

The chain of cold; lever of the competitiveness of the ports or simple link of the supply chain? Case of the port of Agadir

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Abstract

The Agadir's port subdued in the constraints of seasonality, massive influxes of the perishable products in period of campaign's citrus fruits and scoops, and the pressure of the exporters, the port faces difficulties of organization and the agro-exporting flows. Of this fact, the cold chain and the harbour passage constitute links of a significant sensibility of all the supply chain.

Indeed, the importance of the optimization of the cold chain, the coordination of actions, constitutes the main reasons which incited to us to choose this work. So, we shall study possible cause of dysfunction to recommend solutions, with the aim of a better management of the cold chain.

Keywords: *Competitiveness, Optimization, Cold Chain, Capacity, Port, Quality.*

1. Introduction

The globalization of markets and the evolutionary requirements of the competitiveness which it arouses, urged several companies to consider the Logistics as competitive weapon of optimization of the costs and the improvement of the quality of the services) [1]. It is for concerns of rationalization of the practices and to improve the competitiveness, companies must be capable of valuing and of mobilizing all resources and skills according to needs.

Indeed, the search for the performance and for the outsourcing of the logistic activities in a increasing way with qualified logistic service providers[2], are decisive elements for the improvement of the competitiveness of organizations and especially those where the participants are multiple and the interests are divergent; such as the port of Agadir.

This port subdued to the constraints of seasonality and massive influxes of the perishable products in period of

campaign's citrus fruits and scoops, so it faces difficulties of organization and of the agro-exporting flows characterized by irregularities, which impose on the port of counter performances at the level of the quality residual and especially on the plan export of fruits and vegetables. Of this fact; the cold chain and the harbour passage constitute links of a significant sensibility of all the supply chain.

The delay taken in the supply chain and specially that of the managed temperature is translated in terms of cost; by representing an important percentage of the cost price; and any break in the cold chain can cause the partial or total loss of the cargo. So; the costs of break of the cold chain, during the harbour passage, the rest importing compared with those nearby countries, what puts the competitiveness of the port in question and afterward the Moroccan exports.

At this level, the main questions are the following ones:

- **Can we consider that the problems of the cold chain of potentiality or capacity?**
- **Can we say that the optimization of the cold chain is a lever of competitiveness?**

To answer it, we shall be interested of our work in the frame abstract of the competitiveness and afterward, we shall focus our attention on the clarification of the key practices of our problem, and on the discussion of the results, obtained further to the diagnosis which we are going to realize by basing itself on guides of conversations with MarsaMaroc and its partners, with the aim of identifying the dysfunctions and the proposed

improvements with the aim of an optimization of the cold chain and specifically during the harbour passage.

2. Revised by literature on the competitiveness of the ports:

2.1 Frame abstract of the competitiveness:

The competitiveness outcomes of the management and the sociology; in this work one go treaty particularly sources and factors of the competitiveness of organizations. We distinguish between two approaches:

- The one-dimensional approach is represented by the works of Boston Consulting Group (B.C.G) the upholders of this approach stipulate that: in a competitive environment, the competitive company is the one which has the lowest costs, that is the one who knew how to reach the most effective use of factors for costs of equivalent factors and it by means of the experiment. We deduct that from it, the competitiveness of a company is exclusively translated by the competitiveness of its products. This approach was criticized by its vision limited to a single costs and without perceiving the connections between the activities which can influence this criterion, while the competition such as it is lived by companies

- The multi-dimensional approach: several plans of identification of the sources of the competitiveness are presented; concern the reflection base, the model of the value chain to explain in what and how the connections between the various activities implemented by companies can be the source of major competitive advantages [3]. This approach based on the resources considers that the acquisition of the competitive advantage results from the combination of the resources within the company and their translation in term of strategy to be implemented on the markets of the properties [4] [5].

Barney [6] distinguished three categories of resources: the physical capital, the organizational capital and the human resources. These resources cover all the assets , the capacities of the firm, the organizational processes, the knowledge and the know-how which are checked by the company and allow it to develop and to implement competitive strategies directed to the efficiency.

Knudsen, foss [7] focus their attentions particularly on the endogenous or additional conditions in the creation of the competitive advantage which are unlimited (variables of contingency connected with the characteristics of the competition, the asymmetry of the information, the

characteristics of entrance) and exogenous (the uncertainty and the immobility) of the competitive advantage.

