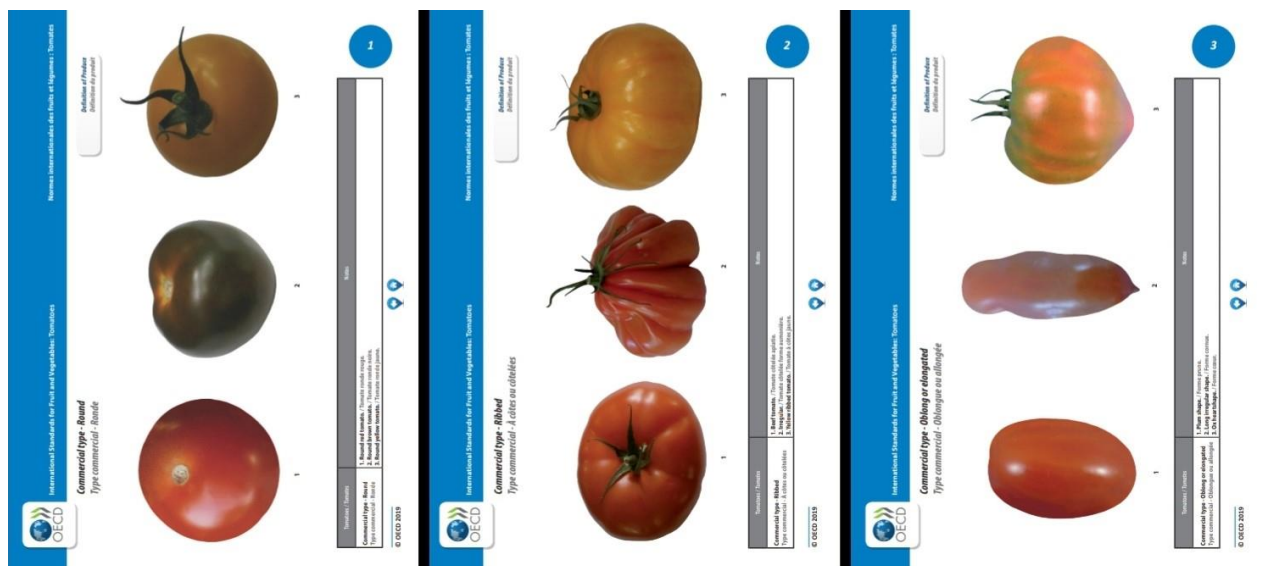
⁴ Herrick, C. (2021, June 22). 6 tips to avoid postharvest losses - Growing produce. Growing Produce.

⁵ IFAD. (n.d.). Market access and value chains. Retrieved from <https://www.ifad.org/en/market-access>. Consulted in : 6/3/2024 at 18 :27.

1.2.4.8. Compliance and food safety:

Compliance and food safety: Meeting regulatory requirements and ensuring food safety standards are essential for fresh agricultural products¹. Compliance with food safety regulations, traceability systems, and quality assurance programs adds complexity to the supply chain but is necessary to protect consumer health and maintain market access. This can also help farmers improve food quality and safety throughout the food chain, reduce risk of legal action, fines, and damage to a farm's reputation, and increase efficiency. Improving compliance and food safety can contribute to reducing poverty and hunger, increasing productivity and incomes, and strengthening food security for producing families and their communities.²

Figure 4: The different variations of tomatoes that could be exported and the specific needs for each.



We can see that these challenges are all around delivery speed and quality perseverance, and with the exception of post-harvest losses which is a problem that can be dealt with only at the farm's level, the rest of the challenges require the collaboration of all actors in the supply chain. One of the solutions to reduce the impacts of these challenges is choosing a suitable package that not only helps with quality preservation but also traceability with the new technology of RFID.

¹ Navigating Regulations and Compliance in agriculture: A guide for farm owners. (n.d.).

² Radojka,B.(25 March 2024).Food Safety Regulations and Compliance: Navigating the Path to a Safer Tomorrow. FoodReady.

1.2.5. types of packages for fresh agricultural products:

1.2.5.1. Cartons and boxes:

Used for fruits, vegetables, and bakery items. Examples: Cardboard cartons for apples, oranges, and berries; corrugated boxes for lettuce, tomatoes, and cucumbers.

1.2.5.2. Plastic bags and pouches:

Ideal for packaging small or individual portions of fresh products. Examples: Polyethylene bags for loose leafy greens, zip-lock bags for herbs and spices, vacuum-sealed pouches for sliced fruits.

1.2.5.3. Trays and clamshells:

Provide protection and visibility for fresh products. Examples: Plastic trays with lids (clamshells) for berries and cherry tomatoes, foam trays for meat cuts, plastic trays with compartments for fresh fruit assortments.

1.2.5.4. Cans and jars:

It is used to save and pack refined or unfinished fresh goods. For instance, canned peaches, canned tuna and jarred pickles.

1.2.5.5. Flexible films and wrappers:

Flexible films and wrappers: they offer flexibility, being light in weight to wrap such things as shrink films used to bundle produce. Examples: Stretch films for wrapping palletized produce, shrink films for bundling vegetables, cling wraps for covering individual portions of fruits.

1.2.5.6. Punnets and baskets:

Materials like plastic punnets are often used for berries and other soft fruits in order to avoid bruising. Examples are strawberries and raspberries while cherries and figs may be packaged in woven baskets.

1.2.5.7. Bulk containers:

Bulk containers are designed so that they can carry large amounts of fresh produce economically. In the case of apples and pears, wooden crates are most suitable for this purpose whereby plastic bins are used with onions and potatoes and pallet boxes are used during bulk shipping of cabbage as well as lettuce.

1.2.5.8. Palletized or unitized packaging:

Used for consolidating and organizing multiple units of fresh products for transportation. Examples: Pallets loaded with cartons of fruits and vegetables, unitized loads of meat cuts wrapped in shrink films, palletized bakery trays.

1.2.5.9. Specialized packaging for temperature control:

Designed to maintain specific temperature conditions for perishable products. Examples: Insulated foam containers for seafood and meat, refrigerated containers for transporting dairy products, thermal blankets for protecting fresh produce during transit.

1.2.5.10. Eco-friendly and sustainable packaging:

Environmentally friendly packaging options made from biodegradable or compostable materials. Examples: Biodegradable paper bags for organic produce, compostable PLA (polylactic acid) clamshells for salads, reusable mesh bags for fruits and vegetables.

To conclude, ensuring compliance with regulatory requirements, maintaining cold chain integrity, and adopting sustainable packaging practices are crucial for successfully exporting fresh agricultural products. By addressing challenges such as shelf-life limitations, transportation logistics, and market access barriers, farmers and exporters can enhance food safety, quality, and sustainability, ultimately contributing to global food security and consumer satisfaction.

1.3. The supply chain of fresh agricultural products:

1.3.1. Definitions of reactive supply chain:

1.3.1.1. Reactive supply chain definition:

A reactive supply chain is one that responds to changes in demand or disruptions in the supply chain as they occur. It focuses on addressing immediate challenges and managing crises as they arise, often relying on ad-hoc solutions and firefighting strategies to maintain operations.¹

A reactive supply chain is characterized by a lack of proactive planning and coordination, resulting in a fragmented and disjointed approach to managing the flow of goods and information. It often leads to inefficiencies, delays, and disruptions, as decisions are made in reaction to immediate challenges rather than as part of a strategic, coordinated effort.

¹ Chopra, S., & Meindl, P. (2016). Supply Chain Management: Strategy, Planning, and Operation (6th ed.). Pearson Education India. ISBN: 1292093560,9781292093567. Pages[22-23].

1.3.1.2. Definition of Efficient reactive supply chain:

This strategy focuses on the cost-effectiveness and efficiency of the finished product. An example would be supermarket supply chains. Distribution centers and logistics work together to replace the goods in supermarkets as fast as possible.

This strategy is much more suitable for fresh agricultural products than its counterpart which is "make to stock" that's the layer that would be detrimental to the products in both time and quality, however the former isn't the ideal choice for cost-effectiveness.

This is the goal and the best supply chain possible for fresh agricultural products, satisfies the factors of trying to optimize delivery speed, cost efficiency, quality perseverance and traceability.

1.3.2. Notions of a reactive supply chain:

1.3.2.1. Responsiveness:

A reactive supply chain is focused on quickly reacting to changes, disruptions, or customer demands as they occur.

- A. Freshness Preservation:** Suppliers and retailers must make efforts to maintain the freshness of products to prevent decay and deterioration.
- B. Risk Management:** Decision models may involve a risk-neutral supplier and a risk-averse retailer, considering the demand for fresh products is affected by product freshness and price¹.
- C. Transportation:** The choice between normal temperature and cold chain transportation can significantly impact the value loss of fresh products during transit.
- D. Supply Chain Coordination:** Contracts such as cost-sharing and compensation strategies can encourage suppliers to improve their fresh-keeping efforts.¹

1.3.2.2. Short-term focus:

Reactive supply chains often prioritize short-term goals and immediate needs over long-term strategic planning.

- A. Efficient Fresh-Keeping Efforts:** Quick actions to preserve the freshness level of products during transportation and storage.

¹ Feng, Y., Hu, Y., & He, L. (2021). Research on Coordination of Fresh Agricultural Product Supply Chain considering Fresh-Keeping Effort Level under Retailer Risk Avoidance. *Discrete Dynamics in Nature and Society*, 2021, DOI: 10.1155/2021/5527215, Pages 1–15.

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- B. Adaptive Pricing Strategies:** Adjusting prices in response to the freshness level and market demand.
 - C. Contract Adjustments:** Implementing or revising contracts that align with current market conditions and freshness requirements.
 - D. Risk Aversion Tactics:** Employing strategies that minimize the risk of product loss due to perishability.

1.3.2.3. Limited visibility:

Reactive supply chains may lack visibility into upstream and downstream activities, making it challenging to anticipate and plan for potential issues.

- A. Complexity:** Agricultural supply chains often involve numerous stakeholders, including farmers, intermediaries, processors, and retailers. Each participant may have different objectives and constraints, adding to the complexity.
- B. Fragmentation:** Many agricultural supply chains are fragmented, with multiple, disconnected stages from production to end consumer. This fragmentation can result in a lack of coordination and data sharing.
- C. Uncertainty:** Factors such as weather conditions, crop yields, and market prices can be unpredictable, affecting planning and decision-making¹.
- D. Data Management:** The vast amount of data generated in agricultural supply chains can be difficult to capture, store, and analyze effectively. However, advancements in digital and analytics technologies, like digital twins, are helping to address these challenges by enabling better simulation and optimization of supply chains.¹

1.3.2.4. Inefficiency:

Reactive decision-making can lead to inefficiencies, such as increased costs, delays, and poor resource utilization.

- A. Fragmented Supply Chains:** The agricultural supply chain is often fragmented with multiple, disconnected stages, leading to a lack of coordination and data sharing. This fragmentation can result in delays, increased costs, and reduced product quality¹.

¹ Denis, N., Dilda, V., Kalouche, R., & Sabah, R. (2020, May 12). Agriculture supply-chain optimization and value creation. McKinsey & Company.

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- B. Unpredictable Yields:** Operational factors like unpredictable yields in each field due to factors such as weather, pests, and diseases can lead to inefficiencies in planning and resource allocation².
 - C. Market Volatility:** External factors like meteorological conditions, inputs, farmer capabilities, and pricing volatility due to global supply and demand imbalances can create uncertainties that complicate supply chain management².
 - D. Complex Decision-Making:** The agriculture supply chain involves complex decision-making with numerous possible outcomes at each step, from crop collection to logistics, which can involve optimization analysis in complexity².
 - E. Data Management:** The vast amount of data generated in agricultural supply chains can be difficult to capture, store, and analyze effectively, leading to potential inefficiencies in decision-making¹.
 - F. Transportation and Logistics:** Inefficient transportation and logistics can lead to increased costs and waste, especially when dealing with perishable goods. Poorly planned routes and underutilized vehicles contribute to this inefficiency².
 - G. Regulatory Compliance:** Navigating the various food safety regulations and compliance requirements can be challenging and time-consuming, potentially leading to bottlenecks in the supply chain¹.

1.3.2.5. Risk of disruptions:²

Reactive supply chains are more susceptible to disruptions due to their lack of proactive planning and preparedness.

- A. Supply risks:** These include the risks of shortages, delays, or quality issues in the availability and delivery of agricultural products and services.
- B. Demand risks:** These include the risks of excesses, uncertainties, or preferences in the consumption and valuation of agricultural products and services.
- C. Financial risks:** These include the risks of losses, costs, or debts incurred by the supply chain actors due to operational or market failures.

¹ Antràs, P., & Zilberman, D. (2023). Risks in agricultural supply chains. University of Chicago Press. Pages:[170-194].

² Sharma, R., Shishodia, A., Kamble, S., Gunasekaran, A., & Belhadi, A. (2020). Agriculture supply chain risks and COVID-19: mitigation strategies and implications for the practitioners. International Journal of Logistics, DOI:10.1080/13675567.2020.1830049, Pages 1–27.

- D. Logistics and infrastructure risks:** These include the risks of disruptions, inefficiencies, or vulnerabilities in the transportation, storage, and processing of agricultural products and services²³.
- E. Management and operational risks:** These include the risks of errors, mistakes, or failures in the planning, coordination, or execution of supply chain activities.
- F. Policy and regulation risks:** These include the risks of changes, conflicts, or inconsistencies in the legal, institutional, or political frameworks that affect supply chain operations.
- G. Biological and environmental risks:** These include the risks of diseases, pests, disasters, or climate change that affect the production and distribution of agricultural products and services.

1.3.2.6. Customer dissatisfaction:

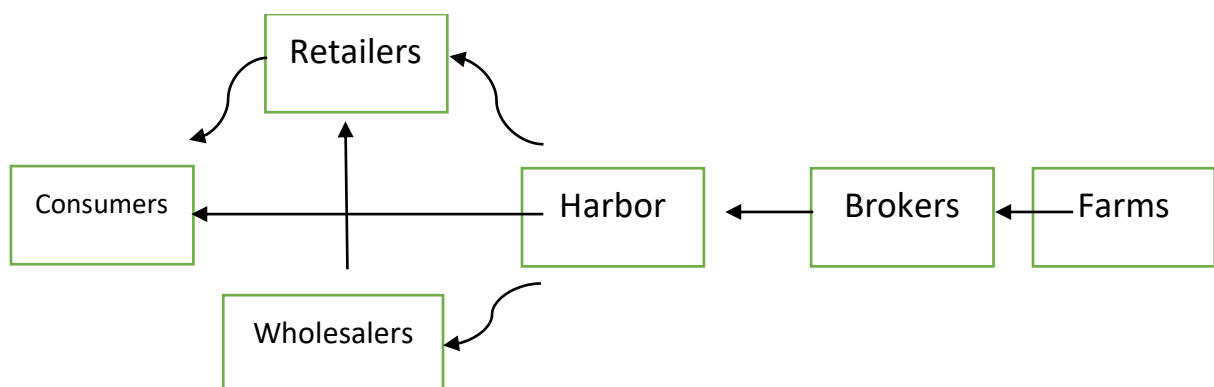
Inconsistent or delayed responses in a reactive supply chain can result in poor customer service and dissatisfaction.

To mitigate these risks and enhance the resilience of a responsive agricultural supply chain, various strategies can be adopted, such as:

- A. Adoption of industry 4.0 technologies:** These include the use of digital tools and platforms to improve the visibility, traceability, agility, and efficiency of supply chain processes².
- B. Supply chain collaboration and shared responsibility:** These include the formation of partnerships and networks among supply chain actors to share information, resources, capabilities, and risks².

1.3.3. actors of the fresh products supply chain:

Figure 5: Fresh agribusiness supply chain



Source: elaborated by students from the existing information.

1.3.3.1. Farm:

Which is the source of all agricultural fresh products whether it be meat or green.

- A. Breeding and Rearing:** This means that one must select high-quality breeding stock and raise them properly until they grow into mature animals. Moreover, the importance of proper nutrition and healthcare cannot be overemphasized.
- B. Cultivation and Harvesting:** To cultivate crops, farmers will have to plant them, water them, apply fertilizers, and control pests. When they mature, fruits can be harvested using either human labor or machines.

1.3.3.2. Brokers:

for meat and poultry:

- A. Slaughter:** When the animals reach maturity, they are transported to processing facilities where they are slaughtered. This process is usually carried out in humane and regulated conditions.
- B. Processing:** After slaughter, the animals are butchered into various cuts of meat. This can include separating the meat into different parts like steaks, roasts, and ground meat.
- C. Packaging:** After which, these same animals are cut up. Furthermore, packaging also takes place as a final step before distributing it whether internally or externally while keeping in mind domestic along with international market standards. The packaging could involve vacuum sealing, specialized labels for exporting, but also compliance with import/export regulations. On arrival at designated export facilities, packed meat shipped abroad is inspected and goes through customs clearance procedures. For the importing country's needs, export declaration forms like health certificates and invoices are duly filled out.

For fruits and vegetables:

- D. Sorting and grading:** After harvesting, the produce is sorted and graded based on factors such as size, color, ripeness, and quality. This ensures that only the best-quality produce is selected for further processing and distribution.
- E. Packaging:** The sorted and graded produce is then packaged into containers suitable for transportation. Packaging may vary depending on the type of produce and destination but often includes crates, boxes, or bags. Packaging is designed to protect the produce from damage and maintain freshness.

F. Storage: If not immediately transported, the packaged produce may be stored in temperature-controlled facilities to extend its shelf life. Cold storage helps slow down ripening and preserve quality during storage.

G. Transportation: Packaged fruits and vegetables are transported to distribution centers or directly to retailers using refrigerated trucks, trains, or ships. Maintaining proper temperature and humidity levels during transportation is crucial to prevent spoilage and preserve freshness.

1.3.3.3. Harbor (export):

International shipping: During international shipping, meat products, fruits and vegetables are commonly transported by sea. Refrigerated containers, designed to maintain specific temperature ranges, are utilized to ensure the meat remains fresh throughout the voyage. These containers may also be used in combination with other transportation modes for certain routes. Upon arrival at the destination port, the imported meat undergoes customs clearance and inspection before being transported to cold storage facilities for further distribution.

1.3.3.4. Harbor (import):

Upon arrival at the destination port, the imported meat and produce undergo customs clearance and inspection to ensure compliance with import regulations. This includes checks for quality, safety, and adherence to phytosanitary requirements (in case of produce).

1.3.3.5. Wholesalers

Distribution: Cold storage facilities are used at distribution centers and warehouses to store meat products and produce before they are shipped to retailers or food service establishments. Maintaining proper temperatures during storage is crucial to preserving the product's freshness and safety.

1.3.3.6. Retailers

Retail Sale: Retailers, such as grocery stores and butcher shops, also utilize cold storage to keep meat products refrigerated until they are purchased by consumers. This ensures that the meat maintains its quality and meets food safety standards until it is sold.

Consumers purchase fresh fruits and vegetables from grocery stores, supermarkets, farmers' markets, or other retail outlets. Proper handling and storage at the retail level help maintain the quality and freshness of the produce until it is purchased by consumers.

1.3.3.7. Consumers

The final stop, who buys the products for direct or indirect consumption

1.3.3.8. Third-party certification bodies/ Government agencies

Entities that provide certificates so long as the produce and meat products satisfy criteria (international/ local norms), without these certificates, selling the products is invalid.

1.3.4. Key regulatory bodies and standards

➤ Codex Alimentarius:

- Established by the FAO (Food and Agriculture Organization) and WHO (World Health Organization), it sets international food standards, guidelines, and codes of practice.

➤ World Health Organization (WHO):

- Works globally to promote health, keep the world safe, and serve the vulnerable. WHO's work on food safety focuses on assessing health risks, setting norms and standards, and offering guidance on food safety issues.

- **Food and Agriculture Organization (FAO):** A specialized agency of the United Nations that leads international efforts to defeat hunger. FAO's role in food safety involves improving food quality and safety throughout the food chain, and providing a neutral forum for nations to negotiate food safety guidelines.

- **The U.S. Food and Drug Administration (FDA):** Governs the safety of food products in the United States, excluding meat, poultry, and processed eggs, which are regulated by the USDA.

- **European Food Safety Authority (EFSA):** Responsible for scientific advice on food-related risks in the European Union.

- **ISO 22000:** An international standard that specifies the requirements for a food safety management system.

- **Hazard Analysis Critical Control Point (HACCP):** A systematic preventive approach to food safety.

- **Canadian Food Inspection Agency (CFIA):** Regulates the safety of food products in Canada, ensuring that they meet health and safety standards while also overseeing the labeling and advertising of food products.

- **Food Standards Australia New Zealand (FSANZ):** Develops food standards for Australia and New Zealand, focusing on the safety and information of food sold in these countries.

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- **China's General Administration of Quality Supervision, Inspection, and Quarantine (AQSIQ):** Responsible for regulating food safety, quality control, and quarantine measures in China. It oversees a broad range of food products, ensuring compliance with national standards.
 - **Asian Pacific Economic Cooperation (APEC) Food Safety Cooperation Forum:** Plays a crucial role in harmonizing food safety standards and practices among its member economies in the Asia-Pacific region, promoting trade while ensuring food safety.
 - **Global Food Safety Initiative (GFSI):**¹ A private organization that benchmarks food safety standards against internationally recognized guidelines. While GFSI itself is not a regulatory body, its recognition of various food safety standards (such as SQF, BRC, IFS, FSSC 22000) guides manufacturers and suppliers in achieving high levels of food safety compliance, often exceeding local regulatory requirements.

To conclude, the supply chain of fresh agricultural products operates within a framework of reactive supply chain management, which entails responding to immediate challenges and disruptions as they occur, often resulting in inefficiencies and increased risks. However, to enhance resilience, key regulatory bodies and standards play a vital role in ensuring food safety and quality throughout the supply chain.

CONCLUSION OF CHAPTER 01:

As we reflected on the intricate web of the agricultural supply chain and the journey of fresh produce from farm to table, we couldn't help but marvel at the interconnectedness of it all. From the hands that cultivate the land to the systems that ensure freshness and quality, each link plays a vital role in sustaining our food ecosystem.

¹ Radojka,B.(25 March 2024).Food Safety Regulations and Compliance: Navigating the Path to a Safer Tomorrow. FoodReady.

Chapter 02: designing an ideal port logistics system for optimizing fresh agricultural exports

Introduction to chapter 02:

In the ever-evolving landscape of global trade, the efficiency of port logistics stands as a pivotal factor in maintaining the freshness and quality of agricultural exports. This chapter, “Designing an Ideal Port Logistics System for Optimizing Fresh Agricultural Exports,” delves into the intricate tapestry of port logistics, laying a foundational understanding of its core components and exploring the nuances of optimizing operations within both non-automated and automated environments. It underscores the unique challenges posed by fresh agricultural products, such as stringent temperature control, adherence to phytosanitary regulations, and the unpredictability of seasonal demands. By dissecting the elements of port infrastructure, services, and the symbiotic roles of various port actors, this chapter aims to construct a comprehensive framework that not only addresses the peculiarities of agricultural exports but also harnesses the potential of technological advancements to elevate the efficacy of port operations.

2.1. Fundamentals of port logistics

2.1.1. Definitions of logistics

There have been multiple definitions of logistics over the years. Traditionally, we cite the original military definition: "Logistics consists of bringing what is needed, where it is needed, and when it is needed."¹

The NCPDM proposes a new definition which considers logistics as a term describing the integration of two or more activities with the aim of planning, implementing, and controlling an efficient flow of raw materials, semi-finished products, and finished products from their point of origin to the point of consumption.²

ASLOG defines logistics as "a set of activities aimed at setting up, at the lowest cost, a quantity of product, at the place and time where demand exists. Logistics thus concerns operations determining the movement of products such as the location of factories and warehouses, procurement, physical management of work in progress, packaging, storage and inventory management, handling and order preparation, transport, and delivery routes."³

In summary, we can define logistics as a process to plan, implement, and control an efficient and effective flow or storage of raw materials, work in progress, finished products, and information from the point of origin to the point of consumption in order to meet customer requirements.

2.1.2. Definition of port logistics:

Port logistics is all about streamlining the movement of goods through a port, making things faster and cheaper. It combines two key areas⁴:

A. Port handling: This is the loading and unloading of ships, using equipment like cranes, forklifts, and reach stackers. There's vertical handling (lifting containers on and off ships)

¹ A.J. Jomini, *Precis of the Art of War*, Part 4: Logistics

² Pierre Médan and Anne Gratacap, *Logistics and Supply Chain Management*, preface by Oliver Labasse and David James, Dunod, Paris, 2008, p. 11

³ Pierre Médan and Anne Gratacap, *Logistics and Supply Chain Management*, preface by Oliver Labasse and David James, Dunod, Paris, 2008, p. 12

⁴ Thommerel, M. (2022, December 9). *What is port logistics? [Definition + challenges]*. XP LOG - Blog. Retrieved May 25, 2024, at 18:23, from <https://blog.xplog.fr/logistique->

and horizontal handling (moving things around on the ship itself). Standardized containers (ISO) make this process much smoother.

B. Port warehousing: This involves storing goods in the port area, either for a short time (like while customs are checked) or for a longer period (if there are delays or storage requirements). Different zones are set up for different storage needs.

2.1.3. Key components of port logistics:

2.1.3.1. Port infrastructures

Ports are the backbone of coastal economies, connecting global production to consumer demand. Maintaining this vital infrastructure is crucial for smooth and secure port operations.

A. Key port infrastructures include:¹

- Access channels, turning basins, and mooring systems
- Complete port terminals and buildings
- Wharves, jetties, bridges, breakwaters, navigation canals, and related equipment
- berthing and mooring structures
- Superstructure facilities for handling and storage

B. Maintenance of port infrastructures involves: ²

- Regular inspections to promptly detect potential issues
- Preventive maintenance to avert problems before they escalate
- Proper water management to prevent water accumulation and flooding
- Routine dredging operations to keep waterways clear and deep
- Swift repairs in case of damage or wear to prevent issues from worsening
- Environmental management to minimize the impact of port infrastructures

¹ Jan De Nul. (n.d.). *Port Infrastructures*. Retrieved May 25, 2023, at 19:24, from <https://www.jandenul.com/fr/expertise/services-maritimes/infrastructures-portuaires>

² Togo Port. (2023, July 17). *Maintenance of Port Infrastructure to Develop Maritime Economy*. Retrieved May 25, 2023, at 19:00, from <https://www.togo-port.net/entretenir-les-infrastructures-portuaires-pour-developper-leconomie-maritime/>

2.1.3.2. Port actors:

A vibrant port community is like a well-oiled machine, with numerous public and private actors working together to ensure the smooth movement of goods and people. These stakeholders can be broadly categorized into two groups:¹

A. Public actors:

- **Port authority:** They act as the governing body, overseeing port development, managing infrastructure, and setting policies for port users.
- **Maritime administrative services:** These services encompass various entities like maritime affairs departments, border police, coast guard, and fire and safety services, guaranteeing safety and security within the port.

B. Private actors:

- Port clients:

Shipowners: Responsible for ship operation, including crewing, provisioning, and ensuring their vessels are equipped for safe transportation.

Cargo owners: Individuals or companies owning or shipping goods through the port. They handle logistics like transportation arrangements, customs clearance, and other aspects related to their shipments.

- **Service providers to ships:**

Harbor master: The traffic controller of the port, responsible for safe and efficient ship movement. They assign berths, coordinate pilots and tugs, and enforce port regulations.

Marine pilots: With their in-depth knowledge of the port and surrounding waters, these professionals guide ships through channels and berths, ensuring safe navigation.

Tugs: Powerful boats assisting ships in maneuvering and docking. They push, pull, or tow ships into and out of berths.

Line handlers: These individuals secure ships to the dock by working with the ship's crew to fasten mooring lines and prevent movement.