Analysis of Lawrence and Lorsh [8] succeeds to consider the competitiveness of a company essentially through the degree of flexibility of its structure. So that a company is competitive, its structure has to be adapted well to the requirements of its environment. Otherwise, if the environment changes, the structure of the company will have to adapt itself.

2.2 Factors of the competitiveness of ports:

Too of ten though, relevant work on the relationship between a port's efficiency and its operating and organisational conditions shows a great degree of discrepancy and divergence across port researchers. This is particularly the case for studies looking at the role of the institutional structure and type of ownership as a determinant of port efficiency, the relationship between scale economies and port efficiency, and the impact of port reform on port efficiency[9], found that private sector participation would improve port efficiency [10].

The researchers in the field of the harbour competitiveness suggested several indicators allowing to measure the competitiveness without being in common on determiners, which form a complete measurement tool for the harbour competitiveness; as these indicators can be qualitative or quantitative. The quantitative factors are the ones who can be to compare and to measure objectively and are grouped whereas the qualitative determiners are the ones who can be to interpret subjectively and are bound to the efforts of all the participants of the port, at the level of cooperation and of the ease of use of the port [11].

The natural environment of the port [12] revises in the factors which concern the surface of the ground, the conditions of the coast, the depth of the channel; all elements influence the production and the exploitation of the port;

- The infrastructures of the port: installations and materials of exploitation consist [13];

- The productivity of the port the productivity allocates directly the transit time of ships to the port. When a ship is in wait in the port it is of the immobilized capital that generates costs for its users [14];

- The price of the harbour services: the users of the port compare the level of the prices with the harbour productivity to judge the prices proposed and consequently to deduct the competitiveness from it of the port [15];

- The quality of the harbour services: it became an imperative on a business level. It is the result of the coordination of the participants in the service offers[16];
- The efficiency of ports: can be reflected in the freight rates practised by shipping companies, for the deadline of rotation of ships, More a ship stays alongside the quay more the cost is raised and it is the same for the goods. So the efficiency of the port translates generally the speed and the reliability of the harbour services [17].

Indeed; we can say that the main factors of the competitiveness, grafting that causal process, are connected at the same time to the company, to the environment and to the product. (“fig 1”):

- The product: the company is considered competitive by its customers only as far as they are perfectly satisfied by the offer, better than the competition.
- The company: this given that the product is only the resultant of a transformation process of assets (active persons) in economic result. It is the company which should combine " the capacity of competitiveness ".
- The environment of the company: he can favor or disadvantage the spot so that the company is competitive[18].

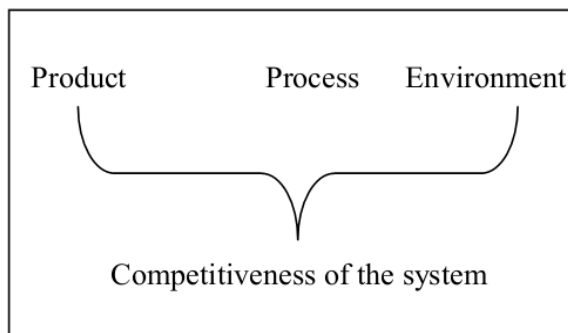


Fig 1. Factors of the competitiveness

3. Evolution and operational aspects of the cold chain

Since the introduction of the first capacity of refrigerated storing with industrial character in Morocco in 1945 (Fes); the installation of new capacities was slow until 1970 when the main part of the investments in this sector and has of state origin. But, after this date, the private sector showed an interest for this sector to participate its growth.

The global volume of storing is at present considered about 1 700 000 m³ of the cold rooms corresponding to 370 000 tons distributed between 495 units, for all the industrial and commercial links.

The average capacity of a refrigerated unit at the national level is about 750 tons or another volume of storing slightly lower than 3500 m³, total of the cold rooms is 1980 rooms with a unitarian capacity of 189 tons. The useful average volume by room is 850 m³.

For the industrial link the average is situated between 10000 m³ and 12 000 m³ (on 2000 in 2400 t) and for the commercial link between 600 and 800 m³ is 120 in 160 tons.

The estimation of the capacity of refrigerated storing necessary for the regulation of the consumption and the marketing of the current production of perishable products estimated at 9 400 000 tons.