¹ Medjdoub, K. B. (2016-2017). *Maritime Transport in Algeria: Shortcomings and Opportunities: A Comparison Between the Port of Mostaganem in Algeria and the Port of Tanger Med in Morocco* (pp. 26-27). Faculty of Economics, Commerce, and Management Sciences.

Ship agents: Representing the shipowner in the port, they handle administrative and logistical matters like customs clearance, immigration, and provisioning for the ship.

Bunkers: Suppliers of fuel and other essentials to ships. They either deliver fuel directly or provide refueling services at the dock.

➤ **Service providers to cargo:**

Freight forwarders: Act as intermediaries between shippers and carriers, managing and organizing cargo movement through the port. They handle various aspects like customs clearance, insurance, and shipment tracking.

Customs brokers: Assist shippers in navigating the complexities of customs clearance, ensuring proper documentation and adherence to regulations.

Terminal operators: Manage and operate port terminals, handling cargo loading, unloading, storage, and container handling.

Cargo surveyors: Inspect and assess cargo condition for transport suitability. They investigate damage claims and provide reports to insurers.

Stevedores: Longshoremen responsible for loading and unloading cargo from ships using specialized equipment under the supervision of terminal operators.

The effective collaboration of these diverse actors is essential for a port's success, ensuring efficient operations, safety, and ultimately, continued economic development for the surrounding region.

Figure 6: Actors and layers of intervention in port resilience-building.



Source : <https://resilientmaritimelogistics.unctad.org/guidebook/22-actors-and-layers-intervention-port-resilience-building>

2.1.3.3. Port services:

Ports are the bustling hubs that keep the world's trade flowing. They act as vital links in the supply chain, connecting producers and consumers across continents. Here's a closer look at what ports do:

A. Cargo handling services:

Efficient cargo handling forms the cornerstone of any successful port. Here's how ports ensure the smooth movement of cargo¹ :²

- **Expeditious loading and unloading:** Ports utilize meticulous processes to ensure swift and secure loading and unloading of cargo from vessels. This minimizes turnaround times for ships, optimizing the flow of goods.

¹ Medjdoub, K. B. (2016-2017). *Maritime Transport in Algeria: Shortcomings and Opportunities: A Comparison Between the Port of Mostaganem in Algeria and the Port of Tanger Med in Morocco* (pp. 28-29). Faculty of Economics, Commerce, and Management Sciences.

² Min, H. (2022). Developing a smart port architecture and essential elements in the era of Industry 4.0. *Maritime Economics & Logistics*, 24(2), 189-207. Retrieved May 26, 2024, at 14:06 from <https://doi.org/10.1057/s41278-022-00211-3>

- **Secure temporary storage:** Ports provide on-site facilities for the temporary storage of cargo awaiting further transportation. This secure storage safeguards cargo until its next leg in the journey.
- **Streamlined customs clearance:** For import and export activities, navigating customs procedures efficiently is crucial. Ports facilitate the smooth movement of cargo across borders by ensuring accurate documentation and compliance with relevant regulations.

B. Navigational technical assistance:

Safe navigation within port limits is achieved through specialized technical assistance ^{1,2}

- **Expert pilotage:** Experienced pilots act as guides, ensuring the safe passage of vessels from the port entrance to their designated berths. Their expertise in maneuvering minimizes risks during docking.
- **Efficient anchorage services:** These services manage the safe anchoring and movement of vessels within designated anchorage areas. Proper management prevents congestion and accidents.
- **Enhanced safety measures:** Ports deploy visual aids like buoys, floating signals, and other navigational aids to enhance safety. These cues guide vessels, prevent collisions, and maintain order within the port.

C. Security and compliance:

Safety and adherence to regulations are paramount for port ³operations:

- **Rigorous access control:** Stringent control measures prevent unauthorized entry and safeguard the port against potential threats. Security protocols are essential for maintaining a secure environment.
- **Thorough cargo verification:** Detailed verification of cargo ensures compliance with regulations and prevents security breaches. Accurate cargo documentation is crucial for maintaining a secure environment.

¹ Bourgioukou, E. (2023). *Investigating the role of technological advancements in port operations and the development of smart, green and sustainable ports*. Newcastle University eTheses2. Retrieved May 26, 2024, at 14:30, from <http://theses.ncl.ac.uk/jspui/handle/10443/6009>

Van den IJssel, D. (2019). *Port Sustainability: A Terminal Comparison Approach* [Master's thesis, Delft University of Technology]. Retrieved on May 26, 2024, at 14:46, from <https://repository.tudelft.nl/>.

² Bourgioukou, E. (2023). *Investigating the role of technological advancements in port operations and the development of smart, green and sustainable ports*. Newcastle University eTheses2. Retrieved May 26, 2024, at 15:05, from <http://theses.ncl.ac.uk/jspui/handle/10443/6009>

³ Van den IJssel, D. (2019). *Port Sustainability: A Terminal Comparison Approach* [Master's thesis, Delft University of Technology]. Retrieved on May 26, 2024, at 15:30, from <https://repository.tudelft.nl/>.

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- **Proactive risk management:** Proactive identification and mitigation of risks associated with port operations enhance overall safety and protect port assets.

D. Environmental considerations:

Modern ports are increasingly adopting sustainable practices to minimize their environmental impact^{1,2}.

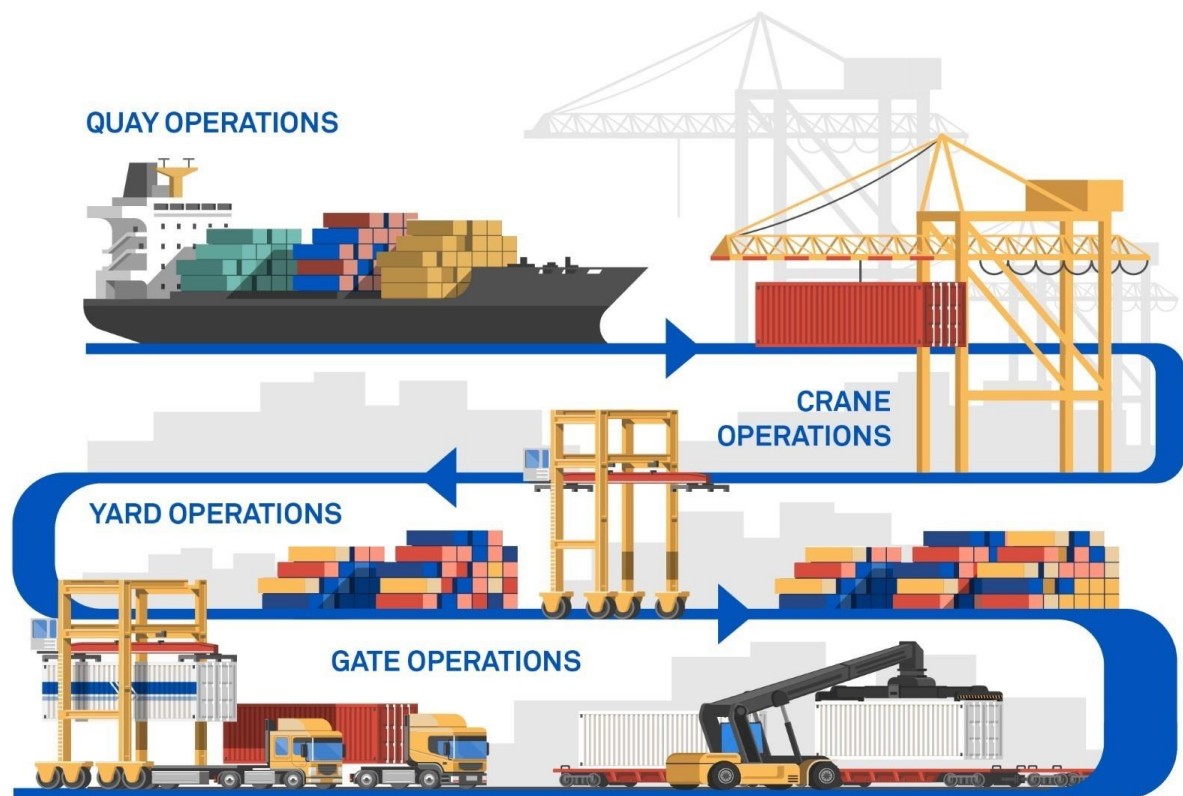
- **Sustainable practices:** Eco-friendly measures like energy-efficient technologies and waste reduction contribute to a more sustainable port operation.
- **Green infrastructure development:** Developing sustainable port infrastructure includes incorporating renewable energy sources and creating green spaces. This approach balances economic growth with environmental conservation.
- **Collaborative community engagement:** Collaboration with local communities ensures a holistic approach to sustainability. Ports actively engage with stakeholders to address environmental concerns.

By prioritizing both efficiency and sustainability in their service offerings, ports can ensure a streamlined flow of goods while minimizing their environmental footprint. This approach creates a long-term benefit for the global economy and the planet.

¹ Alamoush, A.S., Ballini, F., & Ölçer, A.I. (2021). Revisiting port sustainability as a foundation for the implementation of the United Nations Sustainable Development Goals (UN SDGs). *Journal of Shipping and Trade*, 6. Retrieved May 26, 2024, at 15:19, from jshippingandtrade.springeropen.com

² Van den IJssel, D. (2019). *Port Sustainability: A Terminal Comparison Approach* [Master's thesis, Delft University of Technology]. Retrieved on May 26, 2024, at 15:30, from <https://repository.tudelft.nl/>.

Figure 7: main port activities



Source : <https://camso.co/en/blog/road-free/discover-the-world-of-ports-and-terminals-in-five-questions/>

2.1.3.4. Related logistics services (transport, warehousing, etc.)

Beyond port operations, a robust logistics network relies on a diverse range of interconnected services. These services ensure the seamless movement of goods from origin to final destination, optimizing efficiency and cost-effectiveness throughout the supply chain. Let's delve into some of the most crucial ones^{1,2}

A. Transportation: The core, involving physical movement via trucks, ships, trains, and airplanes, each with its strengths (flexibility, volume capacity, cost-effectiveness, speed). Freight forwarding services optimize this further.

¹ Arabelen, G., & Kaya, H. T. (2021). Assessment of logistics service quality dimensions: A qualitative approach. *Journal of Shipping and Trade*, 6(14). Retrieved on May 26, 2024, at 16:50, from <https://doi.org/10.1186/s41072-021-00095-1>

² Kasilingam, R. G. (1998). Introduction to logistics and transportation. In *Logistics and Transportation* (pp. 1–22). Springer, Boston, MA. Retrieved on May 26, 2024, at 17:05, from https://doi.org/10.1007/978-1-4615-5277-2_1

- B. Warehousing and distribution:** Warehouses store goods, manage inventory, and ensure space utilization. Distribution fulfills orders, picks items, packs them, and delivers them. Efficiency here directly impacts customer satisfaction.
- C. Packaging and labeling:** Proper packaging protects goods during transport and storage. Labeling provides crucial information for proper handling throughout the supply chain.
- D. Customs brokerage:** For international trade, customs brokers handle complex regulations and documentation to ensure smooth border clearance and minimize delays or penalties.
- E. Inventory management:** Balancing act of maintaining optimal inventory levels through managing purchases, returns, and forecasting future demand to avoid stockouts or excess inventory.
- F. Order fulfillment:** Encompasses the entire process from receiving a customer order to its final delivery, including processing, picking and packing, and timely deliveries.
- G. Reverse logistics:** Deals with the movement of goods back through the supply chain, including returns, recalls, and proper disposal of expired or damaged goods. Efficient reverse logistics contribute to sustainability and allow businesses to recover value.

2.1.4. Peculiarities of port logistics for fresh agricultural products

Compared to traditional cargo, fresh produce requires specialized handling throughout the supply chain to ensure it reaches consumers in optimal condition. Here's a closer look at these key aspects^{1:2}

2.1.4.1. Temperature control and cold chain management

- A. Cold storage facilities:** Ports need well-equipped cold storage with precise temperature, humidity, and ventilation controls. Ideally, these facilities should be located near docks to minimize temperature fluctuations during transport.
- B. Precooling and preprocessing:** Rapid precooling at the port extends shelf life by slowing down ripening. Sorting, cleaning, and packaging may also occur here. Technologies like hydro-cooling or forced-air cooling can significantly improve product quality.

¹ Sun, J., Jiang, T., Song, Y., Guo, H., & Zhang, Y. (2022). Research on the Optimization of Fresh Agricultural Products Trade Distribution Path Based on Genetic Algorithm. *Agriculture*, 12, 1669. Retrieved on May 26, 2024, at 17:26, from <https://doi.org/10.3390/agriculture12101669>

² Kasilingam, R. G. (1998). Introduction to logistics and transportation. In *Logistics and Transportation* (pp. 1–22). Springer, Boston, MA. Retrieved on May 26, 2024, at 17:05, from https://doi.org/10.1007/978-1-4615-5277-2_1

- C. Cold chain integrity:** Maintaining an unbroken "cold chain" throughout transportation is crucial. Temperature-controlled containers, refrigerated trucks, and real-time monitoring systems ensure products reach their destination within the optimal temperature range.

2.1.4.2. Efficient handling and timely processing

- A. Quick turnaround:** Ports must prioritize swift unloading, inspection, and documentation to minimize the time perishable goods spend exposed to ambient temperatures. Automation technologies can significantly expedite these procedures.
- B. Priority handling:** Fresh produce should be prioritized over other cargo to reduce storage time. Designated lanes and berths can help expedite their movement through the port.
- C. Quality checks:** Rigorous inspections ensure consistent product quality and prevent substandard products from entering the supply chain. Standardized quality control procedures are essential.

2.1.4.3. Compliance with phytosanitary regulations

- A. Inspections and certifications:** Ports play a vital role in preventing the spread of plant pests and diseases. Inspections ensure imported products meet international standards. Collaboration between port authorities and agricultural inspection agencies streamlines this process.
- B. Documentation:** Accurate documentation, including certificates of origin and phytosanitary certificates, is essential for the smooth flow of fresh produce across borders. Electronic documentation systems can expedite this process and minimize errors.

2.1.4.4. Coordination with transport modes

- A. Seamless transshipment:** Ports should facilitate efficient cargo transfer between ships, trucks, and trains, minimizing handling and ensuring products reach their destinations quickly. Advanced cargo handling equipment can expedite the transfer process.
- B. Intermodal connectivity:** Strong rail and road connections from the port to distribution centers create a robust logistics network for efficient onward distribution. Partnerships with transportation providers ensure reliable and cost-effective inland transportation options.

2.1.4.5. Seasonal variability and peak demand

- A. Seasonal peaks:** Ports experience surges in traffic during harvest seasons. Scalable storage solutions and temporary workforce recruitment programs can help address these fluctuations.

B. Storage capacity: Sufficient cold storage capacity is essential to accommodate fluctuations in supply and demand. Utilizing multi-story storage facilities can maximize capacity within a limited footprint.

By addressing these peculiarities, port logistics can play a critical role in ensuring fresh produce reaches consumers worldwide while minimizing waste and maximizing quality. Efficient port logistics for fresh produce becomes a well-orchestrated symphony requiring seamless coordination between various aspects.

2.2.Optimizing Port Operations in Non-Automated and automated Ports

Fresh produce exports are vital for global food security and economic development. They bring new food options to consumers and income to farmers, but challenges like standards, logistics, and quality control must be addressed to maximize their benefits. Optimizing this sector ensures it continues to nourish the world.

2.2.1. Optimizing port operations in non-automated

2.2.1.1. Enhance operational planning and coordination:

A. Optimizing yard layouts for peak performance:

To reach peak performance, non-automated ports require meticulously designed yards. This means striking a balance between maximizing container storage capacity and ensuring smooth equipment access. Data-driven techniques like genetic algorithms can be used to optimize the layout, factoring in storage needs, crane reach, and vehicle capabilities. Furthermore, synchronized operations with designated traffic lanes, strategic pick-up and drop-off zones, and clear communication protocols are crucial for safety and efficiency. A holistic approach that integrates quayside operations with the yard is essential for seamless cargo flow. Finally, advanced mathematical models can be employed to develop optimized storage strategies in the export yard, minimizing wasted space and expediting container retrieval times. This comprehensive strategy ensures non-automated ports can compete effectively by maximizing operational efficiency and cargo throughput¹.

B. Implement yard management systems:

¹ Zhu, H., Liu, C., Wu, G., & Gao, Y. (2023). Cold Chain Logistics Network Design for Fresh Agricultural Products with Government Subsidy. *Sustainability*, 15, 10021. Retrieved on May 26, 2024, at 17:42, from <https://doi.org/10.3390/su151310021>

In today's competitive landscape, non-automated ports can leverage YMS to achieve significant operational transformation. YMS empowers ports through real-time visibility, data-driven decision making, and seamless integration, optimizing cargo flow, resource allocation, and overall yard efficiency. A successful YMS implementation requires a deep dive into current operations, followed by a customized solution that integrates with existing systems and empowers the workforce. By prioritizing scalability and fostering a culture of continuous improvement, ports can unlock the full potential of YMS and gain a sustainable competitive advantage¹.

C. Adopt collaborative decision-making:

To optimize operations in non-automated ports, collaboration is key. Stakeholders like terminal operators, shipping lines, and truckers can leverage shared information systems, joint planning sessions, standardized procedures, and defined conflict resolution for smoother cargo flow, improved decision-making, and minimized delays. Shared performance metrics ensure accountability and continuous improvement, while regular training and technology adoption like EDI systems empower the workforce and streamline processes. This collaborative approach transcends limitations of automation, enabling non-automated ports to achieve greater efficiency².

2.2.1.2. Improve cargo handling processes:

A. Standardize procedures:

SOPs are the foundation for safe, efficient, and environmentally conscious cargo handling in ports. These detailed instructions encompass various aspects, ensuring consistent best practices across all cargo types (dry bulk, liquid bulk, chemicals, hazardous materials) with designated storage, handling protocols, and spill prevention. SOPs promote safe equipment operation through operator training, maintenance schedules, and designated traffic zones for rail and trucks. They prioritize environmental responsibility through waste management, emission control, and strategies to minimize noise, light, and dust pollution. Oversight is ensured through lease agreements, inspections, and regular audits that identify areas for improvement and

¹ Lee, B.K., & Kim, K.H. (2013). Optimizing the yard layout in container terminals. *OR Spectrum*, 35, 363-398. <https://doi.org/10.1007/s00291-012-0298-z>

² Yu, H., Deng, Y., Zhang, L., Xiao, X., & Tan, C. (2022). Yard Operations and Management in Automated Container Terminals: A Review. *Sustainability*, 14(6), 3419 <https://doi.org/10.3390/su14063419>

promote continuous refinement of SOPs based on employee feedback. By implementing these comprehensive SOPs, ports can create a well-oiled cargo handling system that prioritizes safety, efficiency, and environmental well-being¹.

B. Train and upskill personnel:

In non-automated ports, strategic workforce development is key to compete. Training programs aligned with the port's needs equip personnel with the skills and productivity to excel in manual cargo handling. This includes investment in education, safe handling techniques, safety protocols, and best practices. Upskilling through specialized courses, workshops, and mentoring ensures personnel stay current with industry trends and adapt to the evolving demands of port operations. By prioritizing workforce development, non-automated ports can significantly enhance cargo handling efficiency, fostering increased productivity and competitiveness².

C. Optimize equipment utilization:

To maximize cargo handling efficiency, a multi-faceted approach to equipment utilization is crucial. This involves strategic scheduling to avoid bottlenecks, proactive maintenance to minimize downtime, and leveraging digital tools like EDI systems for streamlined processes. Additionally, operations research techniques can be applied to optimize container terminal operations, while a focus on coordinated equipment optimization ensures maximum productivity from quay cranes and other equipment. This comprehensive strategy unlocks significant efficiency gains for non-automated ports³.

2.2.1.3. Leverage technology for non-automated operations:

A. Data acquisition strategies in modern port operation

¹ Pernia, O., & Scattergood, J. *What optimisation means for terminals and ports*. Port Technology International, 59. https://www.porttechnology.org/wp-content/uploads/2019/05/Navis_PT59_V4.pdf

² Port Klang Authority. (n.d.). Standard operating procedure break bulk conventional cargo (pp 6-23). <https://www.pka.gov.my/en/information/download/3-standard-operating-procedure/18-cargo-handling.html?download=114:standard-operating-procedure-break-bulk-conventional-cargo>

³ Kerdjoudj, L. (n.d.). Reskilling and Upskilling to Enhance Resilience and Competitiveness. Port Technology International, Edition 137. Retrieved [31/05/2024 at 15:27], from www.porttechnology.org

Modern port operations require efficient data acquisition to optimize processes, make informed decisions, and streamline operations. Non-automated ports can leverage various techniques, each with its strengths and limitations¹:

- **Manual entry (tablets/phones):** Cost-effective and adaptable, but error-prone and slow.
- **Barcodes/QR codes:** Faster and more accurate than manual entry, but requires initial investment and tagging.
- **RFID:** Real-time tracking with less manual work, but expensive and requires infrastructure upkeep.
- **GPS:** Real-time location data for fleets, but requires investment and system integration.
- **IoT sensors:** Detailed data for maintenance, safety, and resource allocation, but comes with high upfront costs and data management challenges.
- **Mobile apps:** User-friendly data capture, but requires ongoing development, user training, and security considerations.
- **CCTV:** Enhances security and offers visual data, but necessitates high costs, storage, and potential privacy concerns.
- **Automated gates:** Reduces congestion and improves security, but requires significant investment and system integration.

The key is to choose the right mix of these methods based on a non-automated port's specific needs and capabilities, enabling a smooth transition to a more data-driven and efficient operation.

B. Data integration and analysis:

Effective data acquisition is just the first step. To unlock its true potential, ports need robust data integration and analysis. A central management system acts as the brain, consolidating data from various sources (manual entry, RFID, etc.) into a unified view. This eliminates data silos and fosters a deeper understanding of port operations. Real-time analytics provide immediate insights on performance metrics, allowing for proactive adjustments to optimize efficiency. Predictive analytics, using historical data and advanced techniques, forecasts future trends and

¹ Jonker, T., Duinkerken, M. B., Yorke-Smith, N., et al. (2021). Coordinated optimization of equipment operations in a container terminal. *Flexible Services and Manufacturing Journal*, 33, 281-311. <https://doi.org/10.1007/s10696-019-09366-3>

potential disruptions, enabling preventative measures. Finally, the system generates reports and user-friendly visualizations, empowering stakeholders to make data-driven decisions and optimize resource allocation. In essence, this data hub transforms raw data into actionable insights, driving operational excellence in non-automated ports¹.

2.2.1.4. Promote communication and collaboration:

A. Establish clear communication channels:

Ports can achieve operational excellence by implementing a robust communication strategy that tackles information flow and empowers the workforce. Firstly, ensuring clear and immediate communication during operations is paramount. This can be achieved through a combination of reliable, low-tech solutions like walkie-talkies and strategically placed whiteboards that are accessible across all areas of the port. Hand signals can also be incorporated to provide a universal communication method, especially in loud or busy environments .

Secondly, the strategy should address the burden of paperwork and empower workers with the tools and training they need to excel. Implementing standardized digital forms with clear instructions on tablets or ruggedized laptops eliminates the need for excessive paper trails while enabling real-time data capture and updates. This not only streamlines processes but also reduces the risk of errors associated with manual data entry. To further empower the workforce, communication skills training should be provided, emphasizing the importance of clear messages, active listening, and confirming instructions. Investing in communication skills training for supervisors fosters collaboration within teams and ensures information is cascaded effectively throughout the port. By combining clear and reliable communication with a streamlined digital workflow and an empowered workforce, ports can achieve significant gains in operational efficiency².

B. Foster a culture of collaboration:

Ports can cultivate a collaborative work environment through several key practices. Daily briefings at the start of each shift (huddles) ensure everyone is on the same page regarding tasks,

¹ Brunila, OP., Kunnaala-Hyrkki, V. & Inkinen, T. Hindrances in port digitalization? Identifying problems in adoption and implementation. *Eur. Transp. Res. Rev.* 13, 62 (2021). <https://doi.org/10.1186/s12544-021-00523-0>

² Sakita, B.M., Helgheim, B.I., & Bråthen, S. (2024). Drivers, Barriers, and Enablers of Digital Transformation in Maritime Ports Sector: A Review and Aggregate Conceptual Analysis. In A.L. Martins, J.C. Ferreira, A. Kocian, U. Tokkozhina, B.I. Helgheim, & S. Bråthen (Eds.), *Intelligent Transport Systems* (pp. 1-20). Springer International Publishing. https://doi.org/10.1007/978-3-031-49379-9_1

potential obstacles, and safety. A buddy system pairs experienced workers with newer staff, fostering knowledge transfer, teamwork, and efficient task completion. Finally, a centralized knowledge base containing best practices, troubleshooting guides, and safety protocols empowers all staff with easy access to information and promotes consistent approaches across teams. These initiatives create a collaborative spirit that improves communication and ultimately enhances overall port performance¹.

C. Engage with external stakeholders:

Fostering strong partnerships with external stakeholders is crucial for efficient logistics operations. This can be achieved through a multi-faceted approach. First, scheduling regular in-person liaison meetings with key players like shipping lines and freight forwarders allows for proactive discussions on upcoming arrivals, cargo specifics, and potential challenges. Secondly, organizing joint training sessions focused on clear communication protocols, safety procedures, and collaborative cargo handling best practices further strengthens these partnerships. Finally, dedicated communication channels, such as designated phone lines or email addresses, ensure timely and direct exchange of information, concerns, and updates².

2.2.1.5. Continuous evaluation and improvement in port operations:

A. Benchmarking performance:

Port success thrives on a data-driven approach to benchmarking against industry standards. This comprehensive process starts with comparing key performance indicators (KPIs) like ship turnaround time and cargo handling rates against leading global ports. Next, leveraging the United Nations Conference on Trade and Development's (UNCTAD) established benchmarks allows for a deeper dive into efficiency, throughput, and service quality. Finally, continuous improvement fueled by targeted investments in infrastructure or process optimization, along with staff training, ensures the port stays ahead of the curve and maintains its competitive edge³.

B. conduct regular audits

¹ Lu, B. (2023). *Cooperative Operation Optimization for Port Groups* (pp. 63-132). Springer Nature Singapore Pte Ltd. <https://doi.org/10.1007/978-981-99-5277-9>

² Brooks, M. R., McCalla, R., Pallis, A. A., & Van der Lugt, L. (2010). Cooperation and Coordination in Strategic Port Management: The Case of Atlantic Canada's Ports. *Canadian Journal of Transportation*, 4(1), 29-42.

³ Port Cooperation and Coordination Strategies. (n.d.). Retrieved May 31, 2024, at 18:21 from <https://www.example.com/port-cooperation-and-coordination>

Regular audits, as recommended in the Manual of Best Management Practices for Port Operations, offer a comprehensive evaluation tool for continuous improvement. These audits encompass operational efficiency, environmental impact, and risk management. By analyzing data on processes, environmental factors (air/water quality, waste management, energy consumption), and risk mitigation plans (emergency response, security protocols, regulation compliance), audits expose bottlenecks, assess sustainability efforts, and identify weaknesses in risk management. This holistic approach allows the port to continuously refine operational processes, minimize environmental impact, and strengthen risk mitigation strategies, ensuring long-term success ¹.

C. Embrace innovation

In the ever-evolving maritime landscape, innovation is the key to a port's long-term success. Ports can embark on this journey by strategically adopting new technologies. This could involve integrating artificial intelligence (AI) for predictive maintenance, allowing for optimized equipment utilization and streamlined decision-making. Additionally, digital transformation through cargo tracking and automation systems fosters collaboration, facilitates phased automation, and supports sustainability efforts. Finally, investing in research and development (R&D) empowers ports to develop customized solutions that address their specific needs. By collaborating with tech companies for example, ports can stay ahead of industry trends and proactively identify innovative solutions to optimize operations and ensure long-term success².

2.2.2. Optimizing efficiency and security in automated ports

Automated ports offer a revolutionary approach to cargo handling, promising increased efficiency, faster throughput, and reduced costs. However, achieving this vision requires a

¹ Danladi, C., Tuck, S., Tziogkidis, P., et al. (2024). Efficiency analysis and benchmarking of container ports operating in lower-middle-income countries: a DEA approach. *Journal of Shipping and Trade*, 9(7). <https://doi.org/10.1186/s41072-024-00163-2>

² Great Lakes Maritime Research Institute. (n.d.). Manual of Best Management Practices For Port Operations. Retrieved from <https://www.glmri.org/downloads/resources/manualBestManagementPorts.pdf>

multifaceted strategy that considers not just technology, but also data security, human-machine interaction, and seamless data exchange^{1,2}

A. Advanced data analytics and machine learning:

Leverage data to optimize yard layouts for automated vehicles, predict equipment failures for proactive maintenance, and dynamically schedule container movements for minimized congestion.

B. Cybersecurity measures:

Implement robust measures to safeguard critical infrastructure, protect sensitive data, and ensure continuous operations. This includes securing communication networks, safeguarding data integrity, and maintaining continuous vigilance.

C. Human-machine interface optimization:

Design user-friendly interfaces, provide comprehensive training for operators, and clearly define roles and responsibilities to ensure smooth collaboration between humans and automated systems.

D. Standardized data exchange:

Adopt standardized data formats and protocols to facilitate seamless communication and information flow between various port management systems, improving overall visibility and decision-making.

E. Simulation and modeling:

Utilize simulation tools to test automated workflows, identify potential challenges, and minimize disruptions during real-world implementation. This allows for continuous improvement and adaptation to evolving technologies.

F. Remote Monitoring and Control:

¹ Farzadmehr, M., Carlan, V., & Vanelslander, T. (2023). Contemporary challenges and AI solutions in port operations: applying Gale–Shapley algorithm to find best matches. *Journal of Shipping and Trade*, 8(27). <https://doi.org/10.1186/s41072-023-00155-8>

² Weerasinghe, B. A., Perera, H. N., & Bai, X. (2024). Optimizing container terminal operations: A systematic review of operations research applications. *Maritime Economics & Logistics*, 26, 307–341. <https://doi.org/10.1057/s41278-023-00254-0>

Establish centralized capabilities for real-time visibility into port operations, efficient issue resolution, and data-driven decision-making to optimize overall efficiency.

By implementing these strategies, automated ports can unlock their true potential, revolutionizing cargo handling while maintaining robust security and operational excellence.

2.3.Optimizing port operations for fresh agricultural exports in non-automated ports

The clock is ticking for fresh agricultural exports at non-automated ports. Their delicate nature demands swift and efficient handling to reach markets in prime condition. This part explores strategies to optimize port operations, ensuring these vital commodities move seamlessly through manual processes, maximizing their value and minimizing spoilage.

2.3.1. Pre-arrival and documentation:

Smooth port operations are vital for global trade. Here are three key pre-arrival and documentation strategies to expedite cargo flow:

- A. Electronic data interchange (EDI):** For ports that haven't yet fully automated their systems, implementing a partial EDI system can be a game-changer. EDI facilitates the electronic exchange of critical documents, eliminating the need for paper-based processes. This not only streamlines communication between port authorities, customs, and shipping companies but also translates to faster processing times and a significant reduction in errors caused by manual data entry¹.
- B. Prioritization of perishable cargo:** Perishable goods have a limited shelf life, making timely processing crucial. Establishing dedicated lanes or a separate system for perishable cargo at customs can significantly expedite the clearance process. This could involve pre-inspection arrangements, allowing for faster clearance upon arrival, or assigning dedicated personnel specifically trained to handle time-sensitive items like fresh produce. By prioritizing these goods, ports can ensure they reach their final destination in optimal condition².

¹ Baskin, A., & Swoboda, M. (2023). Automated port operations: The future of port governance. In T. M. Johansson, D. Dalaklis, J. E. Fernández, A. Pastra, & M. Lennan (Eds.), *Smart Ports and Robotic Systems* (Studies in National Governance and Emerging Technologies, pp. 149-165). Cham: Palgrave Macmillan. https://doi.org/10.1007/978-3-031-25296-9_8

² Garstone, S. (1995). Electronic data interchange (EDI) in port operations. *Logistics Information Management*, 8(2), 30-33. <https://doi.org/10.1108/09576059510084984>

C. Standardized documentation: Incomplete or inaccurate documentation is a major source of delays at ports. Providing clear and readily available guidelines for exporters regarding pre-shipment documentation is essential. This could involve creating user-friendly checklists, offering downloadable templates for key documents, and conducting training workshops to ensure all parties understand international phytosanitary regulations. By promoting standardized documentation, ports can minimize delays caused by missing or incorrect paperwork, leading to a smoother and more efficient clearance process¹.

By implementing these pre-arrival and documentation strategies, ports can transform their operations, leading to faster processing times, fewer errors, and a more positive experience for importers, exporters, and shipping companies alike. This not only benefits individual businesses but also contributes to the smooth flow of global trade, ensuring a more efficient and interconnected world.

2.3.2. Enhancing operational planning and coordination:

Ensuring the quality and freshness of perishable goods like fresh agricultural products requires several strategic actions within operational planning and coordination at ports. Here's an academic perspective on these strategies:

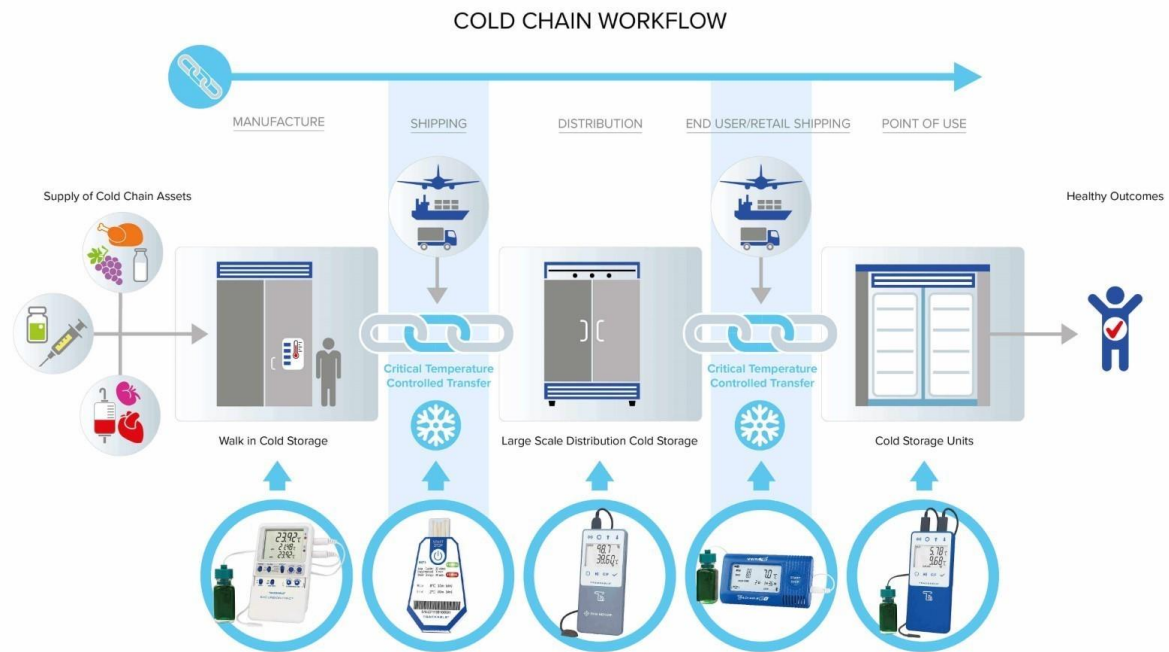
2.3.2.1. Prioritize cold chain management:

Maintaining the quality of fresh produce heavily relies on cold chain management (Figure03). Integrating refrigerated storage and handling equipment directly into the yard layout minimizes temperature fluctuations, a crucial factor for preserving product freshness. According to Majluf-Manzur et al. (2021), efficient supply chains are essential to meet the rising demand for fresh fruits and vegetables. This includes developing cold chain logistics to minimize food waste caused by inefficient practices.²

¹ International Air Transport Association. (2022, December 7). Perishables Logistics and Air Transport. https://www.iata.org/contentassets/68a67924d1794c35880cf41188036b5d/perishable_logistics_and_air_transport.pdf

² International Trade Administration. (n.d.). Trade Guide: WTO PSI. Retrieved from <https://www.trade.gov/trade-guide-wto-psi>

Figure 8: Cold chain workflow



Source: <https://www.coleparmer.com/tech-article/effective-cold-chain-management-temperature-monitoring>

2.3.2.2. Schedule vessels for perishable cargo:

Minimizing dwell time at the port for vessels carrying fresh produce is vital. This can be achieved by allocating berths and prioritizing unloading/loading schedules specifically for such vessels. Swift handling reduces the risk of spoilage. Gao et al. (2023) emphasize the importance of coordination within the fresh agricultural product supply chain. Their research highlights the need for optimization that considers both freshness-keeping efforts and information sharing¹.

2.3.2.3. Real-time inventory management:

Implementing a system for real-time tracking of perishable cargo quantities, expiry dates, and storage locations is critical for optimizing handling and preventing spoilage. This allows for better planning and coordination, as highlighted by research on supply chain coordination for

¹ Majluf-Manzur, Á.M., González-Ramírez, R.G., Velasco-Paredes, R.A., & Villalobos, J.R. (2021). An Operational Planning Model to Support First Mile Logistics for Small Fresh-Produce Growers. In D.A. Rossit, F. Tohmé, & G. Mejía Delgadillo (Eds.), *Production Research: ICPR-Americas 2020* (pp. 1-20). Communications in Computer and Information Science, vol 1408. Springer. https://doi.org/10.1007/978-3-030-76310-7_17

fresh agricultural products. Improved decision-making and profit distribution models are also benefits¹.

These strategies contribute to a broader effort of optimizing logistics operations for fresh agricultural products, ensuring they reach consumers in the best possible condition.

2.3.3. Improve cargo handling processes:

While automation can significantly improve efficiency in ports, non-automated ports can still optimize their operations for fresh agricultural exports by focusing on meticulous cargo handling practices.

2.3.3.1. Enhance cargo handling through standard operating procedures (SOPs) :

- A. Temperature control protocols:** Collaborate with farmers and shipping companies to understand the specific temperature requirements for various agricultural products. Develop clear SOPs outlining these requirements and designate specific storage areas within the port facility to maintain these temperatures (potentially using designated sheds or creating temporary holding areas with insulated tarpaulins). Regularly monitor temperatures and implement corrective actions (ventilation adjustments, relocation to backup generators) if deviations occur².
- B. Inspection procedures:** Train staff to conduct thorough inspections upon arrival of produce. Inspections should focus on identifying signs of damage (soft spots, bruising, leaks) and potential disease outbreaks. Clearly document any issues and segregate compromised produce to prevent further contamination.
- C. Stacking techniques:** Develop SOPs for proper stacking techniques specific to different types of agricultural products (fruits, vegetables, etc.). Emphasize weight distribution to prevent crushing, ensure proper ventilation channels, and utilize appropriate dunnage materials (straw, netting) to separate and stabilize cargo during storage and loading.

¹ Gao, J., Cui, Z., Li, H., & Jia, R. (2023). Optimization and Coordination of the Fresh Agricultural Product Supply Chain Considering the Freshness-Keeping Effort and Information Sharing. *Mathematics*, 11(8), Article 1922. <https://doi.org/10.3390/math11081922>

² Yan, B., Wu, X.-h., Ye, B., & Zhang, Y.-w. (2017). Three-level supply chain coordination of fresh agricultural products in the Internet of Things. *Industrial Management & Data Systems*, 117(9), 1842-1865. <https://doi.org/10.1108/IMDS-06-2016-0245>

2.3.3.2. Invest in specialized equipment (within non-automated constraints:

- A. Forklifts:** While automated cold storage facilities might utilize specialized refrigerated forklifts, non-automated ports can explore alternatives. Consider investing in heavy-duty forklifts with insulated cabins for improved working conditions in cold storage areas. Additionally, explore options for portable or attachable refrigeration units that can be mounted on existing forklifts for limited cold chain maintenance within the port.
- B. Mobile cooling units:** Mobile cooling units become particularly crucial in non-automated ports as they offer greater flexibility. Invest in mobile units with sufficient cooling capacity to maintain target temperatures for your products during temporary holding periods or while awaiting loading onto vessels. Ensure compatibility with available power sources (generators) for seamless operation¹.

2.3.3.3. Prioritize a first-in-first-out (FIFO) system for optimal inventory management:

- A. Implementing FIFO:** Designate specific storage areas within the port for new and older produce shipments. Implement clear procedures for stock rotation to ensure the oldest produce gets loaded first. This can be achieved through manual tracking systems or implementing low-tech solutions like colored tags or stickers on crates to visually identify older inventory².
- B. Stock rotation and labeling:** Encourage farmers and exporters to clearly label all shipments with harvest or production dates. This facilitates efficient stock rotation within the port and helps maintain accurate inventory records³.

2.3.4. Leverage technology for non-automated operations:

Efficient handling of perishable goods at seaports is critical, but non-automated operations can face difficulties in maintaining optimal conditions. Fortunately, technology offers solutions to improve this process.

¹ Air Sea Containers. (n.d.). Your ultimate guide to shipping perishables. Retrieved from <https://airseacontainers.com/blog/your-ultimate-guide-to-shipping-perishables/>

² SkyQuest Technology Consulting Pvt. Ltd. (n.d.). Port equipment market. Retrieved from <https://www.skyquestt.com/report/port-equipment-market>

³ Logos Logistique. (n.d.). Tout ce que vous devez savoir sur le FIFO (First-In, First-Out) en logistique. Retrieved from <https://www.logos3pl.com/fr/everything-you-need-to-know-about-fifo-first-in-first-out-in-logistics/>

Leveraging technology in non-automated seaport operations can significantly enhance the efficiency and reliability of handling perishable goods.

Implement temperature monitoring systems: Installing sensors in storage areas and transport vehicles allows for the continuous monitoring of temperature, which is crucial for maintaining the quality of perishable goods. These systems can alert personnel to potential issues before spoilage occurs, ensuring that the products remain within the desired temperature range throughout their stay at the port. This strategy reflects the principles of smart container port development, where advanced technologies are employed for data collection and monitoring to optimize port operations¹.

A. Real-time tracking for perishables: The use of GPS or RFID tags on perishable cargo enables real-time tracking of their location and movement within the port. This technology facilitates efficient handling by reducing the time needed to search for specific items, thus speeding up the loading and unloading processes. It also helps in optimizing the logistics flow, as mentioned in the research on smart port construction, which emphasizes the importance of applying new technologies for autonomous processing of port operations [46].

B. Develop mobile apps for inspections: Creating mobile applications for port workers to conduct quality inspections allows for the immediate recording of data on temperature and condition. Workers can report any issues in real-time, which contributes to the timely resolution of problems and maintains the integrity of the perishable goods. This strategy is part of the broader trend towards digitalization in ports, where technology is leveraged to create digital dashboards and systems for improved communication and data management².

By adopting these technology-driven solutions, non-automated seaports can significantly improve their handling of perishable goods. Real-time monitoring, efficient tracking, and digital inspection apps can all contribute to enhanced efficiency, reduced spoilage, and improved overall reliability in the perishable goods supply chain.

¹ UNEX. (n.d.). How to implement an effective FIFO strategy in your operation. Retrieved from <https://blog.unex.com/how-to-implement-an-effective-fifo-strategy-in-your-operation>

² Wang, W., Peng, Y., Xu, X., Li, X., Liu, H., Liu, S., & Yan, X. (2024). Smart container port development: recent technologies and research advances. *Intelligent Transportation Infrastructure*. <https://doi.org/10.1093/iti/liad022>

2.3.5. Effective communication and collaboration:

Effective communication and collaboration are crucial for streamlining port operations, especially when handling perishable goods like fresh produce in non-automated ports. Here's how^{1,2}

- A. Establish clear communication with farmers:** Direct and clear communication channels with farmers ensure they have accurate information. This includes expected arrival times for produce at the port, available storage capacity, and any special handling needs. This allows farmers to plan harvesting and packaging accordingly, minimizing the time produce spends in transit or waiting at the port, thus preserving freshness and quality.
- B. Collaborate with inspection agencies:** Working closely with agricultural inspection agencies significantly streamlines clearance processes. Through collaboration, ports can facilitate faster inspections and reduce waiting times for perishable goods. This minimizes delays and prevents potential spoilage. Efficient coordination can lead to the development of pre-clearance procedures or dedicated inspection lanes, expediting the overall process.
- C. Partner with refrigerated transport providers:** Collaboration with refrigerated transport providers is key to maintaining the cold chain's integrity. Seamless connection between port operations and onward transportation is essential. This involves coordinating the timing of refrigerated transport arrivals with cargo discharge to minimize exposure to non-optimal temperatures. Maintaining the cold chain throughout the journey is vital for preserving the quality and safety of fresh agricultural exports.

These strategies contribute to a broader effort to digitalize and improve the resilience of maritime supply chains, as highlighted by reports from the World Bank and the International Association of Ports and Harbors (IAPH). They emphasize the importance of digital collaboration between private and public entities across the maritime supply chain to enhance efficiency and crisis resiliency.

¹ Hillsdon, M. (2018). Port of the future: how technology is transforming shipping. *Raconteur*. <https://www.raconteur.net/technology/technology-digital-port>

²Port Technology Team. (2021, January 21). New report shines light on digital port collaboration. Port Technology International. Retrieved from <https://www.porttechnology.org/news/new-report-shines-light-on-digital-port-collaboration/>

2.3.6. Continuously evaluate and improve:

In today's globalized market, efficiency is paramount for perishable goods like fresh produce. While automation offers significant advantages, many ports lack the resources for extensive automation. This is where the "Continuously Evaluate and Improve" concept becomes even more crucial for optimizing port operations dedicated to fresh produce exports at non-automated facilities. Here's a breakdown of key actions to consider:

- A. Track perishable cargo loss:** This entails monitoring the rate at which perishable goods spoil or get damaged during transit. By keeping track of these losses, ports can pinpoint inefficiencies in their handling practices and cold chain management. For example, the Port of Oakland has implemented measures to improve the flow of agricultural exports, which likely includes monitoring perishable cargo.¹
- B. Benchmark against other ports:** Ports can improve their operations by comparing key performance indicators, such as the dwell time of perishables and spoilage rates, with those of other ports that specialize in agricultural exports. This benchmarking helps identify best practices that can be adopted. The Port of Oakland, for instance, has seen a surge in containerized fresh fruit and vegetable shipments, suggesting effective management practices that could serve as a benchmark for others².
- C. Invest in training on perishable cargo handling:** Providing specialized training to port personnel is crucial. This training should cover proper handling techniques, temperature control measures, and best practices for minimizing damage to fresh produce. Such investment in human capital ensures that the workforce is equipped with the necessary skills to handle perishable goods effectively, thereby reducing spoilage and ensuring the quality of agricultural exports³.

By implementing these measures, non-automated ports can significantly improve the export process for fresh produce. This not only benefits exporters by reducing spoilage and ensuring

¹ Produce Blue Book. (2022, January 6). *Port of Oakland to expedite ag exports*. Retrieved from <https://www.producebluebook.com/2022/01/06/port-of-oakland-to-expedite-ag-exports/>

² Pacific Maritime Magazine. *Port of Oakland Launches Program to Expedite Agriculture Exports*. Retrieved from <https://pacmar.com/article/port-of-oakland-launches-program-to-expedite-agriculture-exports/>

³ Burnson, P. (2018, April 25). *Agricultural exports continue to drive growth at Port of Oakland*. Logistics Management. Retrieved from <https://www.logisticsmgmt.com/article/agricultural-exports-continue-to-drive-growth-at-port-of-oakland/ports-and-infrastructure>

timely deliveries, but also translates to fresher produce for consumers at the other end of the supply chain.

Conclusion of chapter 02:

In conclusion, this chapter has illuminated the multifaceted nature of port logistics and its critical role in the export of fresh agricultural produce. Through a systematic analysis of port infrastructures, services, and logistics, coupled with a deep dive into the operational strategies for both non-automated and automated ports, we have charted a course towards optimizing the delicate balance between efficiency and product integrity. The insights garnered here serve as a beacon for future endeavors in port logistics, advocating for a harmonious integration of technology, human expertise, and continuous improvement. As the global demand for fresh produce escalates, the principles and practices outlined in this chapter will be instrumental in ensuring that the journey from farm to table is not only swift but also safeguards the quality that consumers worldwide have come to expect.

Chapter 03: the current situation of port logistics for fresh agricultural products to be exported in Algeria

Introduction to chapter 03:

In this chapter, we assess the integral role of port logistics in the Algerian agricultural supply chain, focusing on the exportation of fresh produce. We begin with a presentation of EPAL, offering a historical overview of the Port of Algiers and defining EPAL's mission and activities. We explore the company's strategic directions and information systems that support its operations.

The second part scrutinizes the exportation process of fresh agricultural products at Algiers' port. We detail the procedures for receiving and checking full export containers at EPAL and highlight the unique aspects of exporting perishable goods, with a case study on the export procedure for dates.

Lastly, we outline our research methodology, employing a SWOT analysis to critically analyse EPAL's role in promoting fresh agricultural exports. This analysis aims to identify potential areas for optimization and strategic development to enhance Algeria's export capabilities.

3.1.Presentation of EPAL:

Anchoring Algeria's maritime trade, the Port of Algiers stands as the nation's premier seaport. Strategically positioned on the Bay of Algiers along the North African coast, this deep-water port boasts significant cargo handling capacity. Overseen by Enterprise Portuaire d'ALGER (EPAL), the port facilitates a substantial trade volume, with 2019 records indicating over 2,200 vessel calls and 444,621 TEUs processed. EPAL fosters collaboration with the National Corporation of Maritime Transportation and the Algerian Navigation Company, ensuring streamlined port operations and efficient movement of goods.

3.1.1. Historical overview of the port of Algiers:

➤ **9th century BCE:** The Phoenicians establish the first settlement, later known as "Icosium."

Bologhine Ibnou Ziri founds Algiers along with other thriving and affluent cities like Miliana, Médéa, and Bouira in 935.

➤ **15th century:** The Spaniards attempt to occupy Algiers, but an alliance with the Ottomans prevents them.

➤ **1529:** The Spaniards are expelled from Algiers, ending their occupation of the city.

The Grand Admiral Kheire-edddine constructs a pier connecting the "Penon" to the city and builds a mole to shelter ships during rough weather.

➤ **1830:** French colonial invasion; the port of Algiers covers an area of 3 hectares and 50 ares.

➤ **1865:** Completion of the basin of the old port, including the North pier, the large Kheir-Eddine pier, the South pier, and the ramps linking the docks to the city.

➤ **1914:** Construction of the Agha basin.

➤ **1950-1953:** Construction of the maritime station at El Djazaïr mole.

➤ **1961-1963:** Construction of the Skikda mole.

➤ **1987-1988:** Filling of the Calvi dock and construction of an Albe Duke landing stage, as well as six Ro/Ro ramps.

➤ **1994-1998:** Construction of the Container Terminal covering an area of 17.5 hectares and with a capacity of over 250,000 TEUs.

- Algiers regained its status as the capital of the new Algeria in 1962, a period marked by continuous development of the city and its port.

- Today, Algiers is home to over three million inhabitants, and its commercial port plays a significant role in international trade.

3.1.2. EPAL's definition:

The Port Company of Algiers (EPAL) is a public economic institution created in 1982 through the merger of the National Port Authority (ONP) and the National Stevedoring Company (SNM). It then integrated the Quai Unit, which was previously under the supervision of the Algerian National Navigation Company (SNAN), by Decree 286-82 dated August 14, 1982, which established the Port Company of Algiers. It achieved financial independence on September 23, 1989.

The Port Company of Algiers is a joint-stock company (SPA) with a share capital of approximately 10,500,000,000 DA in March 2008. It is entirely owned by the Algerian State and simultaneously exercises the powers of the port authority. It is placed under the authority of SERPORT, after having been under the authority of the Public Services Holding Company, which is part of the Ministry of Transport.

Thus, the Port Company of Algiers is a public service institution operating within the framework of national economic development. It is responsible for the management, operation, and development of port infrastructure, as well as the oversight of commercial activity.

The Port of Algiers stretches from Cap Caxine in the west to Cap Tamentfoust in the east, covering a width of 18 km and including the port of Dellys. The port occupies a maritime area of approximately 184 hectares, with a total quay length of 7,317 meters.

Tableau 1: Quay Data Summary for Algier’s port on 2024

Quay	Number of Berths	Function	Under authority of :
1	1	Designated for fisheries operations.	EPAL
2	1	Designated for fisheries operations.	EPAL

3	1	Designated for fisheries operations.	EPAL
4	1	Designated for fisheries operations.	EPAL
5	1	Designated for fisheries operations.	EPAL
6	1	Handles diverse cargo beyond standard containers. This includes bulk goods and specialized shipments.	EPAL
7	1	Handles diverse cargo beyond standard containers. This includes bulk goods and specialized shipments.	EPAL
8	1	Handles diverse cargo beyond standard containers. This includes bulk goods and specialized shipments.	EPAL
9	1	Facilitates passenger transport ships.	EPAL
10	1	Handles diverse cargo beyond standard containers. This includes bulk goods and specialized shipments.	EPAL
11	1	Facilitates passenger transport ships.	EPAL
12	1	Reserved for ERENAV	EPAL
13	1	Reserved for ERENAV	EPAL
14	1	Reserved for ERENAV	EPAL

15	1	Reserved for ERENAV	EPAL
16	1	Reserved for ERENAV	EPAL
17	1	Designated for container ships and other general cargo vessels.	EPAL
18	2	Designated for container ships and other general cargo vessels.	EPAL
19	1	Designated for container ships and other general cargo vessels.	EPAL
20	2	Designated for container ships and other general cargo vessels.	EPAL
21	1	Designated for container ships and other general cargo vessels.	EPAL
22	5	Designated for container ships and other general cargo vessels.	EPAL
23	2	Designated for container ships and other general cargo vessels.	EPAL
24	1	Functions as a Roll-on/Roll-off (RORO) terminal for vehicles.	EPAL

25	1	Functions as a Roll-on/Roll-off (RORO) terminal for vehicles.	EPAL
26	1	Dedicated to petroleum tankers for loading and unloading.	EPAL
27	0	Eliminated after construction of DPW container terminal	-
28	0	Eliminated after construction of DPW container terminal	-
29	0	Eliminated after construction of DPW container terminal	-
30	1	Functions as a container terminal.	DPW
31	2	Functions as a container terminal.	DPW
32	1	Functions as a container terminal.	DPW
33	3	Functions as a container terminal.	DPW
34	1	Designated for container ships and other general cargo vessels.	EPAL
35	3	Designated for handling cereal cargo (grain).	EPAL
36	1	Designated for container ships and other general cargo vessels.	EPAL
37	2	Dedicated to petroleum tankers for loading and unloading.	EPAL

Total	47		
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Source: Established by students from inner documents of the company

Tableau 2: Port Capacity in Terms of Berths and Quays

	Number of quays	number of berths
Algier's port	34	47
EPAL	30	40
DPW	4	7

Source: Established by students from inner documents of the company

3.1.3. The activity of the port company of algiers (EPAL)

The Port Company of Algiers (EPAL) operates as a commercial entity in its relations with others and is governed by current legislation, in accordance with the rules defined by Decree No. 82-286 of August 14, 1982, which established it. Within the framework of the National Economic and Social Development Plan, it is responsible for participating in the promotion of foreign trade, particularly by facilitating the passage of people and goods under the best economic conditions adopted in operational management and development.