3.1. Definition of the cold chain

All the logistic operations (transport, handling, storage) to maintain foodstuffs in a temperature given to assure the preservation of its healthiness or its gustative qualities. The interest of the term chains is to underline the importance of the continuity of the stages; no link has to give up and annihilate the main part of the spread general effort, and end at the end of chain in a product protected from any heating, thus from break of the cold chain.

The sanitary regulations which fixes the optimal temperatures of preservation of foodstuffs lean on traditional scientific bases. it takes into account the evolution of consumer habits, the food-processing technical progress and their inherent risks, its objective being to guarantee the safety of the consumer.

The fundamental principles of the application of the cold in the preservation of perishable foodstuffs are:

- **Application of the cold on fresh products:** the refrigeration having for consequence the slowing down of the phenomena of change and microbial increase, it is essential that products are initially of excellent quality and little contaminated;
- **Precocity:** the cold is to apply immediately that possible after the slaughter the harvest, before the diverse changes began;
- **Continuity:** every type of cooled products is to be maintained in an appropriate temperature. Any sensitive rise of the temperature of the product over this value causes an acceleration of the microbial increase and the phenomena of degradation. The temperature of preservation of foodstuffs has to remain so constant as possible below this limit, since the slaughter or the harvest until the consumption.

One little to say that the efficiency of cold chain, dependent on that of the lowest link.

3.2. Specificities of the cold chain of fruits and vegetables

The cold has for essential consequence to lengthen the life cycle of fruits and vegetables by delaying their change. Indeed it inhibits the enzymatic reactions, in particular those who are at the origin of the biosynthesis of the éthylène by fruits and vegetables. This gas is responsible for their senescence and for their ripening.

However, the temperature of preservation must be suited because below a certain value fruits and vegetables develop particular changes grouped under the word of the physiological disease of the cold. The responsible triggering factor is a preservation realized below a certain temperature and during a the extension, specific of the species and the variety of fruits or concerned vegetables (eg: hot pepper 5°C 3 j; sweet potato +7°C 2 weeks) [19]. The symptoms show themselves late, after stop of the application of the cold.

Besides the loss in water of fruits and vegetables is an element to be particularly watched. Indeed beyond 4 in 6 % of loss of their initial weight, changes of the quality occur, characterized essentially by an irreversible withering.

4. Study of current situation: inventory of fixtures

4.1- The region Souss-Massa-Draa:

The region of Souss-Massa-Draa is doubtless one of the main engines of economic development of the kingdom. it contributes to height 12,3 % of the gross domestic product. This important contribution is based on The agriculture grafting that economic growth driver of the region, which represents more than 44 % to the regional added value and 32 % in the national added value [20].

Citrus fruits and scoops (truck-farming agricultures) occupy a dominating place in the region as well in production as in export.

During the last five years, the region produces on average 1500 Mt of scoops and 640Mt of Citrus fruits is approximately respectively 21 % and 48 % of the national production

At the level export, the region occupies a dominant place, by a tonnage approximately of 350 Mt of citrus fruits and 500 Mt of scoops, is respectively 62 % and 80 % of the national exports and 44 % of the agricultural exports of the kingdom.

Table 1: production citrus fruits and scoops 1000T

Sectors	2010	National parts %	2013	2020
scoops	1480	77%	1780	2140
citrus	646	39%	893	1070

DEPF in January, 2010

4.2- Presentation of the port of Agadir:

It is among 11 commercial ports which Morocco arranges throughout its coast; seven ports assure however the main part of the maritime trade of the country[21] 1. Four other ports, are essentially for local vocation. A new big one has been create, that of the "Port Tanger Méd". its first vocation is the traffic of transshipment line spacing of container.