Due to the importance of foreign trade at the port level, it assumes a great responsibility in managing port traffic, ensuring in particular:

- Exploitation of the means and port facilities.
- Carrying out maintenance, development, and renovation works for superstructures and port structures.

- Respecting the environment of public port facilities and roads.
- Respecting hygiene and road safety rules and fighting against pollution in the port.
- Developing, developing and implementing maintenance work programs, with the help of the competent authorities, as well as programs for the installation and creation of structures for commercial activities (port infrastructure) such as handling, loading, transport and competition of goods.

Thanks to improved management and considerable investment efforts, the port's activity has reached its current level. Unfortunately, this is no longer sufficient, as the Port of Algiers currently handles more than 9 million tons of merchandise.

3.1.4. The company's directions:

There are 2 types of directions in EPAL.

3.1.4.1. Functional directions:

These directions ensure the animation, coordination, and consolidation of the activities of the operational compositions under their technical authority. They organize the movement, analysis, and combination of information and constantly ensure all the compositions of the company.

There are 06 functional directions:

- Operations and settlement direction.
- Planning & information system direction.
- Finance and accounting direction.
- Human resources & general affairs direction.
- Works & development direction.
- Organization & management control direction.
- Operations and Settlement direction

This is the department responsible for managing the public port domain and handling legal affairs.

A. Planning & information system direction:

Responsible for developing procedures used, organizing the information and communication system, and internal control following a pre-established intervention plan for consolidating the dissemination of the company's dashboards and technical assistance, etc.

B. Finance and accounting direction:

This department implements the financial management policy and accounting procedure of the company, controls cash and bank operations, and proceeds to the condition of results and balance sheets.

C. Human resources direction:

Responsible for human resources management and personnel administration, designing payroll calculation rules, social and fiscal declarations, exercising functional responsibility over personnel management structures, and preventing and resolving individual work conflicts.

D. Works and development direction:

Ensures the organization, coordination, and control of all maintenance and maintenance work on port facilities, buildings, structures, and equipment. Also responsible for the development studies and modernization of the port, technical studies of investment equipment projects, and their implementation.

The services related to the Works and Development direction:

- Monitoring and coordination service.
- Studies and analysis service.
- Grids and surveillance service.
- External relations service.
- Maintenance service.

E. Organization & management control direction:

Responsible for the development of procedures used, organization of the information and communication system. Internal control following a pre-established intervention plan for consolidating the dissemination of the company's dashboards and technical assistance, etc.

3.1.4.2. Operational directions:

This direction has a role in operational management and the implementation of material and human resources. There are six operational directions as follows:

- Harbor master direction.
- Towing direction.
- Handling direction.
- Central logistics direction.
- Stevedoring direction.
- Container direction.

A. Harbor master direction:

Missions:

- Ensures the preservation of the public port domain by enforcing general and specific regulations in effect related to operations, policing, and port safety, in collaboration with the Directorate of operations & regulation.
- Regulates ship movements within the port's maritime boundaries by implementing and executing the daily programs decided by the placement commission.
- Manages piloting, mooring, and towing operations within the port's maritime boundaries in accordance with the current regulations.
- Controls access for individuals, as well as the circulation and parking of vehicles within the port premises.
- Implements special measures related to the handling, transportation, and storage of dangerous goods authorized to transit through the port.
- Manages and coordinates the activities of harbor officers, port supervisors, port security guards, and technical prevention agents assigned to the port premises.
- Organizes and coordinates operations in the event of an incident.

B. Towing directorate:

Missions:

- Executes the ship movement programs decided by the placement commission in support of piloting activities.
- Tows or pushes ships.
- Manages ship docking, undocking, or departure maneuvers.

- Provides convoying and assists in the execution of other navigation maneuvers within the port, basins, and roads.
- Supplies fresh water (at roadstead).
- Offers sea rescue and assistance services.
- Manages and operates the naval fleet (tugs).
- Handles the administrative management of both sedentary and marine personnel.

C. Handling directorate

Missions:

- Manages handling operations, including the loading, stowing, unstowing, and unloading of goods.
- Manages operations of placing and retrieving goods on open spaces or in warehouses.
- Develops handling agreements with consignees or clients.
- Provides various related services.

D. Central logistics directorate:

Missions:

The central logistics directorate is responsible for:

- Providing the necessary human and material resources for ship processing and lifting activities (in collaboration with the handling directorate, container directorate, and stevedoring directorate).
- Managing a diversified fleet of equipment (large-tonnage forklifts, medium and small-tonnage forklifts, RORO tractors, trucks, port cranes, mobile cranes, electric cranes, grain gantries, grain pumps, trailers).
- Managing the maintenance (preventive and corrective) of handling equipment.
- Supplying spare parts, fuel, lubricants, workshop supplies, cleaning products, and small tools for the central logistics directorate as well as other directorates.
- Managing and tracking investment acquisitions (equipment and handling accessories).

- Handling administrative management and payroll for the Directorate's personnel.

Tableau 3: Total number of equipment on 2024 and their Acquisition Years

Designation	Lifting/Traction or Suction Capacity	Number	Field of Activity
Straddle carrier	40 tons	2	Handling 20' and 40' containers
Reach stacker	45 tons	39	Handling 20' and 40' containers
Forklift truck	32 tons	14	Handling 20' containers and various goods
Forklift truck	20 tons	1	Handling coils
Forklift truck	15 tons	12	Handling 20' containers and various goods
Forklift truck	10 tons	10	Handling containers and various goods
Front mast forklift	9 tons	13	Handling 20' and 40' containers
Small tonnage forklift	From 1.5 to 6 tons	19	Handling various goods
RORO tractor	90 tons	27	Transfer of 20' and 40' containers, heavy parcels, and various goods
Road tractor	40 tons	36	Transfer of 20' and 40' containers, heavy parcels, and various goods

Trailer	50 tons	59	Transfer of 20' and 40' containers, heavy parcels, and various goods
Flatbed trailer	120 tons	4	Transfer of heavy parcels and equipment
Mobile harbor crane on tires	100 to 125 tons	3	Loading/unloading of 20' and 40' containers, heavy parcels, and various goods
Mobile harbor crane on tires	64 tons	2	
Telescopic crawler crane	From 50 to 300 tons	8	Handling 20' and 40' containers, heavy parcels, and various goods
Grain gantry	250 tons/hour	3	Unloading grain from ships onto trucks
Grain gantry	180 tons/hour	2	
Grain pump	120 tons/hour	2	Unloading grain from ships onto trucks
Mini loader (scoops)	4 tons	7	Sweeping grain in ship holds
TOTAL	263		

Source: Established by students from inner documents of the company

E. Stevedoring directorate:

Missions:

- Schedules the necessary human and material resources for loading and unloading operations in collaboration with other operational Directorates.
- Receives, acknowledges, and logs various merchandise and rolling goods placed on open spaces or delivers them under the crane.
- At loading: Receives goods from clients and loads them as promptly as possible.
- Invoices services rendered.
- Tracks merchandise in customs storage (recording and unpacking).
- Manages information by coordinating operations related to ships, goods, equipment, and storage.

F. Container directorate

Missions :

- Manages the reception of containers, both during unloading in agreement with the ship and during loading in agreement with shippers (or their representatives).
- Logs containers during loading and unloading.
- Conducts physical inspections of the external condition of containers during loading and/or unloading operations.
- Manages storage areas efficiently.
- Guards and preserves containers awaiting collection by import recipients and loading for export.
- Delivers containers to their recipients.
- Receives and places containers at the quay for export loading.
- Handles commercial and marketing measures and initiatives aimed at promoting container traffic handled by the company.
- Maintains privileged commercial relationships with users and port operators.
- Ensures and improves the quality of services and provisions to clients.
- Provides container scanning services.

- Invoices for all services provided.
- Prepares statistics, activity reports, and budgets.

Tableau 4: Port storage allocation overview in 2024.

STORAGE AREA	SURFACE (m ²)	ALLOCATION
TP 4	3,013	Rolling Park
TP 17	15,514	Containers
TP 20	24,560	Containers
TP 21	15,090	Containers
TP 22	26,725	Containers
TP 25	49,212	Containers
TP 25/2	10,410	Inspection Park
TP 26/1	5,930	Containers
TP 26/2	3,530	Rolling Park
TP 35/1	9,000	Containers
TP 35/2	7,100	Containers
TP 35/3	3,500	Containers
TP 35/4	2,800	Containers
TP 36	4,800	Inspection Park
Total	181,184	

Source: Established by students from inner documents of the company

Based on the head of the export service department declarations, it appears that imported and exported containers are not separated and there is no specific area designated for exported products. This could present challenges, especially considering that the volume of imported containers is significantly higher than that of exported ones. However, it is noted that there is a storage area specified for exported products, but it is not fully utilized due to organizational issues.

Tableau 5: Storage capacity for refrigerated containers in 2024.

Zone	Location	Refrigerated Container Capacity (Number of Plugs)
Central	TP26/1	164

Central	Quay 26	48
South	TP 35/4	48
Total		260

Source: Established by students from inner documents of the company

According to the head of the export service department, "The fact that exported and imported containers are stored in the same area, without a dedicated cold storage specifically for fresh exports, can be a significant concern for maintaining the quality and freshness of agricultural products." Despite having an area for fresh produce, the much higher volume of importations compared to exportations can lead to inadequate space and less than ideal conditions for fresh exports, compromising their quality and freshness.

Tableau 6: The operational status and renovation activities of the container ship docking facilities in 2024.

Quay	Operational berths	Berths under Renovation
17	It is composed of one berth, and it is operational	None
18	None	18.1 and 18.2
19	It is composed of one berth, and it is operational	None
20	None	20.1 and 20.2
21	None	It is composed of one berths, and it is not operational
22	22.2, 22.3, 22.4 and 22PC	22.1
23	23.2	23.1
34	It is composed of one berth, and it is operational	None
36	It is composed of one berth, and it is operational	None

Source: Established by students from inner documents of the company

During our visit to Algiers port, we learned from the Head of the Export Service Department that significant renovations are underway due to damage as the table above shows. This has inevitably reduced the port's operational capacity, leading to longer vessel turnaround times. Limited berth availability may cause ships to wait longer to dock, unload, and reload cargo, potentially disrupting the supply chain.

3.1.5. Information system :

An information system is a comprehensive framework comprising various components designed for data acquisition, storage, and analysis, ultimately facilitating the provision of information, knowledge, and digital products. Organizations, including business enterprises, leverage these systems to execute and oversee their operational activities, engage with clientele and suppliers, and establish a competitive stance in the market.

The Port of Algiers Enterprise (EPAL) appears to employ a multifaceted array of technological solutions to advance its operational development and manage its databases. Below is a synopsis of these technologies:

3.1.5.1. Development tools:

- **Centura:** An integrated development environment used for creating database applications.
- **Laravel:** A modern PHP framework for web development that follows the MVC (Model-View-Controller) pattern.
- **FoxPro:** An object-oriented and procedural programming language, formerly produced by Microsoft, for database applications.
- **WinDev :** An IDE that allows for cross-platform application development, especially for Windows systems.

3.1.5.2. Databases:

- **Oracle 12c :** A version of the Oracle database that features an architecture optimized for cloud computing and large-scale data management.
- **SQL Server :** A relational database management system developed by Microsoft.
- **MySQL:** A widely used open-source database system, particularly in web development.

In the dynamic environment of EPAL, a range of specialized software and mobile applications are utilized to streamline operations, enhance efficiency, and ensure seamless management across various departments. The following table is an overview of the key software and mobile applications that empower EPAL’s operations, ensuring efficient and effective management across all levels of the organization.

Tableau 7: EPAL’s Software and Mobile Applications

Category	Software/Applicati on	Description	Role

Internal Software	GESPORT	Port activity and commercial management tracking.	Centralizes port operations, manages stopovers, tracks goods, and provides operational support ¹ .
	GMAO	Computer-assisted maintenance management.	Plans and monitors maintenance work, manages equipment and human resources, and ensures work safety.
	GEC	Electronic mail management for all of EPAL.	Centralizes, qualifies, circulates, processes, and archives incoming, outgoing, and internal mail.
	Customer Complaint Software	-	Manages and tracks customer complaints, improves customer satisfaction and loyalty.
	Order Management Software	-	Monitors orders, optimizes the supply chain, and improves operational efficiency.
	Supplier File Tracking Software	-	Tracks interactions with suppliers, manages supplier information, and optimizes purchasing.
	CLD Operations Software	Assignment/Programming/History.	Manages logistical operations, allocates resources, and keeps a historical record of activities.
	Electronic Payment Software	-	Processes payment transactions, secures

			payments, and integrates with financial systems.
	Cash Management Software	-	Manages cash transactions, tracks sales and returns, and generates financial reports.
	Human Resources Management Software	-	Manages recruitment, training, performance evaluations, and compensation.
	Payroll Calculation Software	-	Calculates salaries, manages deductions, and ensures tax compliance.
	Navigation Rights Control Software	Payment tracking for navigation rights.	Monitors and manages payments related to navigation rights.
	Billing Software	-	Issues invoices, tracks payments, and manages customer accounts.
	Domain Management Software	-	Manages real estate properties, tracks leases and contracts, and optimizes space utilization.
Acquired Software	Sage accounting software	Finance and accounting software.	Handles financial and accounting management, transaction tracking, and reporting ¹ .
	GED on base	For electronic document management.	Archives and manages documents, facilitates access and document retrieval ¹ .

	Sora software	For legal aspects.	Manages legal aspects, tracks files and contracts1.
Mobile Applications	Container Management by Android	-	Tracks and manages containers, improves operational efficiency, and reduces the risk of loss.
	Remote Consultation Android App	For the Director-General and Deputy Directors.	Provides mobile access to port activity for management and decision-makers.
Under Development	Overtime Management Software	-	Tracks and calculates overtime, ensures compliance with labor laws, and optimizes time management.
In Ideation	Real-Time Container Location Tracking Android App	-	Tracks containers in real-time, improves visibility and traceability in the supply chain.

Source: Established by students from inner documents of the company as well as interviews.

Through this exploration of EPAL and the Port of Algiers, we uncover the transformation of a historic maritime hub that has risen to meet modern trading needs. From its storied past to its present-day operations, EPAL has maintained a consistent focus on managing the port's activities. The company's strategic directions and well-structured information system are key in supporting its capacity to facilitate Algeria's maritime trade. In contemplating EPAL's journey, it becomes evident that the Port of Algiers is a crucial element in the economic structure of the nation.

3.2.Exportation of fresh agricultural products at Algiers's port

3.2.1. Procedure for reception and checking of full export containers at EPAL:

At the EPAL, the reception and checking of full export containers involve a comprehensive set of procedures to ensure the smooth and efficient handling of cargo. This process is critical for

maintaining the integrity and security of shipments, with the objective of ensuring compliance with international shipping standards and facilitating effective port operations.

3.2.1.1. Reception and checking of full containers for loading:

The freight forwarder or client presents themselves at the export service of the container management department to submit the loading forecast and the quay entry slip in seven (07) copies issued by the company, as well as the certificate of origin issued by the chamber of commerce to benefit from a 50 percent discount on national production.

The quay entry slip No. 02 marked "shipping declaration" and the loading forecast slip are archived at the export service.

The export service prepares and issues the truck access order forms and stamps the first and seventh copies of the quay entry slip with the notation "Formalities Agreement," which are then handed over to the forwarder or client.

The forwarder or client, equipped with the quay entry slip No. 07, goes to the integrated area to generate and pay the export invoice and retrieves the unloading slip, the equipment rental slip, the truck access slip, and if necessary, the weighing slip and the scanning slip.

The forwarder and/or the client returns to the export service to obtain authorization for their containers to access the port of Algiers. The stamp marked "access agreement" is affixed to the listing.

The forwarder and/or the client, armed with the truck access slip and the quay entry slip No. 01 marked "Formalities Agreement," brings their containers into the port of Algiers. If the container is damaged upon reception or arrives damaged, a damage report is established by the export service.

The forwarder conducts the weighing at the weighbridge to establish the VGM if the weighing was not done outside the port premises, and then proceeds with customs formalities.

If the container is selected by customs services for inspection, it will be transferred to the inspection yard after the inspection service has been paid, and an inspection slip is issued.

The products whether exported or imported fall under one of the four circuits for the customs Office, these circuits are: red, orange, blue and green.

Tableau 8 : Customs clearance circuits: risk assessment and inspection procedures

Circuit	Purpose	Inspection Type	Clearance Process
Green	Low-risk goods, no suspicion of fraud	None	Immediate clearance after payment and tax guarantee
Blue	Sensitive goods, potential post-clearance fraud risk	Deferred or post-clearance inspections	Clearance after thorough scrutiny, post-payment and tax guarantee
Orange	Moderate fraud risk, requires documentary verification	Documentary checks	Clearance after documentary verification, payment, or tax guarantee
Red	High fraud risk, requires both documentary and physical inspection	Documentary and physical inspections	Clearance only after passing rigorous inspections, including payment and tax guarantee

Source: Algerian customs. (N.D.). Control and verification of the detailed declaration. Retrieved June 17, 2024, at 23:32 GMT+1 from <https://www.douane.gov.dz/spip.php?article67>

Customs services, after reviewing the declaration, validate the file by stamping the third copy of the quay entry slip with the notation "seen for loading"; otherwise, another procedure is initiated, which may involve either seizing the goods or returning them to the client.

If the file is validated, the forwarder and/or client returns to the export service to present and submit the customs services’ approval on their third copy of the quay entry slip. A list of containers approved for export is handed to the checkers, marked "approved for loading."

The same list marked "approved for loading" is given to the checker assigned to the ship for checking containers for loading. The checker consolidates operations using a PDA/smartphone or the listing.

Otherwise, the container is considered left at the quay awaiting further action (seizure/return or possible validation of the file).

3.2.1.2. Reconciliation of loading states:

After the ship operations are completed, the export team leader reconciles the loading states of full and empty containers with the ship and establishes the differential state and the reserve state, which will be signed jointly by the team leader and the ship (or shipping agent).

3.2.1.3. Billing elements:

At the end of the loading operations and after reconciliation with the ship, the loading states by shift and by means (equipment) as well as a seal state are sent to the handling department for the service billing.

If containers are left at the quay, either empty or full, they are managed by the export service for operational aspects while awaiting possible loading operations or return to the empty yard, subject to the payment of the quay stay service handled by the commercial department after the export service prepares a billing element, respecting the free time as follows:

➤ **Free time :**

- For empty containers : 05 days
- For full containers (national production): 10 days
- For full containers (other production): 05 days

3.2.1.4. Recording supports:

Efficient management and secure handling of full export containers at EPAL (Entreprise Portuaire d'Alger) require a robust system of documentation known as recording supports. These documents serve various critical functions, from announcing the arrival of containers to detailing the handling and transportation costs. They ensure that all stakeholders, including terminal operators, carriers, and clients, have access to accurate and validated information necessary for smooth operations. Below is an overview of key recording supports used in this process:

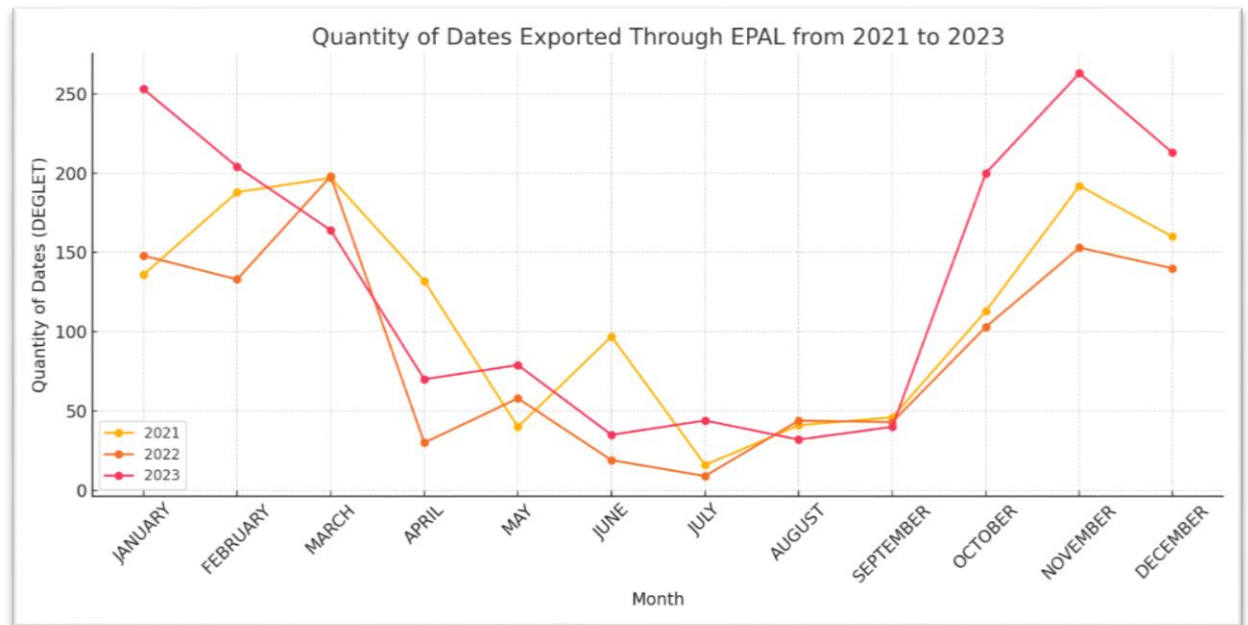
- **Loading forecast slip:** announces the arrival of containers, including details like container number, cargo type, destination, and expected arrival date. (Validated by the terminal operator)
- **Quay entry slip (7 copies):** authorizes placement of containers on the quay for loading. Issued in multiple copies for various stakeholders (terminal, carrier, consignee, etc.) And validated by the terminal operator.

-
- **Full loading list:** lists all full containers to be loaded onto a specific ship, including container number, cargo type, destination, and bill of lading number.
 - **Invoices:** detail handling, transportation, and other fees associated with container shipment.
 - **Order form for equipment and personnel (client):** issued by the client, specifies equipment and personnel needed for loading/unloading containers.
 - **Truck access slip:** authorizes trucks to enter the terminal for loading/unloading containers.
 - **Port access authorization (truck access slip):** official authorization for trucks to access the port.
 - **Equipment rental slip:** indicates the rental of specific equipment for loading/unloading containers.
 - **Export logistics slip:** summarizes essential logistical information for exporting containers.
 - **Weighing slip:** indicates the weight of the container and its cargo.
 - **Scanner slip:** records the passage of containers through scanners for security checks.
 - **(PDA/smartphone):** indicates some documents can be managed electronically.
 - **Global loading status (seal list):** summarizes all containers loaded onto a ship, with their respective seal numbers.
 - **Differential status:** highlights discrepancies between planned and actual containers loaded onto the ship.
 - **Reserve status:** identifies containers not loaded and placed in reserve.
 - **Damage report:** details any damage observed on a container or its cargo.
 - **Storage area status:** indicates the status of the container storage area at the terminal.
 - **Seal status:** indicates the status of seals affixed to the containers for security.
 - **Reception status by shift:** summarizes containers received by work shift during a given period.

3.2.2. Specifics of exporting fresh agricultural products at the port of algiers: dates export procedure at the port company of algiers:

Algeria's export volume is relatively low, especially for fresh agricultural products. This is primarily due to the country's limited agricultural infrastructure. To better understand the export procedures for fresh agricultural products, we consulted with the head of export services at the port of Algiers. He confirmed that dates represent an overwhelming 99% of the fresh agricultural products exported through the port. Given this predominance, we have chosen the date export procedure as an example for our analysis.

Figure 9: Quantity of dates (Deglet) exported through EPAL from 2021 to 2023.



Source: Established by students from inner documents of the company

This graph is displaying the quantity of dates (Deglet) exported through EPAL from 2021 to 2023. The plot shows the monthly export quantities for each year, highlighting trends and variations over the months and years.

During our interview with the head of the export brigade of the customs, we were informed that, in the context of promoting non-hydrocarbon exports and in accordance with the conclusions of the Joint Ministerial Council held on February 28, 2016, as well as Circular No. 634 dated March 13, 2016, issued by the Prime Minister's office, the General Directorate of Customs has taken new measures to further simplify the export process. Among these measures is the introduction of the "green lane" for the export of fruits, vegetables, and other perishable goods destined for sale or storage. These exports automatically benefit from the green lane, regardless of the exporter's status, whether they are an approved economic operator or not.

Declarations directed to the green lane are not subject to immediate control, meaning that the declarations are not checked, and the goods are not inspected. The goods are removed as soon as the declaration is filed, and the duties and taxes are paid by the declarant.

At the EPAL, meticulous protocols are in place for the reception and verification of full export containers, specifically those transporting fresh agricultural commodities. These protocols are integral to ensuring that perishable goods are managed with utmost efficiency and care. This

rigorous process is pivotal in upholding the quality, integrity, and security of the agricultural exports, thereby meeting international shipping standards and enhancing the port's operational effectiveness. Here is an overview of these operations:

3.2.2.1. Document submission:

The forwarder or client presents themselves at the export service of the container department to submit the loading forecast and the quay entry slip in seven copies issued by the company, as well as the certificate of origin issued by the chamber of commerce to benefit from the 50% discount concerning national production.

3.2.2.2. Archiving and approval:

The quay entry slip No. 02 bearing the mention "shipping declaration" and the loading forecast note are archived at the export service.

The export service establishes and issues the truck access order forms, then stamps the copies No. 01 and No. 07 of the quay entry slip with the mention "Approval for formalities" and hands them over to the forwarder or client.

3.2.2.3. Billing and Port Access:

The forwarder or client, with the quay entry slip No. 07, goes to the integrated zone to establish and pay the export invoice and retrieves the unloading slip, the equipment rental slip, the truck access slip, and possibly the weighing note and the scanning slip (if needed).

The forwarder and/or client returns to the export service to obtain authorization to access the port of Algiers with their containers. The stamp with the mention "access approval" is placed on the listing.

3.2.2.4. Container Entry:

The forwarder and/or client, with the access note and the quay entry slip No. 01 bearing the mention "Approval for formalities," brings their containers into the port of Algiers. In case of damage to the container upon receipt or if the container is received damaged, a damage report is drawn up by the export service.

Once the trucks enter the port, they go to the area reserved for refrigerated containers to connect the container if it is not going to be loaded directly onto the ship.

3.2.2.5. Weighing and customs formalities:

The forwarder carries out the weighing at the weighbridge for the establishment of the VGM, if the weighing has not been done outside the port area, and then proceeds with the customs formalities.

3.2.2.6. Inspection and certification:

Date exports automatically benefit from the green lane, regardless of the exporter's status, whether they are an approved economic operator or not.

In this case, the container is not targeted by customs for an inspection, but it should be noted that products benefiting from this advantage may go through a scanner for verification.

The container is subject to an inspection by the phytosanitary services, which takes 5 to 15 minutes according to the service manager's statements, in the presence of the forwarder, to obtain the phytosanitary certificate and be sealed by the customs agents.

We mention that there are three countries with requirements for Algerian dates; these concerns are purely about insects. These three countries are India, Russia, and Argentina (Annex), while other recipient countries like France do not have these requirements.

3.2.2.7. Exporters outside the wilaya of Algiers:

Exporters located outside the Wilaya of Algiers wishing to ship goods abroad can complete the export formalities at the nearest customs office to their company. The customs declaration is then filed and processed at this office. After a phytosanitary inspection on-site, the containers are sealed, eliminating the need for an additional customs inspection. The border post simply verifies the passage abroad, except in cases of suspected abuse, based on a copy of the detailed export declaration.

3.2.2.8. Validation and embarkation:

The customs services validate the file by stamping the copy No. 03 of the quay entry slip with the mention "viewed at embarkation".