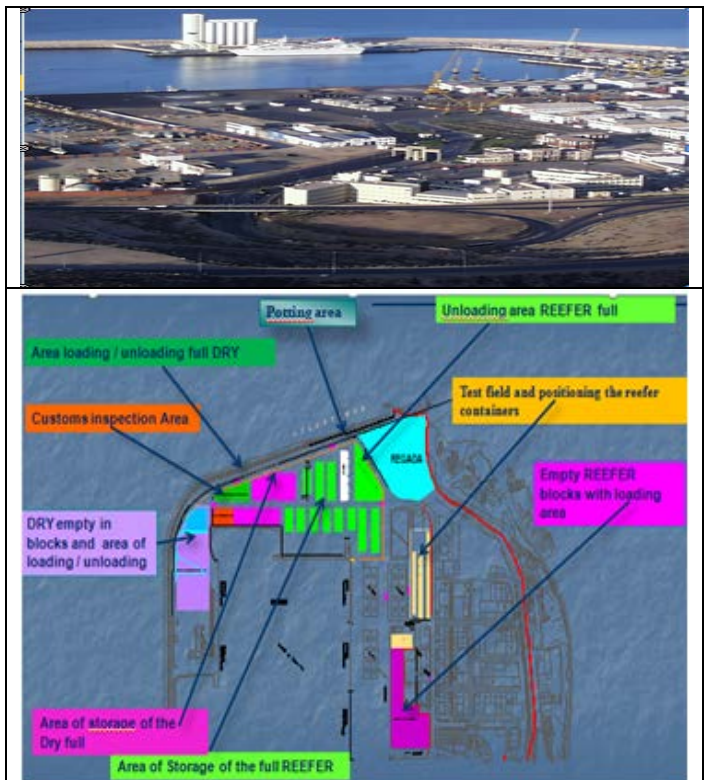


Fig 2: the port of Agadir

¹ Casablanca, Mohammedia, Agadir, Safi, Jorf Lasfar, Tanger, and Nador

Since its creation in 1955, the port of Agadir knew remarkable evolutions, in term of arrangement of equipment and administration, of which the most mattering this one held in 2005, by introducing one re-form ports of Morocco, the latter will join a context marked by the globalization of the international trade.

This upgrade will come to answer in various forced; exogenous, endogenous and those connected to the administration and the infrastructure.

In view of all these weaknesses, the adapted harbour reform and exactly the law 15.02, given birth to two new entities, the ANP, the harbour authority in charge of kingly privileges of management and regulation of the activities within the ports of the Kingdom, and MarsaMaroc, company in charge of commercial activities granted in the aforementioned ports instead of the ODEP so, she(it) aimed at ambitious objectives to improve the competitiveness of ports.

The port of Agadir, and seen the importance of its participation for the national foreign trade, grafting that first port of deep-sea fishing, also bearing of citrus fruits and scoops, knows a growth of the containerization of the traffics by representing more than 5 % of the national traffic [22], endowed with 4 specialized platforms (board 2) and counted several participants at the level of the maritime transport chain; and more exactly the link of the management of the cold chain during the harbour passage.

Table 2: infrastructures and equipments of the port of Agadir

<i>the North Platform</i>	<i>the Est Platform</i>
<p><u>Activities:</u> Containers, citrus, scoops and travel</p> <p><u>Infrastructure :</u> - 290 ml of quay to -10,50 - ground 10 hectares</p> <p><u>Equipements :</u> - 3 Cranes de 100 T; - 3 Cranes de 6 T; - 5 Straddle carriers from 35 to 40 T; - 3 lifts from 8 to 20 T; - 1 Tractor fifth wheel 60 T</p>	<p><u>Activities:</u> (Bulks Solids) + Goods + container + travel + others</p> <p><u>Infrastructure :</u> - 670 ml of quay to -10,50 - ground 17 hectares - Store: 19 440 m2 - Frigo: 7 200 m2</p> <p><u>Equipements :</u> - Rail Cranes 7 6 T; - 1 Crane tire 45 T; - 40 lifts from 1.5 to 7 T; - -12 Tractors 25 T; - 3 Loaders 3.5 m3;</p>

<i>The West platform</i>	<i>The South platform</i>
<p><u>Activities:</u> Traffic Cruises + containers + ore export * Cereals (SOSIPO)</p> <p><u>Infrastructure :</u> - 320 ml of quay to-15m - Median: 03 hectares</p> <p><u>Equipements :</u> - 1 Grasshopper 550 T / H; - 5 Loaders 2.3 to 3.5 m3; - 2 gateways 15 to 18m;</p>	<p><u>Activities:</u> Traffic Hydrocarbons; Sulfuric acid;</p> <p><u>Infrastructure :</u> - 64 ml of quay to - 8m</p> <p><u>Equipements :</u> - 4 Arm unloading 6"; - 3250 ml of pipelines 10";</p>

The port with an annual average traffic of 2,6 million tons, is used in 61 % of its operational capacity (4,3 million tons / year) and in only 43 % of its theoretical capacity[23] ¹ (6 million tons / year) [24].

It thus has important possibilities of development to face the demand of traffic which can be generated in the regions of the South of the Kingdom.