The forwarder and/or client returns to the export service to present and submit the customs services' approval on their copy of the quay entry slip No. 03. A listing of the containers for export with the mention "approval for embarkation" is handed over to the pointers responsible for overseeing the loading onto the ship.

The same listing copy with the mention "approval for embarkation" is given to the pointer assigned to the ship for container embarkation tracking. The latter will consolidate the operations using a PDA/Smartphone or the listing.

It is important to note that the exporter of this type of products does not pay taxes to customs; they only pay fees. Additionally, container storage is free for the first ten days, and connecting a container costs 10,000 DA per day.

In conclusion, the exportation of fresh agricultural products through the Port of Algiers is governed by a comprehensive and stringent regulatory framework. This framework is dedicated to maintaining high sanitary standards and ensuring food safety, which are crucial for consumer protection and international compliance. By adhering to these rigorous measures, Algeria not only safeguards the health of global consumers but also strengthens the credibility and trustworthiness of its agricultural exports in the international market.

3.3.Methodology and research

This segment delineates the systematic methodology employed to execute a SWOT analysis of the Port of Algiers, with the objective of advancing the exportation of fresh agricultural commodities. The analysis serves as a strategic tool to scrutinize and enhance export-related operations.

3.3.1. Methodology for SWOT analysis of the port of algiers in an approach to promote fresh agricultural exports

3.3.1.1. Introduction

This study aims to promote the export of fresh agricultural products through a SWOT analysis of the Port of Algiers, with a particular focus on the export of dates, which account for 99% of fresh product exports via containers. The primary objective is to assess the container management and central logistics processes to identify strengths, weaknesses, opportunities, and threats and thus improve export practices.

3.3.1.2. Research design

The study was designed as a SWOT analysis, specifically targeting the container management processes and central logistics processes at the Port of Algiers. This approach is primarily based on secondary research, supplemented by direct observations and semi-structured interviews with key industry stakeholders.

➤ Analysis objectives

- Identify the strengths and weaknesses of the port's logistical processes.

- Explore opportunities and threats present in the external environment.
- Formulate recommendations to improve the export of fresh agricultural products.

3.3.1.3. Data collection

A. Secondary research

Secondary research constituted the first step of data collection. It involved consulting various sources, such as:

- Reports and publications from the Algiers Port Authority (EPAL).
- Academic articles and case studies on the export of fresh agricultural products.
- Statistics from Algerian customs and international trade organizations.
- Documentation on port infrastructure and logistical capacities.

B. Observations

Direct observations were made at the Port of Algiers to understand the container management processes and logistical operations. These observations included:

- Monitoring container loading and unloading procedures.
- Evaluating the available infrastructure and equipment for container handling.
- Analyzing workflow and interactions between different logistics actors.

C. Interviews

Semi-structured interviews were conducted with key individuals to gain in-depth insights. Participants included:

- Port officials: to understand operational capacities and challenges.
- Freight forwarders: to identify issues and opportunities in the export process.

The interviews aimed to gather qualitative data on the experiences and perceptions of the involved parts, focusing on the SWOT elements specific to logistical processes.

D. Data collection attempt via questionnaires

Questionnaires were distributed to freight forwarders to obtain additional data. However, due to the lack of responses, this method was unproductive, necessitating increased reliance on semi-structured interviews to gather the necessary data.

3.3.1.4. Data analysis

The collected data were analyzed using a thematic approach to extract relevant elements for the SWOT analysis.

A. Processing notes and statistics

The notes from interviews and observations were organized by themes corresponding to the SWOT elements.

Statistics from EPAL were used to quantify the strengths and weaknesses of the port, particularly in terms of containerized operations' capacity and performance.

B. Identification of SWOT elements

- **Strengths:** national leader in non-hydrocarbon traffic, expertise in maritime/port activities, etc.
- **Weaknesses:** complex administrative procedures, lack of qualified personnel, etc.
- **Opportunities:** increased international demand for fresh products, government encouragement for exporting non-hydrocarbon products, etc.
- **Threats:** increased competition from regional ports, stringent international regulations, etc.

Each element was analyzed for its relevance to the container management and central logistics processes at the port of Algiers.

3.3.1.5. Limitations

The study presents certain limitations that must be acknowledged:

- **Reliance on secondary sources:** reliance on secondary sources may not reflect current conditions or may contain biases related to their sources, in addition to a deficit in data focusing on the exportation of fresh agricultural products.
- **Observation limitations:** the observations were time-limited and may not capture all operational variabilities.

-
- **Interview biases:** the opinions collected may be influenced by the interviewees' personal experiences, potentially introducing subjective biases into the data.
 - **Low questionnaire response rate:** the questionnaires distributed to freight forwarders did not receive responses, limiting the diversity of collected data and requiring increased reliance on interviews to fill this gap.
 - **Time constraints:** the delay in starting the internship limited the study's duration, which may have prevented a more in-depth exploration of some aspects of the logistical processes.

These limitations may affect the generalization of the results but do not undermine the main conclusions of the SWOT analysis.

3.3.1.6. Conclusion

The methodology adopted for this SWOT analysis enabled the collection and analysis of relevant data to understand the dynamics of the logistical processes at the Port of Algiers. By focusing on the container management and central logistics processes, this approach identified key factors likely to promote the export of fresh agricultural products, particularly dates. The insights obtained provide a solid foundation for recommendations aimed at improving the efficiency and competitiveness of port operations in the international context.

3.3.2. SWOT Analysis of the port of algiers in an approach to promote fresh agricultural exports

3.3.2.1. Strengths:

- National leadership in non-hydrocarbon traffic ensures priority and focus on diversifying cargo, including agricultural goods.
- Expertise in maritime and port operations leads to efficient handling, reducing spoilage risks for perishable items.
- Strong financial health allows for investment in specialized equipment and facilities for agricultural products. (Young and qualified workforce implies innovative and energetic handling, potentially improving preservation methods.
- Adequate logistical resources ensure that the necessary equipment is available to maintain product quality during transport.
- Sufficient human resource capacity means that there are enough skilled workers to handle large volumes of products without delays.

- Ancillary services like waste management help maintain a clean environment, crucial for food products.
- Comprehensive IT system aids in tracking and managing shipments effectively, ensuring timely delivery.
- ISO 9001 certification indicates a commitment to quality management, which is essential for maintaining the freshness of agricultural products.
- Continuous procedural improvements suggest an evolving operation that adapts to new challenges in product handling.
- Mastery of stevedoring operations minimizes handling time at the dock, reducing exposure to potentially damaging conditions.
- Modern mobile scanners allow for quick inspection without unpacking, preserving product integrity.
- Increased reefer container connections provide more capacity for temperature-sensitive goods.

3.3.2.2. Weaknesses

- Old configuration of Algiers port embedded within the city hinders smooth transit of goods to the hinterland.
- Lack of a centralized commercial structure to ensure face-to-face client relationships.
- Insufficient specialized training for port professions necessary to upgrade operational personnel, hence the absence of specialized training facilities.
- Inadequate internal communication.
- Obsolete and irrelevant individual performance incentive and collective performance reward systems.
- Insufficient means of protection for docks and ships.
- Difficult exploitation of the landfills due to their configuration.
- The software used for container management only includes functionalities for recording full and empty shipments and their weights (export side).
- Disrupted goods delivery (external traffic, truck access, etc.).
- Risk of incidents and accidents due to the degradation of storage spaces.
- Halting operations at Quays 18.1, 18.2, 20.1, 20.2, 21, 22.1, 23.1 and extended turnaround time (unloading/storage), potentially reducing the number of vessels allocated to EPAL.

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- **Product diversity:** The port handles a variety of products (oil tankers, car ferries, containers, cereals). While this is a strength, it creates bottlenecks when dealing with limited operational quays. Each product type requires specific equipment and procedures, further complicating scheduling and potentially leading to delays.
 - **Inefficient procedures:** Unlike many ports where documentation and inspections happen before ship arrival, EPAL waits until the ship docks to begin these processes. These delays loading and potentially impacts ship schedules.
 - **Paperwork inefficiency:** Despite digital options, heavy reliance on paper, such as requiring multiple copies of the “Docking Form,” leads to time loss and inefficiency. Manual inventory management increases costs, paper waste, and error risk.
 - **Cold chain disruption :**
 - Among the major challenges faced by the export of fresh agricultural products at EPAL is the risk of cold chain disruption. The head of the export department confirms this issue, stating: 'We are significantly lacking in both material and human resources. We have three refrigerated zones and require at least two specialized technicians per shift (morning, evening, and night) to handle cold-related tasks. Calculations show that we need 18 specialized cold technicians to monitor the cold chain for refrigerated containers. However, we currently have only four cold chain technicians at EPAL, resulting in a shortfall of 14 technicians. Additionally, the equipment used in the refrigerated zones is inefficient. We have fixed container plug niches on the ground, which makes it nearly impossible to perform verifications. In contrast, DPW has metal infrastructure with niches and stairs for horizontal access to refrigerated containers, allowing them to conduct verifications twice a day.

Furthermore, with a limited number of power outlets (260), if all outlets are occupied and a ship needs to embark, we cannot unload until the outlets are freed. Even an export-bound container cannot be connected to the port until outlets become available. This situation may cause cold chain problems for our clients, especially if the company is located in another province.

- **Storage iimitations :**

- Inefficient stacking methods: The port can only stack containers four high, and the reach stacker used for stacking requires 08 meters in norms of maneuvering space between containers. This combination creates wasted space within the storage yards.
- Slow customs clearance and documentation: Delays in clearing imported containers lead them to occupy space . This disrupts the flow of both import and export activities.
- Despite having an area for fresh produce which is already limited, the much higher volume of importations compared to exportations can lead to inadequate space and less than ideal conditions for fresh exports, compromising their quality and freshness.
- The container area's storage is inefficient, with imports and exports intermingled, leading to challenges due to the higher volume of imports. A dedicated export storage area is underused because of organizational inefficiencies.

➤ **Equipment issues :**

- Breakdowns occur frequently for several reasons:
 - Untrained drivers cause operator errors and equipment damage due to inadequate training.
 - Poor terrain conditions, such as uneven or damaged surfaces, accelerate wear and tear on machinery.
 - Inconsistent equipment usage results in some machines being overworked while others remain underutilized, leading to premature wear.
 - The absence of maintenance tracking complicates the identification of issues and scheduling of preventive maintenance, exacerbating equipment failures.
- Unnecessary handling costs: Scattered container storage and the need to "borrow" buried containers (remove overlying containers to access a specific one) create extra handling steps and associated costs. Additionally, containers from the same client are stored in different areas, leading to excessive movement and increased wear on machinery (tires, engines, parts, etc.).
- Maintenance problems:

There are two types of maintenance, curative and preventive.

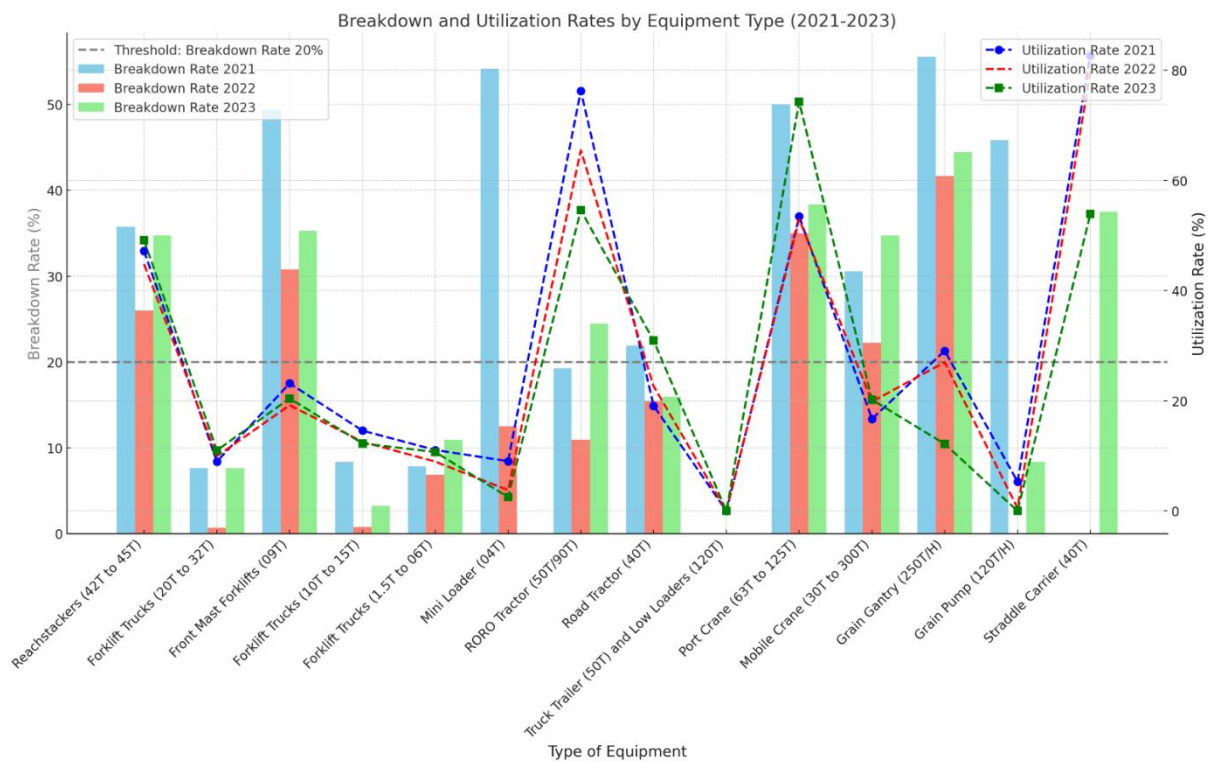
Preventive maintenance aims to optimize equipment activity and minimize breakdowns. When equipment breaks down, curative maintenance is chosen, following this process: diagnosis, repair parts or change them if needed, if parts are unavailable in stock we purchase them then place them after that the equipment should be approved as functional.

Problems found in each step are:

- A. Diagnosis: The lack of qualified field engineers can delay diagnosis of the problem.
- B. Parts procurement: Finding the necessary parts can be slow, especially if they need to be ordered.
- C. Placement: Lack of specialized qualifications.
- D. Approval process: Public entity restrictions require a lengthy chain of approvals before a purchase can be made, further extending repair timelines.

Maintenance workshops are not up to standard because they were initially storage warehouses. Additionally, there is a lack of qualified technicians.

Figure 10: The breakdown and utilization rates for various equipment types from 2021 to 2023



Source: Established by students from inner documents of the company

Comments:

This study examines the breakdown and utilization rates of various equipment types from 2021 to 2023, incorporating factors such as lifting/traction or suction capacity and acquisition years to understand trends and identify potential causes behind the observed rates.

Breakdown Rates Analysis

The analysis reveals several key insights into equipment breakdown rates. Notably, the Grain Gantry (250T/H) consistently exhibits high breakdown rates, suggesting potential maintenance issues or the impact of a harsh operating environment. Similarly, the Front Mast Forklifts (09T) show high breakdown rates across the years, indicating possible overuse or aging equipment. On a positive note, the Mini Loader (04T) shows significant improvement, with breakdown rates dropping to 0.00% in 2023. This improvement might be attributed to better maintenance practices or the replacement of older equipment.

However, certain equipment types such as Reachstackers (42T to 45T) and Mobile Cranes (30T to 300T) display fluctuating breakdown rates, indicating inconsistent performance possibly due to varying usage intensity or maintenance schedules. Such fluctuations highlight the need for a more consistent and structured maintenance approach to mitigate the impact on operational efficiency.

Utilization Rates Analysis

Utilization rates provide insight into the operational demand and reliability of the equipment. The Straddle Carrier and RORO Tractor (50T/90T) exhibit high utilization rates, reflecting their critical roles in operations. However, a concerning trend is observed with the Grain Gantry (250T/H) and Straddle Carrier, which show a decline in utilization rates over the years. This

decline may be attributed to increasing breakdown rates or operational shifts, necessitating a review of their operational strategies and maintenance schedules.

In contrast, Reachstackers (42T to 45T) and Road Tractors (40T) maintain relatively stable utilization rates, suggesting steady demand and reliability. This stability indicates that these equipment types are well-managed and are essential for regular operations.

Correlation between Breakdown and Utilization Rates

A correlation analysis between breakdown and utilization rates reveals interesting patterns. High-utilization equipment, such as the Straddle Carrier, demonstrates that increased usage can lead to higher breakdown rates if not properly maintained. On the other hand, equipment like the Mini Loader (04T) and Grain Pump (120T/H) show that low utilization results in fewer breakdowns but may indicate underuse or redundancy, highlighting the need for balanced operational planning.

Impact of Acquisition Years

The acquisition years of the equipment significantly influence their performance metrics. Older equipment, acquired before 2010, like the Forklift Trucks (10T to 15T) and Mobile Cranes (30T to 300T), tend to exhibit higher breakdown rates, reflecting the wear and tear over the years. Conversely, newer equipment, acquired post-2010, such as the Grain Pump (120T/H) and Road Tractor (40T), show better performance, emphasizing the benefits of newer technologies and reduced operational fatigue.

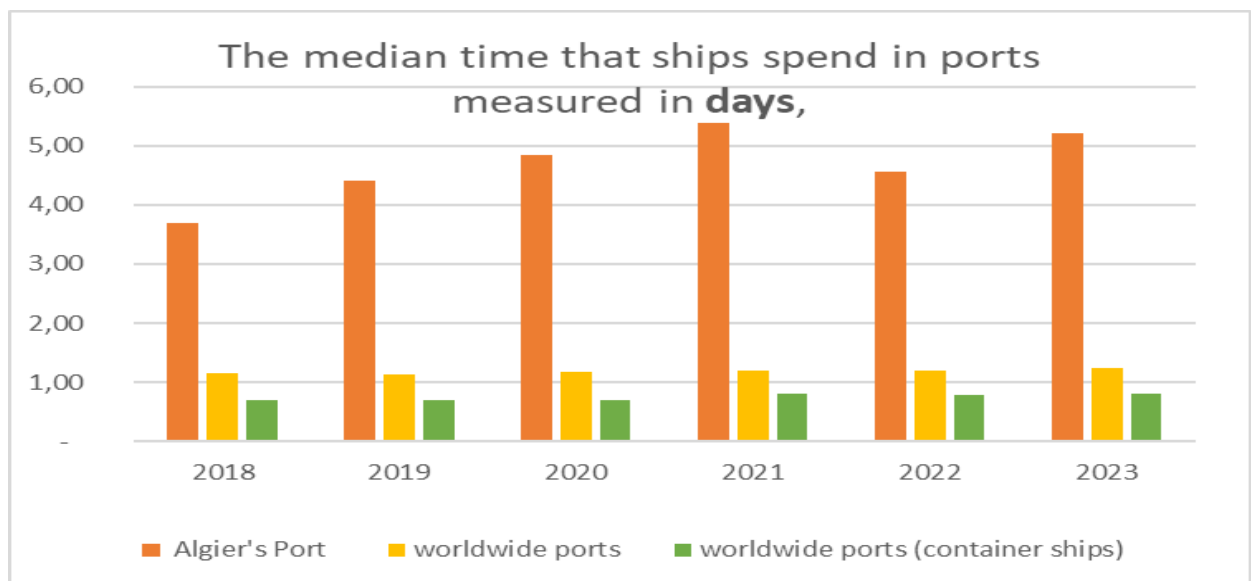
Conclusion

This analytical study underscores the importance of regular maintenance, timely upgrades, and balanced utilization in managing the breakdown and utilization rates of port equipment. By addressing these areas, operational efficiency can be significantly improved, reducing downtime and enhancing productivity.

- **Lack of autonomy:** As a public entity, all port revenue goes to the national treasury. This lack of independent funding makes it difficult for the port to invest in improvements or purchase new equipment. The lengthy approval process for any purchase further hinders progress.

- **Decentralization issue:** The central logistics directorate manages the machinery, while the container directorate manages the containers. This leads to suboptimal use of machinery, as the primary goal of the container directorate is to extract the containers without considering machinery consumption.
- **Poor workforce distribution:** Despite an overstaffing issue, most workers are in administration, while there is an insufficient number of technicians. This extends the time required for machinery repairs, as a good diagnosis is often needed to identify the problem, repair it, or buy the necessary parts and install them on the broken machinery.
- Extended stay of ships in Algiers ports compared to the global average, leading to quality degradation, increased post-harvest losses, and higher logistic costs, resulting in decreased competitiveness in international markets.

Figure 11: The median time that ships spend in ports.



Source: Research Department, Statista. (2021). Port turnaround times worldwide by ship type 2021. Retrieved June 18, 2024, 01:41 AM, from <https://www.statista.com/statistics/1367767/port-turnaround-times-global-ship-type/>

Comments:

The graphic shows the median time spent in ports over six years. For Algiers Port, there's a general upward trend in time spent, peaking in 2021, which could indicate increased congestion or handling times. The slight decrease in 2022 might reflect improvements or reduced traffic. Worldwide ports show a decrease from 2018 to 2019, followed by a steady increase, suggesting

a global trend towards longer port stays, possibly due to increased trade volumes or supply chain issues.

For container ships at worldwide ports, the increase is more gradual, which could reflect specific challenges in container shipping, such as capacity issues or longer turnaround times.

Comparing Algiers Port to worldwide ports, we see that Algiers Port has a higher median time spent, which has increased more significantly over the years. This could suggest that Algiers Port faces unique challenges or inefficiencies not reflected in the global average. While worldwide ports also show an increase, it's less pronounced than at Algiers Port, indicating that Algiers might be experiencing issues such as infrastructure limitations or operational delays more acutely. As previously mentioned, these trends are crucial for port authorities and shipping companies to consider when planning for infrastructure development, operational improvements, and logistics strategies to enhance port efficiency and reduce congestion.

3.3.2.3. Opportunities

- The port enjoys a monopoly on commercial activities, except for a concession. This could give them a strong position in negotiating fees and attracting business.
- The port handles a majority of container traffic for nearby businesses. This strong base could be leveraged to further develop container handling facilities and services.
- Government encouragement for exporting non-hydrocarbon products is leading to increased export traffic. This presents an opportunity for the port to expand its capacity and services for exports.
- The government's continued investment in infrastructure projects could benefit the port by improving access and efficiency.
- A new scanner for vehicles and containers is being acquired. This could improve customs clearance times and efficiency.
- Fresh agricultural products benefit from a green lane for customs, reducing inspection times, taxes, and prioritizing perishable goods.
- There's a growing demand for fresh produce in Europe and North Africa, creating an opportunity for Algerian exporters using the port.
- New markets for Algerian agricultural products are emerging, such as China and Russia.
- Fresh agricultural products benefit from not paying taxes; they are subject only to a levy

3.3.2.4. Threats

- Difficulties obtaining spare parts for equipment, especially due to lengthy procurement procedures, can lead to downtime and hinder port operations.
- Changes in regulations, container access hours, etc., could disrupt port operations and require adaptation.
- The outbreak of contagious diseases, as seen during the COVID-19 pandemic, can lead to port closures or restrictions, impacting operations.
- A lack of skilled personnel for equipment maintenance can lead to breakdowns and inefficiencies.
- The closure of dry ports has caused congestion at the docks, straining storage capacity and machinery.
- Algeria faces competition from regional countries like Morocco and Tunisia in exporting fresh produce.
- Price fluctuations for fresh produce can make it difficult for exporters to plan and budget.
- Strict phytosanitary regulations in importing countries can increase export costs and complexity.

The SWOT analysis culminates in a comprehensive understanding of the Port of Algiers' strategic position. It underscores the imperative to capitalize on inherent strengths and emergent opportunities while concurrently mitigating identifiable weaknesses and potential threats, thereby facilitating an augmented facilitation of fresh agricultural exports.

Conclusion of chapter 03:

This chapter has illuminated the critical function of port logistics within Algeria's agricultural export framework, with EPAL standing at the forefront of this operation. Our exploration revealed a rich historical tapestry that shapes EPAL's current practices and strategic orientation. The intricate procedures and systems in place for handling fresh produce exports, particularly dates, underscore the complexity and importance of efficient port logistics.

The SWOT analysis conducted has provided a clear-eyed view of EPAL's operational strengths and areas ripe for development. It highlights opportunities for growth and innovation that can propel Algeria to new heights in the competitive arena of agricultural exports.

Moving forward, it is imperative that EPAL continues to refine its strategies, leveraging its strengths and addressing its weaknesses to optimize the exportation process. By doing so, EPAL can significantly contribute to Algeria's economic vitality and sustain its position as a key player in the global market for fresh agricultural products.

**Chapter 04: actions to be undertaken to
optimize port logistics for exporting
fresh agricultural products and their
impact on it**

INTRODUCTION TO CHAPTRE 04:

we begin the final phase of our investigation into agricultural supply chain efficiency, we continue with the Algiers Harbor. Building on the insights learned in previous chapters, which study the path of fresh items from farm to recipient countries and the complexity of processing these Goods at the harbor, chapter 4 goes deeper into the Practical ideas for improvements. Specifically, we focus on container handling, an essential component of the supply chain that has a direct impact on the efficiency, dependability and competitiveness of Algerian exports.

This chapter presents a complete set of ideas to meet the Port's operational difficulties. Each solution includes a detailed action plan describing the steps needed for its implementation. By deliberately integrating these solutions we hope to reduce downtime, and overall optimize port operations.

4.1.Solutions for the terrain issue and the procedure issue:

The terrain of EPAL poses several challenges, including the deterioration of quay berths affecting operational capacity, and prolonged repair times. As for the procedure issue, the delayed documentation treatment and inspection, add to it the container storage constraints, would be quite the hurdle to surpass. For that we thought of the following solutions:

4.1.1. Prioritize repairs:

Ascertain which quays are crucial for commercial operations and repair them first to prevent any hindrances to operations.

4.1.2. Increased funding :

could be a critical solution to the port of Algiers issues. With adequate financial resources, the port can speed up maintenance work, engage in infrastructure enhancements, and improve operational efficiency. This introduction establishes the context for investigating how financing can benefit various aspects of port management and infrastructure development.

4.1.3. Pre-arrival documentation and inspection:

create a system in which documentation and inspection processes can begin before the ship arrives, allowing these duties to be done currently with unloading.

4.1.4. Flexible scheduling:

In order to cater for arrival and departure times of ships which differ, we are looking at possibilities that would make our loading activities schedules more flexible.

4.1.5. Action plans for the implementation of solutions:

Tableau 9: Action plans for the implementation of solutions (1)

Actions to be taken	Responsible direction	Allocated time	KPI	Target aimed at
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Prioritization of repair projects				
Assessment: Examine all quay berths and evaluate their status quo in regard to decay levels and likely negative consequences on business operations. Criteria development: Create criteria for selecting port facility repair works on the basis of the role they play in commercial activities, safety issues, and general economic benefits after their improvement. Partner engagement: Involve port authorities, shipping companies, and local businesses in order to get their views on the criteria for prioritizing various projects to justify this and analyze to ensure that their requirements and priorities are taken into account. Priority ranking: Use given factors when ranking wharf repairs in terms of importance thereby concentrating more on the ones that are most urgent or could lead to disruption in operations of the port. Resource allocation: Funds, manpower and other resources should be allocated to support repair projects ensuring they are enough to	-WDD	4m to 8m	-Quay berth utilization rate	90%
	-OMCD	3m to 6m	-Repair progress	10%
	CDOO		-Repair time	6m to 9m
			-Budget variance	+/-5%
	-CU	3m to 6m	-Operational downtime	5%
	CDOO			
	CDAO		-Safety incidents	00
	-CDOO	4w to 6w	-Environmental impact	
	WDD		-Return on investment (ROI)	3y to 5y
	-FAD	6m to 12m	-Compliance with timeline	

fix quay berths that are the most critical first.				
Project management: Oversee repair projects with proper project management practices such as scheduling, budgeting and monitoring how fast they go on for timely completion.	-WDD	3m to 6m		
Communication: Throughout the renovation, it is important to always keep in touch with those with interest in it, this is done on a regular basis by giving updates on status and progress of the project as well as mentioning any possible disturbances that may occur in the ports..	-CU	3m to 6m		
Continuous improvement: The process of ranking should be reassessed and improved based on experiences gained from other similar projects thereby making sure that future efforts become efficient through information from concerned parties.	-All depart	4m to 6m		
Increase funding				
Assessment of funding needs: Do a comprehensive study for the funding necessary for renewal and maintenance of quay berth	-FAD OMCD WDD CDOO	1m to 2m	-Funding acquisition rate	10%

infrastructure. The quantification needs to be based on repair extent, cost of materials and waged labor and subsequent up-keep charges. Budget planning: Draft a comprehensive financial plan that reserves ample funds so that it can be used for repairing purposes or other future upkeep actions. For efficiency purposes, this plan should only focus on crucial repairs and assign resources appropriately to respond effectively in short run. Financial analysis: The financial analysis should be conducted to find potential sources of funding such as government grants, loans, private investments or revenue from port operations. Conducting a detailed evaluation will help ascertain the viability and sustainability these sources of funds.. Advocacy and lobbying: Be an advocate for more funds for repairing and maintaining dock infrastructure at the governmental side. Public-private partnerships : Look into how government can partner with private sector corporations in order to finance restructuring initiatives. Also establish collaborations with	-FAD WDD CDOO	2m to 3m	-Budget utilization	90%
			-Grant success rate	30%
			-Public-private partnership (PPP) implementation rate	1
			-Advocacy impact	15%
	-FAD	1m to 2m	-Financial sustainability	
			-Project completion rate	90%
	-CEO		-Continual funding efforts	
	-LALD FAD	3m to 6m	-Impact on port efficiency	10%

corporate entities which may be interested in contributing towards lessening their spending on reparation costs over a long period of time. Grant applications: Apply for government grants or funding programs specifically designed for port infrastructure repair and maintenance. Prepare comprehensive grant proposals outlining the scope of repair projects, expected outcomes, and budget requirements. Budget allocation: Once money from these sources has been secured then follow carefully through the allocated budget considering that the already-built plan contains how cash will be spent. The monitoring of how money is spent directly related with the efficiency in terms of both time and resources while executing repairs on port properties therefore it needs to be done keenly Project oversight: Establish oversight mechanisms to monitor the progress of repair projects and ensure that funds are being used appropriately. Implement regular reporting and accountability measures to track budget expenditures and project milestones.	-OMCD FAD LALD Ministry -AD	6m to 12m 3m to 6m		
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Continual funding efforts: Go on working to secure supplementary funds for future repairs and maintenance requirements. When necessary, appraise and change finance tactics to suit the altering situations and emerging concerns..	-FAD			
Use pre-docking documentation				
Assessment and planning: Assess the existing procedures and ascertain possible points of documentation and inspection initiation even before the vessel docks. Keep in mind legal requirements, safety regulations and logistical constraints among other things. Partner engagement: Have meetings with shareholders such as cargo handlers, ship lines, port officials, as well as any concerned government representatives to talk over these alterations that have been suggested. Collect opinions and handle any issues that arise in order to get approval and work together. Process redesign: Redesign the documentation and inspection processes to allow for pre-docking activities. This may involve revising	-OMCD	1m to 3m	-Turnaround time	80%
			-Container loading time	70%
			-Error rate	10%
	-CU	1m to 2m	-Utilization rate	70%
			-Customer satisfaction	80%
			-Compliance rate	95%
	-OMCD	2m to 4m	-Cost reduction	-5%

standard operating procedures, updating forms and paperwork, and implementing new protocols for early submission and review. Technology integration: Invest in technology solutions to support pre-docking activities. This could include implementing digital platforms for submitting documentation, developing automated inspection systems, and integrating data sharing mechanisms between partners. Training and education: Provide training and education to partners involved in the revised processes. Ensure that personnel understand their roles and responsibilities, are proficient in using new technology tools, and adhere to updated procedures for pre-docking documentation and inspection. Pilot testing: Collect comments from the participants and make changes as needed before full implementation. Monitoring and evaluation: Track the implementation of pre-docking documentation and inspection processes regularly. This could be done by monitoring key performance indicators like turnaround time, efficiency gains	-ISD -HRD -All depart -All depart	3m to 6m 1m to 2m 1m to 2m 3m to 6m	-Container dwell time	70%
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and customer satisfaction. Periodically evaluate how these modifications have affected the change and make more where necessary in order to continue improving.				
Implement flexible departure schedules				
Assessment and planning: Check the present departure timetables suitability and also their ability to allow adjustments. Where there are shortfalls, we look at the type of flexibility needed for loading time fluctuations. Partner engagement: Discuss and create a platform for exchange of the amendments to the shipping programs with shipping organizations, freight forwarders among other parties. This is through gathering some inputs, responding to the worries that exist in addition to working together on forms of scheduling flexibilities. Regulatory compliance: Ensure that the changing of times for leaving adheres to all regulatory and contract needs. Ensure smooth communication with appropriate	-OMCD	1m to 3m	-Vessel utilization rate	5%
			-Waiting time reduction	-10%
	-CU	1m to 2m	-Schedule adherence	90%
			-Customer satisfaction	80%
			-Cost savings	-5%
	-ORAD	1m to 2m	-Turnaround time	-10%
			-Port efficiency	5%

departments, organizations, and acquire the necessary grants. Scheduling tools and software: Think about tools used in planning programs so that EPAL can find them helpful when dealing with take-off times that vary a lot. They help to use ships more effectively, decrease delays, and make work generally more efficient. Communication and coordination: Make sure to establish clear communication channels and coordination mechanisms between EPAL, shipping companies and other partners . For smooth operation, make sure that there are timely updates on schedule changes, loading progress and any other relevant information. Training and education: The staff who are carrying out this flexible departure schedule must get training on how they should manage it. Ensure that personnel master their roles and responsibilities and be able to use scheduling tools as well as software's proficiently. Pilot testing: Try out the new flexible departures in order to identify issues, refine the methods used and come up with a better plan.	-ISD	2m to 4m	-Environmental impact	5%
	-CLD	1m to 2m		
	-HRD	1m to 2m		
	-All depart	1m to 2m		

Furthermore, get opinions from all those involved in this project before finally implementing it. Monitoring and evaluation: After that, keep tabs on how these new flexible leave times are working out for everyone involved in the project area especially when it comes to key performance indicators (KPI).	-All depart	3m to 6m		
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The application of either of these solutions will help smooth the operations in the port while minimizing any disruptions, add to it the increased efficiency and the turnaround speed and a shorter downtime.

4.2.Solutions for the stocking issue:

Addressing the stocking issue; which could be surmised in 2 problems: inefficient staking methods and the wasted time for customs clearance; would require the implementation of optimization related solutions.

4.2.1. Stocking method optimization:

Redesigning the method of stocking in parks to reduce wasted space while increasing the storage capacity.

4.2.2. Customs clearance and documents streamlining:

collaborating with Customs officials to establish streamlined clearance procedures, which may include pre-clearing options for specific categories of cargo, implementing digital documentation solutions, prioritize Customs clearance for critical commodities, ensuring that they are processed and transferred through the port as fast as possible.

4.2.3. Infrastructure Investments:

Determine the viability of investing in new infrastructure such as automated second cranes as well as technology in order to lessen dependence on manual labor.

4.2.4. Action plans for applying the solutions:

Tableau 10: Action plans for the implementation of solutions (2)

Actions to be taken	Responsible direction	Allocated time	KPI	Target aimed at
Reconfiguring the stocking process				
Assessment of current process: Critique the current stocking system in order to locate its inefficiencies and room for improvement. Space allocation, safety measures and equipment capacity are some of the factors to take into account while doing this analysis. Consultation with partners : The step involves consulting the relevant parties; consult partners such as port operators, security teams among others involved in stock taking for reconfiguration insights into challenges faced as well as possible recommendations. Redesign stocking layout: Create a new arrangement for storage that is designed to fill up space using safety and accessibility as major concerns. Think about having	-ORAD	1m to 2m	-Space utilization rate	20%
			-Safety incidents	-15%
			-Efficiency gains	10%
	-CU ORAD	1m to 2m	-Equipment utilization	15%
			-Training effectiveness	80%
	-OMCD	2m to 3m	-Pilot test results	90%

other methods like double stacking or rack systems that will increase Storage Capacity Vertically. Equipment evaluation: Review the existing equipment with the intention of determining its appropriateness to the new arrangement for stocking. Check to find out if some changes or improvements have to be done in order to make them suitable for various forms of stacking. Training and education: Offer training and education to personnel in the ports and operators of machinery about new stocking layout and guidelines. Make sure that they understand how to work with machines using new stocking layout which is safe for them as this will help improve safety measures. Pilot testing: Change the configuration of the stockpiling system within a trial version to test it and receive feedback about possible problems from all partners involved. After this any modifications that need to be made before it takes place are done in good time based on the necessary observations.	-CLD	1m to 2m	-Implementation timeline adherence	90%
	-HRD	1m to 2m	-Process improvement metrics	10%
	-OD	1m to 2m		

Implementation plan: Create a detailed implementation plan that contains a clear timeline, roles, responsibilities, as well as requirements for the reconfiguration. coordinate with the concerned departments to guarantee that changing over to the new stocking method runs smoothly. Monitoring and evaluation: Keep tabs on how the reconfigured stocking operates by looking at factors like space utilization efficiency gains and safety enhancements and monitor key indicators throughout this phase. Additionally, changes should be evaluated regularly while amendments could be suggested as need be.	-OMCD	1m to 2m		
	-OD	3m to 6m		
Investing in better equipments				
Needs assessment: Perform a full assessment in order to pinpoints exact areas, where investing would solve the inefficiency of stocking method as well as equipment limitations. This might involve reviewing the existing stacking	-ORAD	1m to 2m	-Space utilization rate	20%
			-Safety incidents	-15%
				5%

methods, equipment capacities and usage of storage space. Equipment upgrade or replacement: Find out whether current equipment like Reach Stackers requires an upgrade or replacement for better performance in terms of storage space use. It is wise to go for current stackers which permit stacking methods which are cheaper in terms of time and money. Technology integration: Explore technology solutions that can enhance stocking processes and improve space utilization. This could involve implementing warehouse management systems, RFID tracking systems, or other digital tools to optimize inventory management and space allocation. Cost-benefit analysis: Evaluate potential returns on investments by performing a cost-benefit analysis of each investment opportunity. As the following are taken into account when making this evaluation: labor savings; improvement in productivity; gains from the best allocation of space usage among other things..	-CLD	3m to 6m	-Efficiency gains	10%
			-Equipment utilization	80%
			-Training effectiveness	90%
	-ISD	3m to 6m	-Pilot test results	
			-Implementation timeline adherence	90%
	-FAD	1m to 2m	-Process improvement metrics	+5%
	-FAD	1m		

Budget allocation: Assign funds from EPAL's budget towards new expenses on infrastructure upgrade trials including purchasing new machinery, exploiting technological advances among others. Choose the most important projects depending on their possible effects concerning the efficiency of stocking strategies as well as utilization of area.	-FAD OD	6m to 12m		
Procurement and implementation: Get the right tools, materials, and equipment that have been identified through the process of needs assessment. Ensure that there are no hitches during the exercise of making the investments by working closely with the suppliers, contractors and all those who might be involved in the process.	-HRD	1m to 3m		
Training and education: Train the workers about how to use the new equipment. Consequently, the workforce needs not only to acquire these items but also know how best they should be used with regard to the updated rules meant for increased gains from those particular investments.	-All depart	3m to 6m		
Monitoring and evaluation: Supervise investments				

performance, and follow up on key performance indicators concerning stocking effectiveness, space occupancy and operation generally. Periodically evaluate the outcome of investments, and adjust to maximize results when necessary.				
Streamlining customs procedures				
Process mapping: Begin by mapping out the current customs clearance and documentation processes to identify bottlenecks, redundant steps, and areas for improvement. Engage with relevant partners , including customs authorities, freight forwarders, and documentation teams, to ensure a comprehensive understanding of the existing processes. Based on the process mapping exercise, identify specific opportunities to streamline customs clearance and documentation processes.	-OMCD	1m to 2m	-Customs clearance time	-15%
			-Documentation processing time	-15%
			-Container dwell time	-10%
			-Stocking space utilization	80%
Collaboration with customs authorities: Engage in discussions with customs authorities to explore options for streamlining clearance procedures. Advocate for the	-ORAD	1m to 3m	-Container handling efficiency	+10%

adoption of electronic documentation systems, pre-clearance initiatives, and other measures to expedite the customs clearance process for EPAL's containers. Technology integration: Invest in technology solutions to support streamlining efforts, such as electronic documentation platforms, customs clearance software, and tracking systems for monitoring container status. Collaborate with ISD department and external vendors to implement and integrate these technologies effectively. Training and capacity building: Provide training and capacity building initiatives for EPAL staff involved in customs clearance and documentation processes. Ensure that personnel are equipped with the necessary skills and knowledge to navigate streamlined procedures effectively and comply with regulatory requirements. Pilot testing: Conduct pilot tests of the streamlined customs clearance and documentation processes to assess their effectiveness in real-world scenarios. Gather feedback from	-ISD -HRD -All depart	3m to 6m 1m to 3m 1m to 2m	-Error rate in documentation -Customer satisfaction -Cost reduction	5% 80% -10%
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partners and identify any challenges or areas for improvement before full-scale implementation.				
Continuous monitoring and optimization: Continuously monitor the performance of the streamlined processes and collect data on key performance indicators such as clearance times, documentation errors, and customer satisfaction. Use this data to identify opportunities for further optimization and refinement of the processes.	-All depart	3m to 6m		
Regulatory compliance: Ensure that all streamlining measures comply with relevant regulatory requirements and international standards. Stay updated on changes to customs regulations and adapt streamlining efforts accordingly to maintain compliance.	-LALD	1m to 2m		

Implementing these solutions would address the crux of the problem and solve it, it would reduce wasted storage and that by consequence would increase storage capacity, increase efficiency and reduces turnaround time.

4.3.Solutions regarding the equipment issue and the autonomy issue:

In order to deal with these issues, whether it be the high breakdown rate, the lack of autonomy, the unnecessary handling costs or the maintenance process delay. It would require comprehensive solutions.

4.3.1. Driving training program:

creating and implementing a thorough training program for equipment operators will ensure their understanding of correct operation and maintenance procedures. Provide an ongoing or pressure training will reinforce the best practices and upgrade their skills as necessary.

4.3.2. Equipment utilization tracking:

using equipment utilization tracking systems will help in monitoring consumption Trends and discovering opportunities for resource optimization. As well as analyzing data to identify the most efficient distribution of equipment depending on demand changes and operating needs.

4.3.3. Streamlined maintenance processes:

increasing diagnostic skills by employing qualified field Engineers or offering further training to current employees. Also implementing streamlined procurement methods for equipment parts such as: pre-approved suppliers and expatiated purchasing procedures to reduce downtime.

4.3.4. Delegation of authority:

Empower department heads to make choices within their area of expertise to a certain economic threshold. This may decrease the need for many layers of authorization station for routine transaction or selections.

4.3.5. Budget allocation:

set aside the portion of the port sales to cover its operational expenses this allows the poor crater flexibility in funding crucial gadgets and infrastructure improvements without Reliant solely on external approvals.

4.3.6. Decision making training:

educate staff on decision-making and encourage a culture of autonomy and accountability inside the firm.

4.3.7. Action plans for implementing the solutions:

Tableau 11: : Action plans for the implementation of solutions (3)

Actions to be taken	Responsible direction	Allocated time	KPI	Target aimed at
Driving training program				
Assessment of training needs: Assess the current skills and information gaps of the drivers. Find areas which require training most like operation of machines, safety rules, basic maintenance works..	-HRD ORAD CLD	2w to 4w	-Training completion rate	90%
Develop training materials: Formulate all-embracing training materials such as manuals, videos or slides that are within the series of topics. All the drivers should be able to understand their work. Ensure the accessibility and clarity of the materials.	-HRD -ORAD -OMCD	1m to 3m	-Safety incidents -Equipment downtime	-20% -20%
Training delivery: Schedule training sessions for drivers, either in-person or through online platforms. Consider incorporating hands-on practical training sessions to reinforce theoretical knowledge.	-HRD CLD	1m to 3m	-Operational efficiency -Cost savings	15% -10%
Certification and evaluation: Execute a certification process aimed	-HRD ORAD	1m to 2m	-Driver feedback -Compliance	80% 100%

at determining whether drivers have the required skills after going through the training program. This may include examinations in writing, physical observation tests or even evaluations while working on duties. Ongoing support and refresher training: Ensure drivers always have the necessary support and that there are refresher trainings when they need them in order to help them develop and keep using the right skills in this field.. Feedback mechanism: Create a feedback platform through which drivers can provide their comments on how effective the training course has been, as well as give ideas that could make it better.. Management oversight: Hold up management backing for driving forces so as to allow them take part in it as well as overseeing the training program.	-HRD -CLD -OMCD	1m to 2m	-Training effectiveness	80%
Equipment utilization tracking				
Streamlined maintenance processes				

Assessment and analysis: Conduct a thorough assessment of current maintenance processes, including procedures, workflows, and resource allocation. Analyze historical maintenance data to identify common breakdowns, recurring issues, and areas for improvement. Identify improvement opportunities: Identify specific areas within the maintenance process that can be optimized, such as reducing downtime, improving spare parts management, enhancing technician training, or implementing preventive maintenance strategies. Develop an implementation plan: Create a detailed implementation plan outlining specific initiatives, timelines, responsibilities, and resource requirements. Prioritize improvement opportunities based on their potential impact on equipment reliability, operational efficiency, and cost savings. Implementation of initiatives: Implement targeted initiatives to improve maintenance processes, such as: Streamlining maintenance workflows to reduce downtime and increase efficiency. Implementing preventive maintenance schedules to proactively address potential issues	-CLD OMCD	2w to 4w	-Mean time Between failures	High
			-Mean time to repair	Low
	-CLD	1w to 2w	-Overall equipment effectiveness	85%
			-Planned maintenance percentage	90%
	-CLD OMCD	2w to 4w	-Maintenance cost as a percentage of revenue	5%
			-Inventory turnover ratio for spare parts	High
	-CLD HRD	3m to 6m	-Technician utilization rate	80%
			-Compliance with preventive	100%

and minimize unexpected breakdowns. Enhancing spare parts management to ensure timely availability of critical components and reduce equipment downtime. Investing in training programs for maintenance staff to enhance their skills and knowledge in equipment maintenance and troubleshooting. Monitoring and evaluation: Establish metrics and Key Performance Indicators to track the effectiveness of implemented initiatives. Monitor maintenance performance regularly to assess progress, identify areas for further improvement, and ensure that objectives are being met. Continuous improvement: Foster a culture of continuous improvement within the maintenance team, encouraging feedback, innovation, and collaboration. Regularly review maintenance processes, gather feedback from maintenance staff, and incorporate lessons learned into future improvement efforts. Training and development: Provide ongoing training and development opportunities for maintenance staff to enhance their skills, keep them updated on the latest technologies and	-CLD ORAD -OMCD CLD -HRD	1m to 2m 1m to 3m	maintenance schedule	
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best practices, and empower them to perform their roles effectively. Communication and partners engagement: Communicate the goals, objectives, and progress of the maintenance process improvement initiative to all relevant partners, including management, maintenance staff, and other departments. Solicit feedback and input from partners to ensure alignment with organizational goals and address any concerns or challenges that may arise during implementation.	-CU			
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Actions to be taken	Responsible direction	Allocated time	KPI	Target aimed at
Delegation of authority				
Identify decision-making levels: The complexity, impact of decisions and financial implications determine the decision-level of an organization..	-CEO	1m to 6m	-Decision-making speed	-30%
Define financial thresholds: Financial thresholds are clear and well known to the management. One example is that department heads can approve routine purchases that are	-FAD	1m to 4m	-Cost savings	10%
			-Employee satisfaction	80%

below a certain amount of money while larger expenditure needs authorization from top-level managers. Training and communication: New decision-making authority guidelines for when to seek approval from higher levels should be shared with department heads and managers. All employees should be informed on these changes to make sure they comprehend the process. Monitoring and accountability: Measures should be instituted so that decisions can be scrutinized and those behind them made responsible; this might involve regular reviews of made decisions, monitoring spends as well as performance appraisals that measure how effective a decision was made. Feedback and adaptation: The new decision-making process should be assessed by employees for its effectiveness. Organizations will need to adjust and refine the process if necessary in light of internal factors (such as feedback from employees) and external outcomes..	-HRD -FAD -HRD	4w to 6w	-Compliance rate -Feedback incorporation -Operational efficiency -Training effectiveness	90% 70% +15% 80%
Increase budget allocation				

Financial analysis: Conduct a thorough financial analysis to determine the port's revenue streams, expenses, and funding requirements for operational needs, including equipment purchases and infrastructure upgrades. Budget planning: Develop a budget plan where some part of the harbor's earnings goes directly as income meant for its running or that help in its operations. It could also mean putting aside some money each month so that you can buy certain things after some time. Approval process: Develop a budget approval process that includes senior management, finance department, and other relevant department heads. Make sure that decision-makers are involved in order to receive support for operational money distribution. Implementation: After approval has been given, ensure that funds are allocated within given operational categories, which means updating financial systems; creating budget accounts; and forwarding this information. Monitoring and review: Assure that funds are used effectively and as planned as spelled out by their respective budgets. Take time to	-FAD	4w to 6w	-Accuracy of financial data analysis	95%
	-FAD	6w to 8w	-Timeliness of financial analysis	100%
			-Budget alignment with strategic goals	90%
			-Budget variance analysis	5%
	-CEO and above	4w to 6w	-Budget execution rate	90%
			-Adherence to budget guidelines	95%
	-All depart		-Budget compliance rate	90%
	-All depart			

review financial reports and performance metrics regularly so as to monitor how fund allocation affects operation efficiency.. Adjustment and adaptation: Modify financial resources distribution as may be necessary when unforeseeable circumstances, emerging priorities, or new challenges arise.	-FAD		-Performance metrics achievement -Flexibility of budget allocation -Effectiveness of adjustments	80% 90%
Decision-making Training				
Training needs assessment: Find out where employees need to improve their decision-making skills in order to thoroughly assess your organization's training needs as it relates to autonomy & accountability. Furthermore, this should include understanding of autonomy & accountability. Curriculum development: Design and construct an elaborate training program that can be used for teaching decision-making frameworks, problem-solving methods, autonomy principles and accountability ideas too.	-HRD -HRD -HRD	4w to 6w 6w to 8w 2w to 4w	-Training effectiveness -Employee engagement -Decision-making confidence -Leadership support	80% 75% 70% 80%

Delivery of training: Deliver training sessions through a variety of methods, including workshops, seminars, online courses, and on-the-job training. Incorporate interactive exercises, case studies, and role-playing scenarios to engage participants and reinforce learning. Leadership support: Gain support from organizational leaders and managers to champion the importance of autonomy and accountability and actively participate in training initiatives. Leaders should model the desired behaviors and provide ongoing guidance and support to employees. Feedback mechanisms: Set up systems to receive opinions from the learners of the training program in order to measure how effective it has been. And to suggest possible improvements too. Also help learners communicate openly and discuss the problems they have encountered. Integration into organizational culture: ensure that the organization's culture and values include communication, recognition programs, and performance evaluations as per autonomy and accountability guidelines. Ensure that employees comprehend the	-All depart	4w to 6w	-Culture of learning	80%
			-Performance improvement	70%
			-Retention rate	85%
			-Turnover rates	10%
	-HRD		-Feedback incorporation	75%
			-Adaptability and innovation	70%
	-All depart		- Accountability measure	75%

anticipations as well as duties linked with autonomy and accountability. Continuous learning and development: Foster continuous learning environment and make further chances available to employees to enhance their decision-making capabilities and reinforce their grasp on autonomy as well as accountability.	-HRD			
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These solutions will improve equipment management, reduce downtime, enhance operational efficiency, and ultimately improve EPAL's competitiveness in the maritime industry.

4.4.Solutions for the paperwork issue:

there is room for improvement in streamlining the processes for paperwork. We have considered different solutions that would save time, money, and improve overall efficiency. As well as allowing for easier tracking and management of the various documents involved in the logistics process.

4.4.1. Digital document management system:

Implementing a digital system for managing and storing papers electronically, that can contain electronic signatures, do comments routing, version control and search capabilities to help with documents handling and retrieval.

4.4.2. Centralized documents:

it provides a more efficient approach to organize in various papers inside an organization. Centralized documents enables simple access to critical information while promoting collaboration and documents integrity my integrating all consonants into a single repository and including features such as: Version control, access controls and extensive search abilities.

4.4.3. Electronic signatures:

include electronic signature features in the port digital document management system to make it easier to sign documents electronically this eliminates the need to print, sign and scan actual papers. Saving time and decreasing paper consumption.

4.4.4. Action plans for the appliance of the solutions:

Tableau 12: Action plans for the implementation of solutions (4)

Actions to be taken	Responsible direction	Allocated time	KPI	Target aimed at
Implementing a digital document management system				
Assessment and planning: Assess the current document management systems to locate the weak points and highlight the need for the new system. Define the project scope including digitizing and arranging documents.	-ISD CDOO CDAO	1m to 3 m	-Document processing time	-20%
Research and selection: Investigate various document management systems that are available and select the most appropriate with regard to functionality and cost. Such factors as scalability user-friendliness security features as well as integration capabilities should be put into consideration when deciding on which one to choose.	-ISD FAD CDOO	2m to 4m	-Workflow efficiency	25%
			-Search and retrieval time	-40%
			-Compliance and security	95%
Customization and configuration: Adjust chosen	-ISD	3m to 6m		

system to align with specific workflows and requirements. One may have to configure document categories, metadata fields, access permissions, and workflow automation rules. Data migration: Move the present record documents that are made of papers and digital files into the new system which may entail making scan of papers, converting of files' formats and carrying out organization of contents based on the new structure. Training: Teach the new document management system rightly to the employees. This can involve training sessions, user manuals, video tutorials, and continued support. Testing and feedback: Test the system thoroughly to make sure that it functions as planned and attend to any arising issues or bugs. Therefore, collect feedback from users for further improvements and necessary corrections. Rollout and adoption: Implement widely the new document management system in all relevant departments	-ORAD ISD -ISD HRD -All depart -All depart	2m to 6m 1m to 2m 1m to 3m 1m to 3m	-User adoption and satisfaction -Cost savings -System uptime and reliability -Integration and interoperability - Environmental impact	8/10 99%
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aimed at encouraging massive take up. Monitor and get feedback on usage in order to make sure that the change is smooth and handle any issues or resistance.				
Implementing the centralized Documentation				
Assessment: Thoroughly assess the current documentation process. Determine the types of documents being used and how they are related to each other.	-ORAD	4w to 8w	-Document processing time	-20%
Consolidation: Find out which files can be integrated or dropped. Make a unified model or mechanism including all the information needed for freight forwarding processes.	-ORAD	2m to 6m	-Paper usage reduction	-50%
Digitalization: Switchover from paper-based forms to digital records. Selection of an appropriate document management system or software that enables easy creation, storage, access management and exchange files.	-ISD	2m to 6m	-Document accuracy rate	95%
Training: Training employees on how to use the new digital documentation system effectively and making sure they	-HRD	1w to 4w	-Employee satisfaction score	80%
			-Cost savings percentage	-20%
				90%

appreciate the benefits of this change for their workflow. Implementation: Gradually phasing out the old paper-based system and fully integrating the new digital system into daily operations while closely monitoring the transition process to attend to any emerging issues during this period. Feedback and improvement: Collect feedback from staff regarding the new system and making the necessary adjustments, while also the search for all possibilities to enhance its user-friendliness and operational efficiency.	-ISD	2m to 6m	-Compliance rate	99%
			-System uptime percentage	90%
	-All depart	6m to 12m	-Training completion rate	
Implementing electronic signatures				
Research and choose software: Search for the various e-signature programs in the market. Think about issues like functions, compatibility with current systems, safety tools, and cost implications. Get the software that complements the port's requirements and financial plan.	-ISD FAD	4w to 8w	-Adoption rate	80%
			-Processing time	-20%
				-20%

Train employees: Train the employees on how to use electronically signed software accurately so that they can sign documents easily whereas also making it understood how they can create these papers securely. Besides, ensure that there are some security protocols which need to be taken into account during that time. Integration: Integrate the electronic signature system into documents administering ones that are already operational or workflow ones ensuring that it is correctly merged to prevent interruptions with ongoing processes. Pilot test: Start an initial test on the online signature auto-signing software with a few users to ascertain potential issues and difficulties. Request for opinions from users before launching the software in the entire company. Rollout: Extend the use of electronic signature software to the rest of the staff and other department workers. Provide continuous backing and guidance during user's	-HRD ISD	2w to 4w	-Document turnaround time	-15%
			-Error rate	-20%
			-Cost savings	90%
	-ISD	2m to 6m	-Compliance rate	100%
			-Security measures effectiveness	80%
	-ISD ORAD	4w to 8w	-User satisfaction	-50%
			- Environmental impact	
	-ISD	2m to 6m		100%

movement towards adoption of the new system. Security measures: Apply security measures to ensure that important electronic records remain safe and protect e-signatures from corruption as well are essential. This can involve use of cryptographic algorithms, two factor authentication etc. Legal compliance: Ensure that Algeria's legal requirements and regulations are adhered to when using electronic signature software. This may entail consulting legal experts on issues related to compliance with laws. Monitor and evaluate: Assure that Electronic Signature Use is Traced and reviews conducted periodically for its self-assessment within submitting means for quick approval processes leading to decreased paper use along with more feedback on e-signature software being gathered by both clients & outside partners as means of identifying where these solutions could become better suited.	-ISD -LALD -All depart	1m to 3m 1m to 3m 1m To 3m	-Integration success	
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Overall, these suggested solutions will, in the long run, reduce both the documents handling time and the retrieval time by 50% and 30% respectively. As well as reducing the costs for paper usage and also eliminating its storage space.