Table 3: refrigerated capacity of the port of Agadir

Public refrigerated warehouse:		Private cooling units and processing fish	
Surface	5500 m2	Number	40 warehouses
Storage capacity	3,500 tons	Superficie occupée	83 270 m2
1000 tons 3 rooms on negative temperature		Units being built	26 000 m2
2500 tonnes dans 8 chambres à température positive			
Installed power of 1260 KVA			

¹ The theoretical capacity of a port terminal is the potential of the existing terms of volume of traffic infrastructure, whereas the organization and mode of operation of this device are optimum.

5. Presentation of the results of the study:

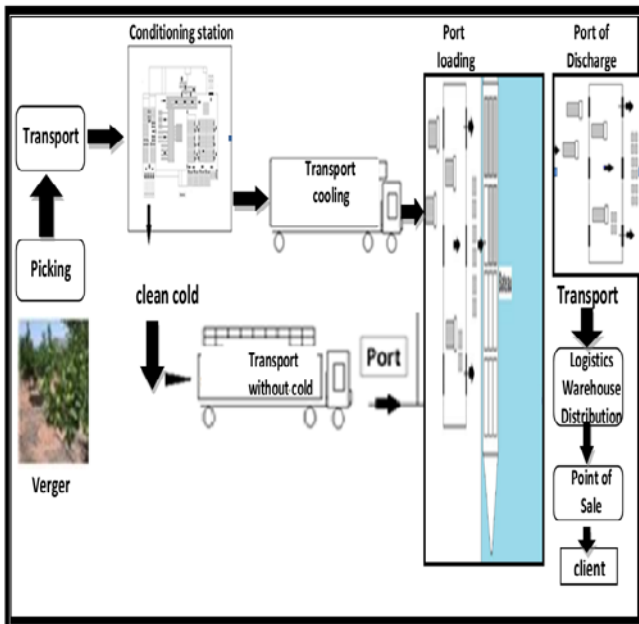
5.1- Approach and results:

With the aim of answering the questions relative to our problem, we proceeded to the realization of this study, by following a deductive reasoning and an approach of qualitative nature, to highlight the role of the logistics grafting that determining element of the best management of the cold chain while lifting the impact of the optimization of this link on the competitiveness of ports; so, we aimed at the understanding of the reality of the harbour operations, by the assistant on the ground of all the stages and the procedures of stopover of ship and operations connected during an internship of three months within department of exploitation Marsa-maroc, the port of Agadir.

So, during our study, we interested in us to have the opinion of the persons in charge of the operations of two main shipping companies and the main participants in the cold chain (2 producers, 2 stations (resorts) of conditioning (packaging), 2 exporters, 1 ground carrier, 1 Stevedores, 1 forwarder and harbor office) through direct conversations of 30 min for each, to detect the common and real dysfunctions, also make them participate to recommend adequate solutions.

The guides of conversations and the direct meetings; allowed us to end in the following result:

- The cold chain of fruits and vegetables appears as follows (“fig 3”):



- The cold chain in the network fruits and vegetables, plays a double strategic role in the reliability of the process of production / marketing; she allows on one hand the conservation of the quality of products between the moment of the harvest and the marketing and on the other hand it makes possible the long-term preservation of products is of four in eight weeks;
- The cold chain of fruits and vegetables generates important physical and informative flows. Since the harvest and until the final consumption, products pass by a chain rather long and complicated by the number of the actors who participate in it;
- Bottlenecks in the cold chain persist at several levels the main things of which are the ones of storage and handling after harvest (during the picking, the fruits and vegetables are put in boxes and stored under trees under temperatures relatively high according to the season and the weather report during a relatively long duration), so at the time of harbour passage (for example in the case of expedition by container, three cases of empotage are possible or in station, in cold storage plant or in port, this last type represents more than 50 % and represents a real problem of break of the cold chain);
- The ground transport between the station of conditioning and the port of load (transport without Genest), also the port of transfer is a brake in the continuity of the cold, indeed, on Temptales put inside container, the persons in charge notice long-term temperature drops which can achieve 12 hours;
- Inadequacies in the network of fruits and vegetables in refrigerated equipments, of specialized handling and safety (slowness in the operations and the damage of products); in spite of all the efforts spread to improve the capacity, present numerous limits bound to the not control of the supply chain of the cold, to the lack of coordination between participants significant number in the chain, and seasonality of the production;
- The transit time and the cost of sea transport are all so critical: indeed if a ship is delayed by the wait in harbour, it involves costs of transport, which are going to inflate the cost of the goods in the import or in the export. So sometimes the customer assumes retaxations caused by the defects of forecasts ;
- The requirements of the cold chain complicate the transportation of goods over longer periods (15-25 days) and increase expenses;

- Absence of interconnection between the participants arranging information systems.