CONCLUSION OF CHAPTER 4:

This chapter provides a comprehensive approach to address the operational difficulties at EPAL, by implementing these ideas and excusing the thorough action plans, we hope to dramatically improve the port's efficiency when it comes to cost, time and quality, and reliability. We want to increase equipment reliability, optimize resources allocation and reduce downtime through focus training programs, strategic technology Investments and streamlined operation processes. The successful deployments of these Solutions will assist not only Force operations but also the overall goals of improving customer satisfaction, strengthening competitiveness and driving long-term growth.

General conclusion

In this memoir, we look at the intricate dynamics of the Agricultural supply chain, with a special emphasis on how it affects the handling of fresh products at the EPAL Harbor. The exploration divides into four chapters, each of which delves into critical aspects of a supply chain, its optimization and Lincoln School since it would have on the Harbor's activities. The first chapter of the study follows the best of agricultural Fresh Products from Farm to recipient countries, noting the intricacies and obstacles inherently existing in this process. Chapter two delves into the optimal handling of fresh products at the harbor, showing strategies to enhance efficiency and quality amidst logistical intricacies. Building upon this foundation, chapter three zooms in on fresh product handling specifically within Algiers Harbor, offering insights into current practices and areas that need improvements. Finally, chapter four combines and builds upon the findings in the third chapter by proposing action plans to implement the corrective solutions in order to enhance the agricultural supply chain's impact on container handling in Algiers Harbor.

Upon rigorous observation and analysis, as well as interviews with key managing figures and clients, key insights have emerged in regard to the current state of fresh product handling in Algiers Harbor. Starting with the evident fact that existing processes suffer from inefficiencies stemming from a somewhat disjointed transportation, storage, and logistical procedures. These inefficiencies compromise product quality, impede timely delivery to reception countries, and increase operations costs, affecting overall market competitiveness. Additionally, logistical bottlenecks and infrastructural limitations further exacerbate challenges, necessitating a much-needed approach to optimization. However, amidst these challenges lie opportunities for improvement, particularly through the adoption of innovative technologies and streamlined processes. By leveraging data-driven insights and fostering collaboration among stakeholders, Algiers Harbor can position itself as a pivotal hub for efficiently handling fresh agricultural products, thereby driving economic growth and sustainability in the region.

By analyzing the results obtained from our observation and the interviews, we were able to reach the following conclusions:

- **H1:** The principle logistic defects met during the exploitation of fresh food products from Algeria to International markets include mismanagement of the temperature conditions, international adhering to the International sanitary norms and deadlines.

We confirm this hypothesis: One of the principal logistic challenges encountered during the export of fresh food products from Algeria to international markets include mismanagement

of temperature conditions, non-compliance with international sanitary norms, and meeting strict deadlines. Addressing these issues requires efficient temperature control, adherence to hygiene standards, and timely transportation.

H2: The logistic cause impact directly the competitiveness of Algerian products in the international market and reducing these costs would make the products more attractive compared to the competitors.

We confirm this hypothesis: Through our experiences in the internships, we came to understand firsthand the pivotal role that logistics play in shaping the competitiveness of Algerian products in the international market. By addressing the logistical challenges that EPAL has head-on and continuously striving for improvement, we can elevate the reputation and desirability of Algerian goods on a global scale.

➤ **H3:** Shipment by sea provide the most cost-effective method for exporting products however the process is quite slow while an alternative is air transport which is way faster but more costly.

We confirm this hypothesis: Throughout our observations as interns, we consistently found that sea freight was the preferred choice for transporting bulk goods due to its lower transportation costs per unit. However, this cost-effectiveness often came at the expense of longer transit times, leading to delays in delivering products to international markets.

In conclusion this study could be considered a step in the right direction for the port in order to mitigate the current obstacles, and looking ahead, future studies could build upon the foundation laid in this memoire to further enrich our understanding of the agricultural supply chain and its interface with Algiers Harbor. One potential area of exploration could delve deeper into the "integration of digital solutions", such as blockchain and IoT technologies, to enhance traceability and transparency throughout the supply chain. Additionally, research could investigate the "socio-economic impacts of supply chain optimization", including its effects on local farmers' livelihoods and market access. Furthermore, there is scope to explore "the environmental sustainability aspects of fresh product handling", examining strategies to minimize carbon footprint and reduce food waste. By synthesizing findings from diverse studies, we can develop robust strategies to address the multifaceted challenges and opportunities inherent in this complex ecosystem.

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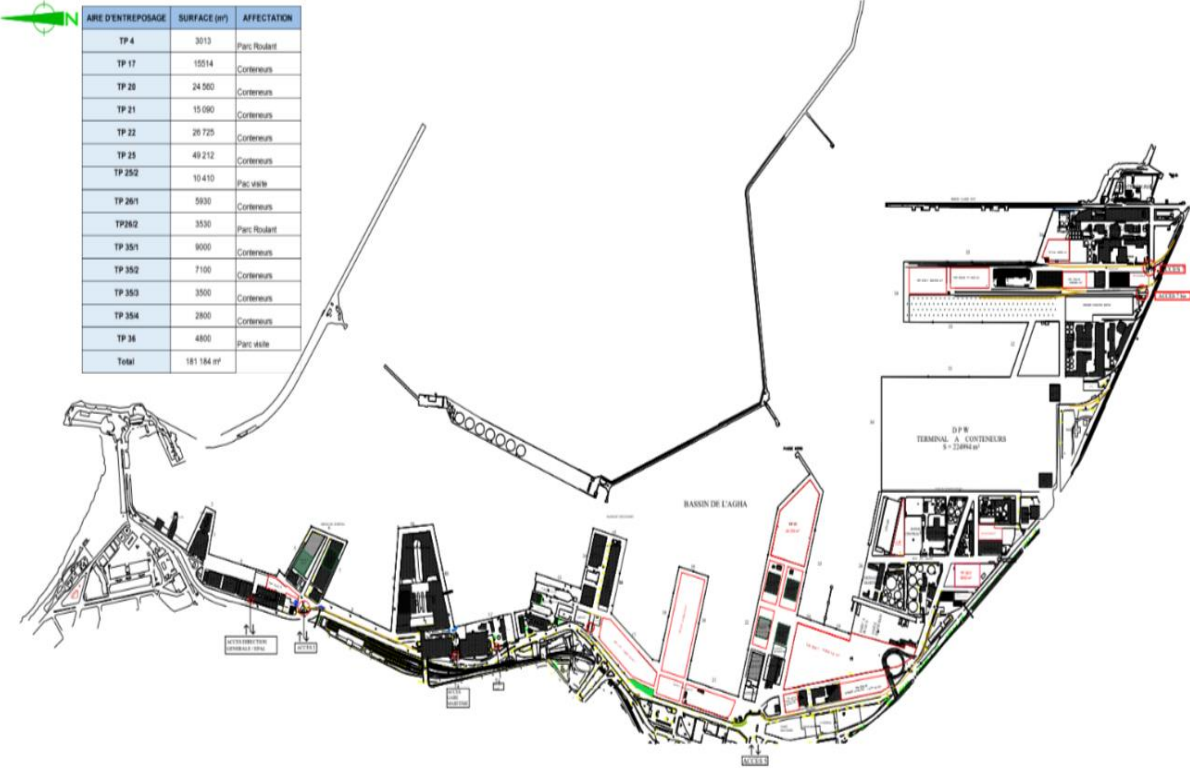
Appendixes

Appendixes 01: Interview guide

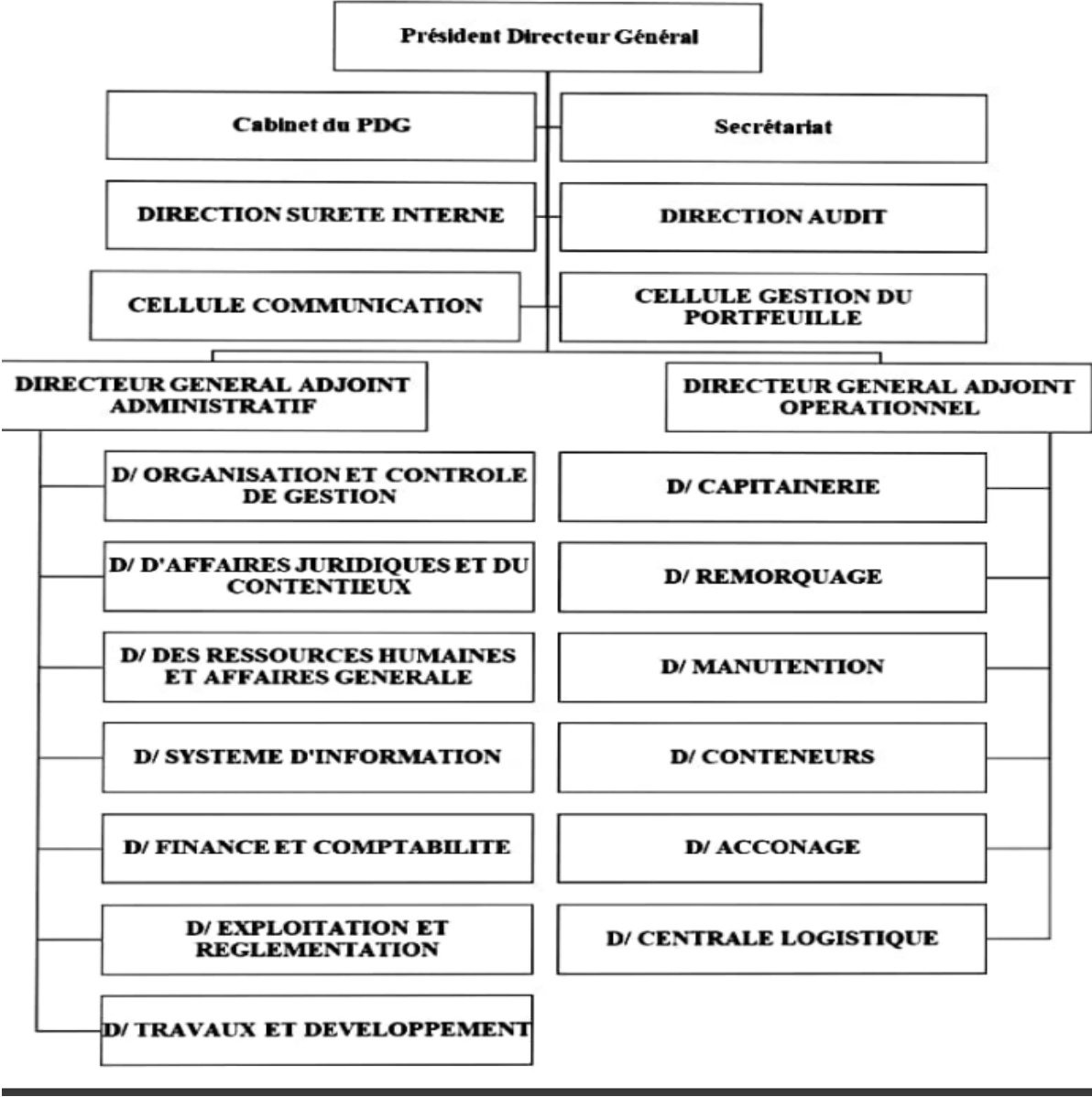
Interviewee unction	Areas of questioning
We asked 12 freight Forwarders	- Transit process for fresh produce at the port
	- Difficulties encountered in customs and logistics management
	- Coordination among actors in the logistics chain
	- Satisfaction with Port of Algiers Services
	- Desired Improvements and Suggestions
Export Service Manager, Container Department	- Contribution of the service to port logistics optimization
	- Challenges faced during export of fresh produce containers
	- Measures taken to improve efficiency and speed of operations
	- Management of time constraints and quality requirements
	- Proposals for improvement of container export service
Head of Maintenance Department, Central Logistics Department	- Departmental responsibilities regarding port logistics operations
	- Maintenance processes for equipment
	- Proposed improvements to meet specific export needs
	- Challenges that faces equipment maintainance
	- Recent technologies adopted to improve equipment maintenance
Methods & Engineering Service Manager, Central Logistics Department	- Service missions and objective
	- Tools used to improve efficiency of logistics operations
	- Collaboration with other departments for a smooth logistics chain
	- Key performance indicators
	challenges and difficulties
Planning & IT Department Managers	- Role of planning and IT systems in logistics operations
	- Challenges of integrating IT systems in supply chain management
	- Examples of projects that improved logistics performance
	- Key functionalities of IT systems used for export management
	- Proposed improvements or innovations for logistics chain IT systems
Customs Export Team Leader	- Role of customs in the fresh produce export process
	- fresh products exportation procedure
	- Measures proposed to facilitate and expedite customs procedures
	- Collaboration with other stakeholders to optimize export operations
Phytosanitary Inspector	- Role of the phytosanitary service in the export chain
	- Control procedures
	- Proposed improvements to ensure quality and compliance of exported fresh produce

	- Collaboration with other services to ensure adherence to standards
	- Challenges encountered in managing phytosanitary controls

Appendix 02: Algiers' port map



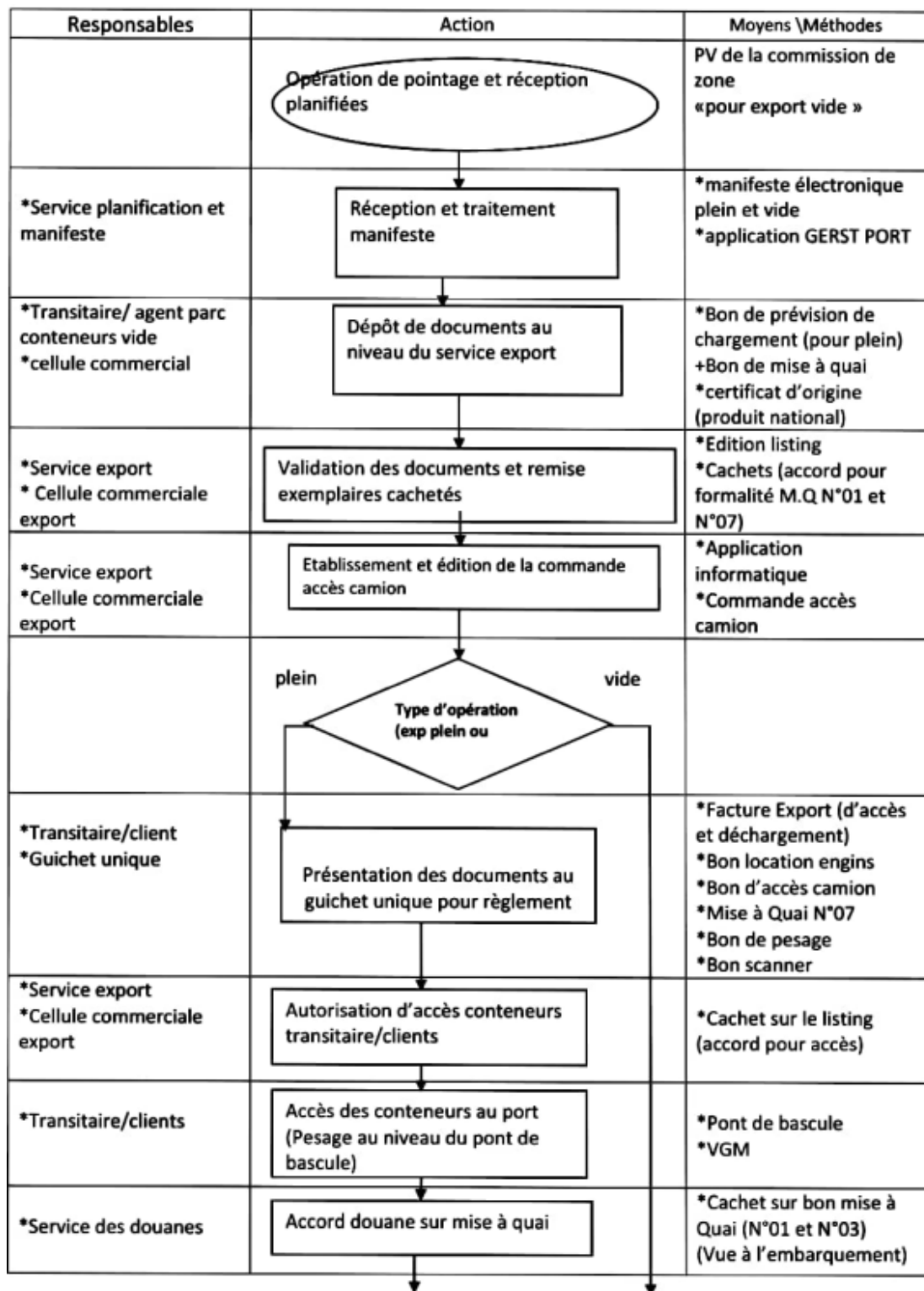
Appendixes03: Organizational chart

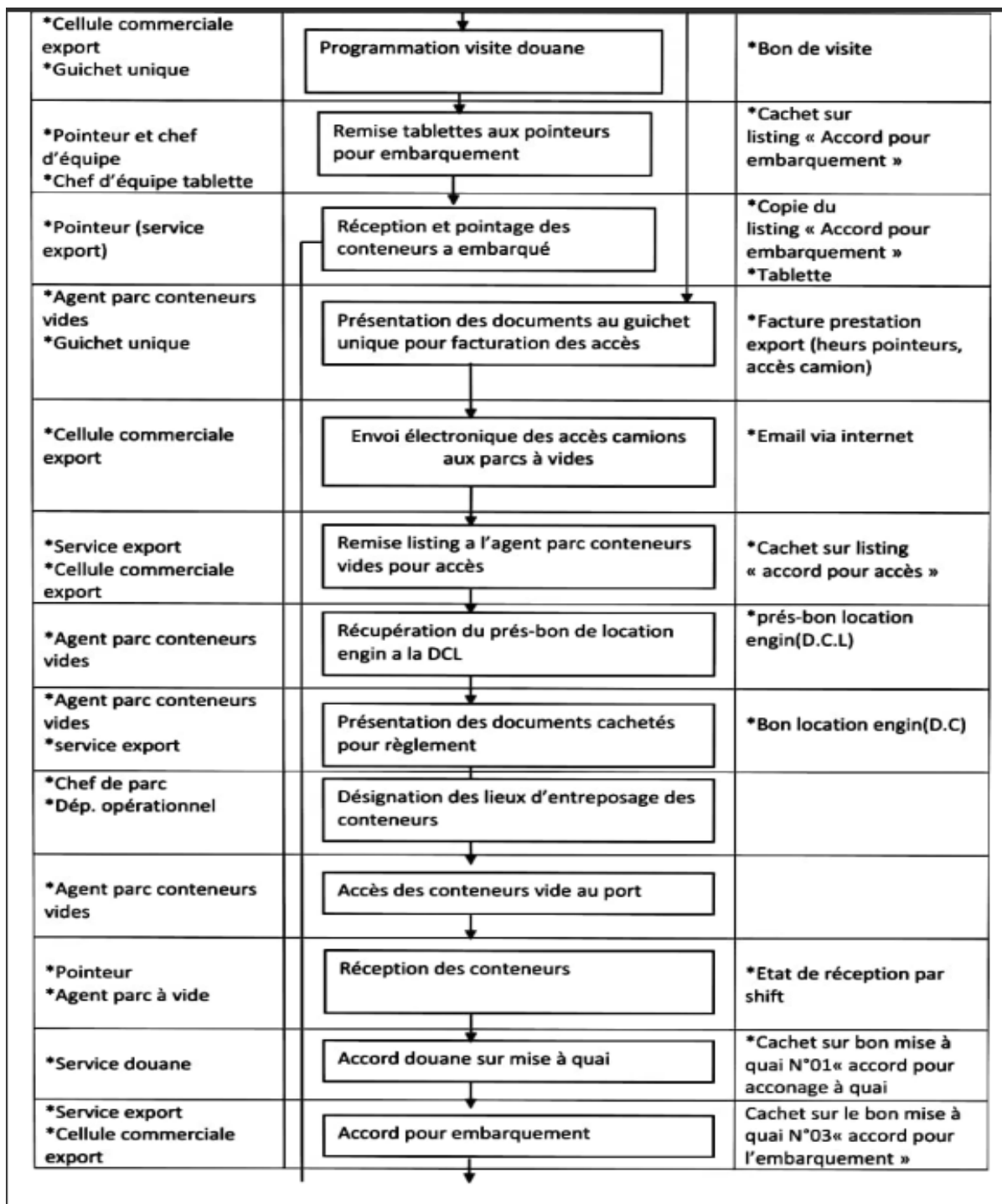


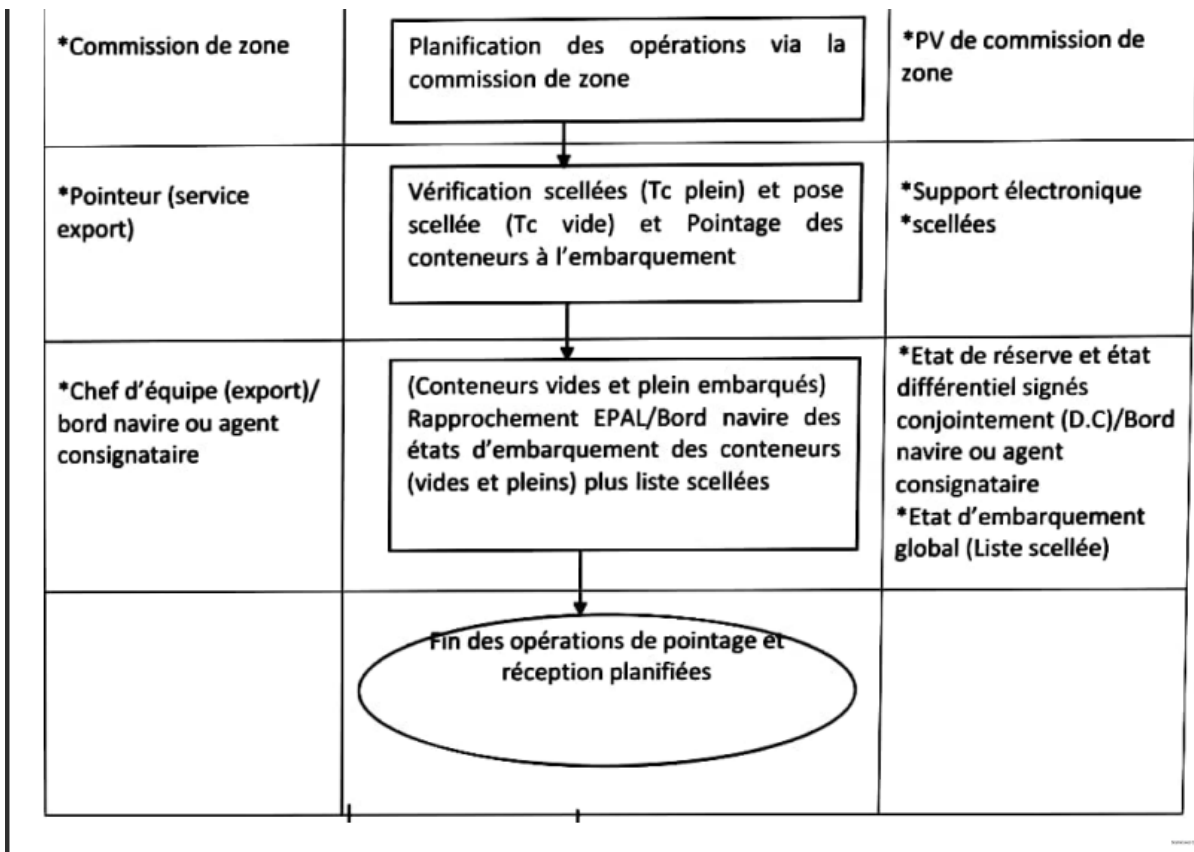
Appendixes 04: EPAL's containers loading and unloading list from 2017 to 2022

	Realisation 2017	Realisation 2018	Realisation 2019	Realisation 2020	Realisation 2021	Realisation 2022	Realisation 2023	Evolution 2018/ 2017	Evolution 2019/ 2018	Evolution 2020/ 2019	Evolution 2021/ 2020	Evolution 2022/ 2021	Evolution 2023/ 2022
DEBARQUEMENT	NOMBRE E	193 181	226 619	170 445	138 398	120 112	134 799	1,43%	17,31%	-24,79%	-18,80%	-13,21%	12,29%
	Pleins 20p	51 139	58 019	47 893	38 972	30 488	32 361	1,45%	11,83%	-17,45%	-22,80%	-17,54%	6,14%
	Pleins 40p	69 663	84 300	61 276	50 713	44 812	51 219	1,42%	19,32%	-27,31%	-17,24%	-11,64%	14,30%
	TONNAGE	2 474 735	2 855 311	2 335 777	1 873 819	1 656 506	1 801 372	1,81%	15,38%	-18,20%	-19,78%	-11,60%	8,75%
	Net	2 011 655	2 356 750	1 960 798	1 569 343	1 392 259	1 504 814	1,89%	14,98%	-16,80%	-19,96%	-11,28%	8,08%
	Tare	424 958	498 562	374 979	304 476	264 246	296 558	1,43%	17,31%	-24,79%	-18,80%	-13,21%	12,23%
EMBARQUEMENT	NOMBRE E	189 354	194 467	173 026	145 559	126 390	125 646	2,70%	12,10%	-20,63%	-15,87%	-13,17%	-0,59%
	Pleins EVP	5 679	7 553	8 956	9 611	11 854	15 005	33,00%	18,68%	-0,45%	7,79%	23,34%	26,58%
	20p	1 571	2 665	2 528	2 433	2 458	3 083	69,64%	-5,22%	-25,34%	20,00%	1,03%	25,43%
	40p	2 054	2 444	3 215	3 589	4 698	5 961	18,99%	31,55%	9,33%	2,11%	30,90%	26,88%
	Tonnage Total	76 852	112 055	110 276	128 834	167 884	217 167	45,81%	6,88%	-4,48%	14,03%	30,16%	29,51%
TOTAL	Net	64 359	95 438	93 364	107 690	141 606	184 156	48,29%	3,28%	-5,28%	15,34%	31,40%	30,05%
	Tare	12 494	16 617	19 615	21 144	26 079	33 011	32,99%	18,57%	-0,44%	7,79%	23,34%	26,58%
	Vides EVP	183 675	186 914	209 046	135 948	114 536	110 641	1,76%	11,84%	-21,59%	-17,16%	-15,75%	-3,40%
	20p	52 773	51 458	52 416	35 550	32 486	27 729	-2,49%	1,86%	-10,33%	-24,38%	-8,62%	-14,64%
	40p	65 451	67 728	78 315	50 199	41 025	41 456	3,48%	15,63%	-25,23%	-14,27%	-18,28%	1,05%
	Tare	404 085	411 211	361 042	299 086	251 979	243 410	1,76%	11,84%	-21,50%	-17,16%	-15,75%	-3,40%
TOTAL	NOMBRE E	379 819	387 648	343 471	283 957	246 502	260 445	2,06%	14,70%	-22,75%	-17,33%	-13,19%	5,66%
	Total 20p	105 483	106 006	96 779	74 955	65 432	63 173	0,50%	6,56%	-14,33%	-22,55%	-12,70%	-3,45%
	Total 40p	137 188	140 821	123 346	104 501	90 635	98 636	2,66%	17,76%	-25,62%	-15,28%	-13,36%	8,95%
	Tonnage Total	2 911 616	3 433 488	2 809 798	2 301 738	2 076 170	2 261 949	2,97%	14,53%	-18,16%	-18,08%	-8,80%	8,55%
	Net	2 076 013	2 145 175	2 054 162	1 677 033	1 533 865	1 688 970	3,33%	14,46%	-16,34%	-18,36%	-8,54%	10,11%
	Tare	835 601	852 826	755 636	624 705	542 304	572 979	2,06%	14,70%	-22,75%	-17,33%	-13,19%	5,68%

Appendix 06: Procedure for the reception and tallying of containers for export, version n°03







Appendix 06: Green lane for perishable goods

الجمهورية الجزائرية الديمقراطية الشعبية
MINISTRE ALGERIENNE DU COMMERCE ET DE L'INDUSTRIE
MINISTERE DES FINANCES
CENTRAL DES DOUANES DIRECTION
LE DIRECTEUR GENERAL

وزارة التجارة
الجمهورية الجزائرية الديمقراطية الشعبية
المعمر كدم

رقم 16/013 م/ع 14/11/2016
تاريخ: 14/11/2016

المادة: - المراء الجوهريين للمجرك،
- منبر المرك الوطى لإعظم الأتي والأصغر،
- رؤساء المصالح الجوهري للرقية الإلحق،
- رؤساء مقتنيات القسم الجمارك،

يتم إعلام المادة:
- الملقى التام للمجرك،
- المراء المركبين للمجرك،
- مراء الراسمات بالمجرك،
- مراء المراكز الوطية للمجرك،
- مراء مدارس الجمارك،

الموضوع: ترقية المصالحات خارج مجال المصالحات

في إطار العمل على ترقية المصالحات خارج مجال المصالحات وتطبيقا للتابع التي خرج بها
لجساع المجلس الوزاري المشترك، المنعقد يوم 28 فبراير 2016 وكذا مقتضيات الإرسالية
رقم 634 للمرجحة في 2016/03/13 الصادرة عن محتاج المنيق الوزير الأول، يترشي أن
أجلكم علما بأن المبرية العامة للمجرك قد اتخذت تدابير جديدة فيما يخص التسييلات التي
تهدف إلى تخفيف أكر لتعليق التصدير.

تتمثل هذه التدابير الجديدة فيما يلي:

1- فتح الأوراق الأخضر للمصالحات من المراكز والمطبخ والمصالح الأخرى مبرية التفت:

إن المصالحات من الفواكه والخضرو والمنتج الأكرى مبرية التفت والمبرية التفت أو التفت
بالإدراج، تستفيد بشكل آلي من الرزاق الأخضر مهما كانت صفة التصدير سواء كان مستملا
القبوليا مستملا أو غير ذلك.

16/013 م/ع 14/11/2016
14/11/2016
Direction des Douanes
Bureau des Perishables
16/013 م/ع 14/11/2016

Appendix 07: Loading forecast



Siège : 07 rue Hamani Arezki ALGER
☎ +213(0) 1718 61 11 – Fax : +213(0) 1718 61 11

MARFRET ALGERIE SARL
Sarl au capital de 500.000 DA
Agrément n° : 0282/07
RC n° : 0972359 - Ale. Fiscal : 000616019025939
Banque : SOCIETE GENERALE ALGERIE
AGENCE DIDOUCHE MOURAD N° 02100051130006222/92
Tél : 021 73 13 48/49 - Fax : 021 731356

SARL AU CAPITAL DE 500 000 DZD
RC 06 B 0972359
NIS 000616019025939

ALGER LE 25/04/2024

Agence d'Alger

PREVISION DE CHARGEMENT

NAVIRE : SAUMATY
QUAI :

DU 28/04/2024

DESTINATION : MARSEILLE
MISE A QUAI N° : 758

CHARGEUR	NOMBRE	NATURE DE MARCHANDISE	POIDS
TRANSIT P/C SARL	01	01 TC 40 DRY STC 2520 COLIS DATTES	23680 KGS

MARFRET ALGERIE
AGENCE MARITIME ALGER
BON A EMBARQUER
Alger, Le.....

Sarl au capital de 500.000 DA
07, Rue Hamani Arezki Alger centro (Ex Rue Chartras) - Tél.: 023 49 21 92 - 023 49 24 25

BON DE MISE A QUAI

ANNEE 2024

**CONTRÔLE
(SOUCHE)
D'EMBARQUEMENT**

aux clauses et conditions de connaissances de l'Armement MARITIME dont le chargeur déclare avoir pris connaissance et qu'il accepte entièrement

Marques	Numéros	Nbr	Nature de colis et contenu	Longueur	Long	Haut	Cubage	Poids	Valeur Observations ou réserves
SEGU SEAL 216970	793687/6				01 TC 40"				
DOUANES ALGERIENNES PORT DE DATTES EN VRAC DE 09 KG IDAC - ALGER PORT BRIGADE EXPORT VU A L'EMBARQUEMENT									
NAVIRE : <i>Souvet</i>				POIDS BRUTS :				23680 KG	
QUANTITE : <i>36</i>				Net :				4180 KG	
ALGER PORT LE : <i>24.04.94</i>				Total :				27 860 KG	
AGENCE ALGERIENNE AGENCE MARITIME ALGER BON A EMBARQUER ALGER, Le									
FRAIS ET FRET D'AVANCE									

Cette déclaration, signée par le chargeur, doit être remise à la Société avant tout dépôt de Marchandises à Quatre

Les marchandises sont remises aux conditions indiquées au dos que les chargeurs déclarent accepter.

UNE DÉCLARATION PAR CONNAISSEMENT

Signature du chargeur, le 23/04/2024



Appendix 09: EUR.01 (Can replace certificate of origin)

شهادة تنقل السلع

CERTIFICAT DE CIRCULATION DES MARCHANDISES

1. Exportateur (nom, adresse complète, pays) SARL DOMINIQUE OMBRELLI 0315 BNSIRA-NGERRE 1. Exportateur (nom, adresse complète, pays) SARL DOMINIQUE OMBRELLI 0315 BNSIRA-NGERRE		2. Importateur (nom, adresse complète, pays) GFA de la Grande Jacquerie Domaine de Vilpail 7027 Route de Moules BP 26 13110 SAINT MARTIN DE CRAU France RC 498 379 666 RC 513 666 2. Importateur (nom, adresse complète, pays) GFA de la Grande Jacquerie Domaine de Vilpail 7027 Route de Moules BP 26 13110 SAINT MARTIN DE CRAU France RC 498 379 666 RC 513 666	
3. Description des marchandises 2204 COGNAC DE DATTES EN CRAC DE 40%V 3. Description des marchandises 2204 COGNAC DE DATTES EN CRAC DE 40%V		4. Origine des marchandises FRANCE 4. Origine des marchandises FRANCE	
5. Numéro de déclaration d'exportation 2204 COGNAC DE DATTES EN CRAC DE 40%V 5. Numéro de déclaration d'exportation 2204 COGNAC DE DATTES EN CRAC DE 40%V		6. Date de déclaration d'exportation 2204 COGNAC DE DATTES EN CRAC DE 40%V 6. Date de déclaration d'exportation 2204 COGNAC DE DATTES EN CRAC DE 40%V	

Imprimé C.N.R.C. agrément n° 50 / DGD / D100

1. Pour les marchandises **2204 COGNAC DE DATTES EN CRAC DE 40%V**, indiquer le nombre d'objets ou mentionner "en vrac".
 2. A remplir seulement lorsque les règles nationales du pays ou territoire d'exportation l'exigent.

1. Pour les marchandises **2204 COGNAC DE DATTES EN CRAC DE 40%V**, indiquer le nombre d'objets ou mentionner "en vrac".
 2. A remplir seulement lorsque les règles nationales du pays ou territoire d'exportation l'exigent.

مؤسسة ميناء الجزائر
Entreprise Portuaire d'Alger

Stylo au capital de 10 500 000 000 DA
Siège social : 2, rue d'Angkor - Alger, BP : 259 Alger P.O.
Site internet : www.portalgier.com.dz
E-mail : cpa@portalgier.com.dz
Tél : 021.42.56.14/0178 - Fax : 021.42.56.03/06

RC N° 0080011530 - SIREN N° 153069
Tél : 021.42.56.14/0178 - Fax : 021.42.56.03/06
N° d'ordre : 16070311007 NIS : 098910110011445

FACTURE AU COMPTANT 10002452/004 9-4-06

Interleek

 interleek
Société par actions
Capital : 100 000 000 DA
Siège social : 10, rue de la Liberté - Alger
Tél : 021.42.56.14/0178 - Fax : 021.42.56.03/06
N° d'ordre : 16070311007 NIS : 098910110011445

Téléphone : 021.42.56.14/0178 - Fax : 021.42.56.03/06

Date: 29/04/2024
Adresse: Rue Khmissat Sand Bir Toula
Mode de Paiement: ESPECE R.C.N : 481491 A 05 N.I.S.
Tél; Fax; Mail: 021/44 42 78 - N.I.F: 193609040033442

Date Arrivée: 28/04/2024
Date Solde: 29/04/2024

Code	Libellé de Prestations	Quantité	Unité	P U	Montant
Prestation					
PES40P	PESAGE CONTENELUS 40P	1		1 000,00	1 000,00
GARDIL	GARDIENNAGE	1		100,00	100,00
POINTIL	HEURE FONCTEUR OUVRABLE	1		650,00	650,00
ACCES	ACCES CAMION	1		300,00	300,00
CDCC40	CHARGT. OU DECHARGT. CTN 40P ALG	1		3 750,00	3 750,00
VGMPFI	FRAIS VGM	1		500,00	500,00

Arreté la présente facture à la somme de : Sept Mille Six Cent Quatre Vingt Treize Dinars et Zéro Centimes	Frais Impression 100,00
Certificat Confirme	TOTAL HT 6 400,00
Le caissier CAISSE Zone Sud SHIFT.S Caisse et signature GOUIN ABDELLAH	TVA 19,00 % 1 216,00
	TIMBRE 77,00
	TOTAL TTC. 7 693,00

Appendixes 11: VGM

PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA
THE VERIFIED GROSS MASS OF A CONTAINER CARRYING CARGO
STATEMENT OF COMPLIANCE



This statement supplements the Bill of Lading
issued under the provisions of the
INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE
AT SEA, 1974, as modified by the protocol of 1988 relating thereto
Under the authority of the people's Democratic Republic of Algeria

(Person or port/terminal facility or weighing facility duly designated)

Bill of Lading Number _____
Shipper[SH] _____
Carrier[CA] _____ Voyage number _____
Vessel Name Saumarky
Port of loading ALG
Port of discharge MRS
Place of transshipment _____

Approval Verification Method Number by Competent National Authority [SM. 1] _____

N°	Container ID	SEAL NUMBER	Verified Gross Mass [VGM]	Verification Date and Time [VDT]
01	<u>SEGU 733 68716</u>	<u>216970</u>		<u>28 220 kg</u>
02				
03				
04				

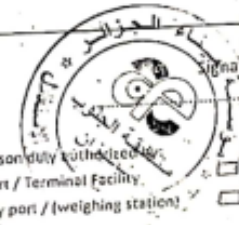
The party that has verified (e.g. the operator of the weighing facility)
Contact details (Name, Address, Tel, Email) _____

Method of weighing 1 (Crane, scale, weighbridge or lifting equipment) _____

Signature _____
(Person duly authorized by the shipper)

Place and Date
ALGER LE




Signature
Person duly authorized for:
- Port / Terminal Facility
- Dry port / (weighing station)

*Name in capital letters
1. If the VGM of a closed container is obtained by weighing the container while it is on the road vehicle, the tare mass of the road vehicle & the driver (as indicated on their registration documents) should be subtracted. The mass of any fuel on the vehicle should also be subtracted (IMO/Circ1475 paragraph 3.1)

Appendix 12: Phytosanitary certificate

ALGERIAN DEMOCRATIC AND POPULAR REPUBLIC

MINISTRY FOR AGRICULTURE

DIRECTION OF THE AGRICULTURAL SERVICES

WILAYA OF.....**ALGIERS**.....

PLANT HEALTH INSPECTION OF

BORDER POST OF.....**ALGIERS**.....

PHYTOSANITARY CERTIFICATE

Law n° 87-17 of August 1, 1987

Executive decree n° 93 - 286 of November 23, 1993

Directive n° 105/SPM of Octobre 26, 2000

N°**10/EXP/100**.....

DESCRIPTION OF THE SENDING

Name and addresses of the Sender: **ETS HADDOUD SALIM - BISKRA - ALGERIA..**

Name and addresses declared of the recipient: **NASSIM AL BARARI GENERAL TRADING
COL.L.C 22927 DUABAI UAE P/C HR&SON E32 APMC MARKET-1 SECTOR**

19, TURBHE PHASE-2 VASHI NAVI MUMBAI INDIA

Parcels: **6140BOX**

Mark parcels: **HADDOUD**

Place of origin: **ALGERIA**

Declared means of transport: **DANIA STAR**

Point exit declared: **ALGIERS**

Name of the declared product and quantity: **DATE COMMUNES OF 5 KG = 30700 KG**

Botanical Name of the product: **PHOENIX DACTYLIFERA**

Import permit N° : 0017343 Date 09/12/2009

It is certified that the date described above was inspected and recognized unscathed of Visés
enemies by the plant health and practically unscathed regulation of other dangerous enemies
which is judged Conform to the plant health regulation in the importing country.

TREATMENT OF DESINFESTATION AND/OR DISINFECTION

Date: type of treatment:

Chemical product: time and temperature:

Active goods: Further information:

Concentration:

Name and first name of the agent of control:

issue **ALGIERS** on **09/04/2010**



Appendix 13: Turnover of EPAL and the list of needs of central logistics directoriate

	u:da		
	2021	2022	2023
ca	11 959 538 800	12 197 957 400	12 556 493 700

inv direction dcl		u:kda
libelle operation	montant	
achat 6 cavaliers gerbeurs	2 000 000	
deux grue (02)portuaires 100t	1 000 000	
quatre(04) chariots elevateur 2,5t	18 000	
trois (03) chariots elevateur 2t	12 000	
une nacelle	45 000	
trois (03) mini chargeurs chouleurs pour nav	15 000	
six 6 palonniers semi automatique	22 000	
deux02 portique a grain	1 000 000	
deux moteurs pour grue portique	600 000	
	4 712 000	

Appendix 14 : ISO 9001:2015 certificate



**CERTIFICAT
D'ENREGISTREMENT**

Le Système de Management de :

**ENTREPRISE PORTUAIRE
D'ALGER**

Site principal : 02 Rue D Angkor BP 02, Alger, Algérie
a été enregistré par Intertek comme étant conforme aux exigences de
la norme :

ISO 9001:2015

Le Système de Management est applicable à :

Pilotage, arrimage, remorquage, avitaillement en eau, manutention
manuelle et mécanique, accostage marchandises diverses et
conteneurs

Certificat n° :
0061084

Date de certification initiale :
11 août 2015

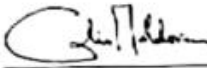
Date de certification :
07 septembre 2018

Date d'émission du certificat :
13 septembre 2018

Date d'expiration :
30 août 2021

cofra
ACCREDITATION
COFRA
N° 4-014
PORTS
ISO 9001:2015
www.cofra.fr

**CERTIFICATION
DE SYSTÈMES
DE MANAGEMENT**



Calin Moldoveanu
Président, Business Assurance
Intertek Certification France, 67, Boulevard
Gasselin / 9017 Paris - France

Le titulaire du présent certificat reconnaît la responsabilité d'assurer aux clients une qualité conforme aux exigences du présent certificat, et de maintenir la conformité du système de management par rapport aux exigences de certification de système d'assurance. La validité pour être
confirmée aux clients par email à : certificats@intertek.com ou par téléphone au 01 69 10 10 10 ou par la poste au 10101 Paris - France. Le certificat est la propriété d'Intertek, et
ne doit être réutilisé en cas de demande.



Appendix 15: Refrigerated zone of EPAL



Appendix 16: Refrigerated zone of DPW



Appendix 17: Procedure for exporting agricultural products

Procédure d'exportation des produits agricoles

Objet :

L'exportation des produits végétaux est régie par un cadre législatif et réglementaire et procédural suivant :

Procédures d'exportation :

- Les produits végétaux destinés à l'exportation sont soumis à un contrôle phytosanitaire obligatoire au niveau des points de sortie aériens, terrestres et maritimes officiels du territoire national (loi n° 87-17 du 1^{er} Août 1987 relative à la protection phytosanitaire - décret exécutif n° 93-286 du 28/11/93 réglementant le contrôle phytosanitaire aux frontières).
- Le contrôle phytosanitaire porte sur l'examen minutieux de la totalité de la cargaison à exporter avec prélèvement d'échantillons à des fins d'analyse en vue de s'assurer de la conformité de la marchandise avec les exigences phytosanitaires du pays importateur.

Conditions :

- L'agent de l'autorité phytosanitaire aux frontières territorialement compétente chargé du contrôle phytosanitaire inspecte la cargaison avant son expédition vers le pays importateur.
- L'autorité phytosanitaire aux frontières territorialement compétente délivre un certificat phytosanitaire selon le modèle conforme à celui établi par la Convention Internationale pour la Protection des Végétaux, texte révisé en 1997 (décret présidentiel n°02-400 du 25 novembre 2002 portant ratification de la Convention Internationale pour la Protection des Végétaux, telle qu'approuvée par la conférence de l'Organisation des Nations Unies pour l'Alimentation et l'Agriculture à sa vingt-neuvième session de novembre 1997) accompagnant obligatoirement l'envoi destiné à l'exportation.

Références légales

- Loi n° 87-17 du 1^{er} août 1987 relative à la protection phytosanitaire ;
- Décret présidentiel n°02-400 du 25 novembre 2002 portant ratification de la Convention Internationale pour la Protection des Végétaux, telle qu'approuvée par la conférence de l'Organisation des Nations Unies pour l'Alimentation et l'Agriculture à sa vingt-neuvième session de novembre 1997 ;
- Décret exécutif n° 93-286 du 23 novembre 1993 réglementant le contrôle phytosanitaire aux frontières ;

De leur côté, les services du contrôle de la qualité et de la répression de fraudes aux frontières établissent un procès verbal de constat de conformité de dattes destinées à l'exportation.

2.2 Pour la cargaison ayant fait l'objet de contrôle sur site de conditionnement :

Il est procédé à un contrôle de vérification des documents établis de la marchandise présentée dans le ou les conteneurs scellés.

Un certificat phytosanitaire est établi par le service phytosanitaire aux frontières territorialement compétent certifiant que la marchandise destinée à l'exportation est conforme aux exigences des services officiels du pays de destination.

Références légales

- o Loi n° 87-17 du 1^{er} août 1987 relative à la protection phytosanitaire ;
- o Décret exécutif n° 93-286 du 23 novembre 1993 réglementant le contrôle phytosanitaire aux frontières ;
- o Arrêté interministériel du 17 novembre 1992 relatif à la qualité et à la présentation des dattes destinées à l'exportation ;
- o Décision n° 105 du 28 septembre 2000 portant organisation du contrôle de l'exportation de la datte ;
- o Note n° 1051 du 13 octobre 2001 portant sur le dispositif de contrôle de la datte sur sites de conditionnement ;

Appendix 18: Phytosanitary requirements for the export of vegetables and fruits

République Algérienne Démocratique et Populaire

MINISTÈRE DE L'AGRICULTURE ET DU DÉVELOPPEMENT RURAL

DIRECTION DES SERVICES AGRICOLES
ET DU DÉVELOPPEMENT RURAL
DE LA WILAYA D'ALGER

Exigences phytosanitaires des Légumes et Fruits destinés à L'exportation vers l'Inde

Espèce	Nom Commun	Exigences	Présent en Algérie	Absent en Algérie
<i>Phoenix dactylifera</i>	Datté	<i>Pachymerus lacerdae</i> insecte		X

Exigences phytosanitaires des Légumes et Fruits destinés à L'exportation vers l'Argentine

Espèce	Nom Commun	Exigences	Présent en Algérie	Absent en Algérie
<i>Phoenix dactylifera</i>	Datté	<i>Trogoderma granarium</i> insecte	X	

Russie
Trogoderma granarium
Dinoderus bifoveolatus insecte.

Appendix 19: Phytosanitary control of plant products for export

L'EXPORTATION DES PRODUITS VÉGÉTAUX, DES ANIMAUX, DE PRODUITS ANIMAUX ET/OU D'ORIGINE ANIMALE

1- CONTRÔLE PHYTOSANITAIRE DES PRODUITS VÉGÉTAUX À L'EXPORTATION

L'exportation des produits végétaux est régie par un dispositif de contrôle phytosanitaire basée sur les exigences phytosanitaires du pays importateur afin de prévenir l'introduction et/ou la dissémination d'organisme nuisible de quarantaine dans ce pays.

À ce titre, le contrôle est obligatoire au niveau des points officiels de sortie du territoire national (aériens, terrestres et maritimes) et porte sur :

- ☐ La vérification documentaire de la cargaison à expédier,
- ☐ L'examen minutieux de la totalité de la cargaison à exporter,
- ☐ Le prélèvement d'échantillons à des fins d'analyse, en vue de s'assurer de la conformité de la marchandise par rapport aux exigences phytosanitaires du pays importateur.

Procédures :

Afin de rendre la procédure d'exportation en matière de contrôle phytosanitaire aussi fluide que possible, des allègements ont été instaurés et concernent :

◆ Dispositions générales :

Avant toute exportation, l'opérateur économique, exportateur de produits végétaux doit aviser l'inspection phytosanitaire de wilaya (IPW) suffisamment à temps, au niveau de la DSA concernée, pour qu'ils puissent procéder au prélèvement d'échantillons de l'envoi en question en vue de les analyser au laboratoire.

Le contrôle peut se faire de deux manières :

⇒ **En cas d'analyse phytosanitaire exigée** par le pays importateur pour les fruits et légumes :

Le contrôle se fait au niveau de la wilaya concernée, sur site de conditionnement. À ce titre :

- ☐ L'exportateur doit identifier les lots destinés à l'exportation qui doivent être conditionnés dans un endroit approprié (Chambre froide...).
- ☐ Un contrôle sur site de conditionnement est effectué par l'inspecteur phytosanitaire de wilaya qui procédera à l'inspection de la marchandise et prélèvement des échantillons pour analyse phytosanitaire.
- ☐ Un Procès-verbal de contrôle est établi attestant que la marchandise est indemne d'organisme nuisible.
- ☐ La marchandise est scellée avant son acheminement au point de sortie.
- ☐ L'inspecteur phytosanitaire aux frontières (IPF) délivre un certificat phytosanitaire d'exportation accompagnant obligatoirement l'envoi destiné à l'exportation et ce, sur la base du PV de conformité attestant que la marchandise est indemne d'organisme nuisible, établi par l'inspecteur phytosanitaire de wilaya.

Il est à noter que toute rupture de charge, fractionnement de la marchandise ou modification d'emballage, entraîne un nouveau contrôle obligatoire de la cargaison.

☞ En cas d'analyse phytosanitaire non exigée par le pays importateur pour les fruits et légumes :

☐ L'envoi peut être présenté directement à l'embarquement

- L'inspecteur phytosanitaire aux frontières délivre un certificat phytosanitaire d'exportation dans le cas où la cargaison est reconnue indemne d'organisme prohibé et qu'elle est conforme aux exigences des services officiels du pays de destination.

☐ Pour l'envoi ayant fait l'objet de contrôle sur site de conditionnement

- La délivrance d'un certificat phytosanitaire par l'inspecteur phytosanitaire aux frontières est tributaire d'un procès-verbal préétabli par l'inspecteur phytosanitaire de la wilaya concernée.

Il est important de préciser que toute rupture de charge, fractionnement de la marchandise ou modification d'emballage, entraîne un nouveau contrôle obligatoire de la cargaison.

◆ Palette en bois

Conformément à l'Arrêté Interministériel se rapportant à la réglementation des matériaux d'emballage à base de bois destinés au commerce et à la norme internationale des mesures phytosanitaires « NIMP 15 », les emballages en bois (Palettes.....) destinés à l'exportation sont soumis au traitement (Fumigation) par des opérateurs agréés pour la marchandise de nature végétale (fruits et légumes) ou autres (pattes, limonade...etc.).

L'inspecteur phytosanitaire aux frontières est chargé de délivrer le certificat phytosanitaire sur la base du certificat de traitement établi par les opérateurs agréés.

Références

- ✓ Loi n° 87-17 du 1er août 1987 relative à la protection phytosanitaire ;
- ✓ Décret présidentiel n° 02-400 du 25 novembre 2002 portant ratification de la Convention Internationale pour la Protection des Végétaux, telle qu'approuvée par la Conférence de l'Organisation des Nations Unies pour l'Alimentation et l'Agriculture, à sa 29ème session de novembre 1997 ;
- ✓ Décret exécutif n° 93-286 du 23 novembre 1993 réglementant le contrôle phytosanitaire aux frontières.
- ✓ Arrêté du 7 avril 2004 modifiant et complétant l'Arrêté du 21 mai 1955 fixant les normes phyto techniques et phytosanitaires à l'importation des semences et plants des espèces maraichères, arboricoles, viticoles et grandes cultures ;
- ✓ Arrêté interministériel du 05 août 2009 portant approbation du règlement technique relatif à la réglementation des matériaux d'emballage à base de bois destinés au commerce.
- ✓ Convention Internationale pour la Protection des Végétaux (CIPV), texte révisé en 1997.

Pour plus d'informations, adressez-vous au:

Ministère de l'Agriculture, du Développement Rural
Direction de la Protection des Végétaux et des Contrôles Techniques
12 Boulevard Colonel Amirouche, 16 000 – Alger – Algérie
Tel-Fax : +213 – (0) 23– 50.31.77
Web: www.madrp.sdct1@gmail.com

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