5.2- Discussion of the results:

In the light of these results of our study, we can deduct that the logistics of the managed temperature developed more over the years with the exports towards demanding markets and or distant (EU, the USA, Russia), because the Moroccan exporters were grateful to make level them ways to answer the international standards.

However the sector of fruit and vegetables always knows some constraints influencing directly the factors of the competitiveness of ports (“Table 4”):

Contraints	Factors of competitiveness
- Cold application is not early (weak pre-cooling at the farm);	Service
- The cold chain is not continuous at the national level; - Morocco remains largely under-equipped in terms of transport refrigeration equipment and accessories;	Service and process
- The lack of awareness of the importance of logistics in temperature led among Moroccan companies do not contribute to the emergence of this sector; - The offer advice in this domain a is almost non-existent; - Limited use of EDI, which usually disrupts the fluidity and continuity of flow.	Service, process and environment

Indeed, and by referring to the made conversations we propose a triangle of the competitiveness of ports (“fig 4”) to improve the logistic performance of the port of Agadir and which will be articulated around measures proposed in the short and medium term.

This triangle, based on the three factors of competitiveness (service, process and environment) allows different port stakeholders to identify the main critical points throughout

the cold chain, and recommends some axes to be developed for each factor.

These axes are intended to improve the management of temperature-controlled transport from the verger and up to the final destination, taking into consideration all the regulatory constraints and specificities of the fruit and vegetable sector.

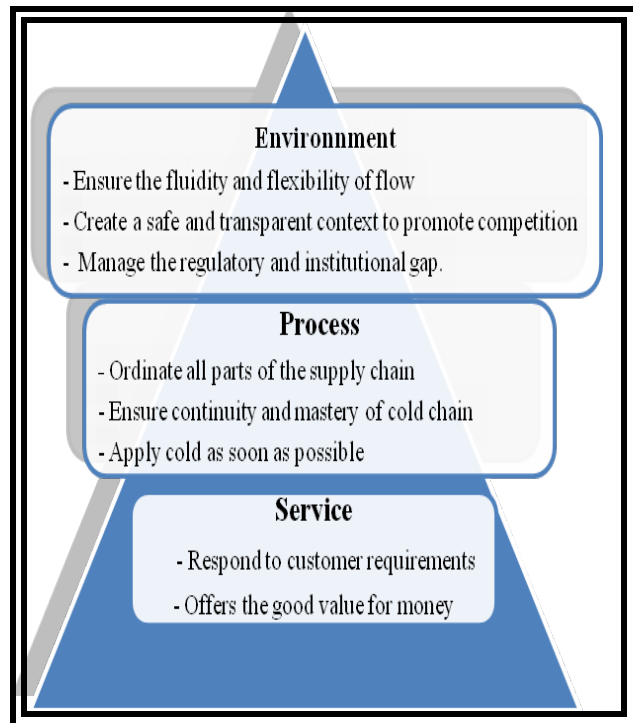


Fig 4: triangle of the improvement of the competitiveness of ports

4. Conclusions

The decrease of the direct and indirect costs, bound to the break of the cold chain, is an essential vector of the improvement of the competitiveness of all the organization. Indeed, according to our study this improvement is connected to the implication of all the participants in the triangle of the competitiveness (performance, process and environment) and in the efficient management of all the supply chain.

However, the biggest priority is situated from the point of view of the logistics management, especially when we treat the case of the seasonal and perishable products, by modernizing the ways of coordination between the various operators and by emphasizing the effective management of the cold chain.

The interest of the term of the cold chain is to underline the importance of the continuity of the stages and to end at the end of the chain in a product protected from any heating, while respecting the temperature imposed by the legislator or by the conditioner for the preservation of the healthiness and the durability of fruits and vegetables.

Now, the durability, throughout the process, is a fixed asset which must be protected, by all the participants of the chain to favor the competitiveness and forbid the competitive advantage of the organization to value the comparative advantages of the country towards its Mediterranean context and seize a part of the market of the maritime international trade.

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