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Multimodal Chains and Transport Interoperability between the Maghreb and Western European Countries: Some Empirical Evidences

Summary

The objective of this paper is the analysis of the multimodal transport chains between Maghreb and Western European Countries.

The paper describes the main results of the Work Package 4 within the DESTIN (Defining and Evaluating a Strategic Transport Infrastructure Network in the Western Mediterranean), a research project under the INCO-MED of the Fifth Framework Programme. Under the methodological point of view, the paper presents an innovative approach as the analysis of the transport chains takes origin from the identification of the related supply chains.

The paper is structured in four sections: the first one defines the key concepts (multimodality, intermodality and interoperability) for the empirical analysis; the second describes the methodology used for the analysis of a transport chains; the third presents the main results of the empirical analysis focussing on three transport chains. In the last section, some conclusion and policy recommendations are given in order to improve the level of interoperability within the region.

Key words: Transport chain, Interoperability, Policy, Maghreb Countries.

Introduction

In the recent years, the European Union has shown great interest towards the Mediterranean Countries, given the increasing economical, political and social interrelationships between the Southern and Northern shores, which has brought to the Barcelona Declaration in 1995.

Without doubt, one of the most important objective of this process is the creation of Euro Mediterranean Free Trade Area (FTA) in 2010 (European Commission, 2001).

To this aim the development of an efficient multimodal transport system, connecting the Mediterranean transport networks to the trans-European network, represents a fundamental issue and requires efforts from both shores in order to improve and modernise transport infrastructures, develop specialised and trained workforce, simplify procedures and harmonise transport technical standards.

Among the all Mediterranean regions, Maghreb is the most important for the European Union for both commercial¹ and political reasons.

Starting from this scenario, DESTIN (Defining and Evaluating a Strategic Transport Infrastructure Network in the Western Mediterranean) - a research project under the INCO-MED programme of the Fifth Framework Programme - attempts to design and apply a decision-support system for the identification and evaluation of a strategic transport network in the Western Mediterranean.

Within DESTIN, IRAT-CNR has been the project leader of WP4, that dealt with the analysis and assessment of the multimodal chains and transport interoperability between Maghreb countries and between each country of this region and Mediterranean countries of EU.

This paper presents the main findings arisen from the empirical analysis of the most representative multimodal transport chains.

The first section of this paper concerns with the concept of multimodality, intermodality and combined transport; the elements (both qualitative and quantitative) - through which the integration between transport modes can be improved - are also discussed. Great attention has also been given to the concept of interoperability, meant as a qualitative characteristic of transport systems.

The second section describes the methodology used to analyse a transport chain

The third section presents the main results of the empirical survey on the structure and the level of interoperability of the most representative which affect the relationships between Maghreb and Western EU countries.

In the last section, some conclusion and recommendations are given in order to improve the level of interoperability within the chain analysed.

¹ The share of exports/imports to/from the EU, accounts for more than 65% of the total in 2001 (Femise, 2003)

1. Key concepts for the analysis of a transport chain

1.1 Multimodal, Intermodal and Combined Transport

It is generally accepted, both in literature and in practice, that multimodality, intermodality and combined transport may be considered as a subset of the concept of transport chain.

It is also recognised that the transport chain is a sequence of transport modes used to carry certain quantity of goods from its origin to its final destination.

Every single consignment is realised by a specific transport chain and can follow the shortest or the fastest path towards its final destination. Depending on economic, technical and legal features, the transport chain can be unimodal, multimodal or intermodal.

Multimodality is a characteristic of a transport network in which at least two modes compete for taking trips in the same corridors (Eurosil, 2000). It provides independent alternative means of travel and therefore more transport options and more capacity on particular corridors. As such, multimodality influences transport efficiency.

The key element of the intermodal transport concept is instead the integration of shipments across modes. The literature on the concept of intermodality has given great attention to the modal integration for both transport chain efficiency and the associated advantages for the various stakeholders (transport operators - both decision makers and executives -, transport clients – the intermediary between demand and transport supply, final customers and Public Institutions).

Nevertheless, it must be acknowledged that, until the recent years, the emphasis was essentially placed on the operational and technical integration of intermodal transport, as well as the shipper and global carriers expectations and requirements.

What has evidently received less attention is the economic integration, e.g. the organisations involved in management, administration and decision-making relating to intermodal transport and contributing to its economic success (Panayides, 2002).

Most intermodality terms can be located between two extremes ranging, from very broad to very narrow definitions:

- “Intermodalism is the carriage or transport of goods between two points by two or more modes or means of transport (such as air, sea, rail and road or inland waterway)” (Muller and Gerhardt, 1989).
- “Intermodal transport is the movement of goods in one loading unit, which uses successively several modes of transport without handling of the goods themselves in changing modes” (CEN, 1997).
- “The movement of goods whereby at least two different modes (road, rail, water, air) are used in a door-to-door transport chain” (European Commission, 1997) .
- “Intermodal transport may be defined as being those integrated movements involving at least two different modes of transport under a single through rate” (Slack, 2001).

While the first definition of intermodality is very broad, because the only condition required is that goods are shipped by two or more modes or means of transport, the others increasingly found that cost effective and time saving transportation systems can be the factor facilitating the commerce between the point of origin to the final destination.

In detail, the definition proposed by the European Conference of Ministers of Transport (CEN, 1997) put a further condition to the intermodal transport - the loading unit - and therefore restricts the term to unitised transport.

Somewhere in-between is the Commission's definition, which considers intermodality a quality indicator of the level of integration between different modes. The economic basis for intermodality is that transport modes can be integrated into a door-to-door transport chain in order to improve the overall efficiency of the transport system.

A global understanding of issues concerning both technical and economic integration can be found in the last definition. According to Slack (2001), intermodal transport has two basic components:

- The transferability of the items transported;
- The provision of door-to-door service.

The first one deals with technical solutions to overcome bottlenecks at the transfer points and reduce the relating high terminal costs. The second one concerns with the organisational structure necessary to provide integrated transport services under a single liability. It is generally easier to overcome technical problems than the organisational difficulties, which frequently involve regulatory restrictions. Some of these difficulties relate to documentation and liability issues, and others derive from co-ordination problems between different modes.

As far as the concept of combined transport is concerned, the definition given in a 1992 directive by the European Council aimed at reducing the overall dominance of the road transport sector by encouraging a shift to other modes with spare and under-exploited capacity. Under its terms, combined transport is defined as: "The intermodal transport where the major part of the journey is by rail, inland waterways or sea and any initial and/or final legs carried out by road is as short as possible".

In other words, while intermodality is aimed at achieving the integration between different modes in order to provide a seamless transport system from point of origin to the final destination, combined transport encourages the shift from road to less environmentally intrusive modes.

1.2. Transport chain interoperability

Interoperability is generally defined as a process where at least two different operating parties or systems work together effectively. Within the transport sector, interoperability allows the interaction between two or more transport system, offering

harmonised interfaces and thus easy access to operators for the provision of intermodal services (Eurosil, 2000).

According to a more extensive definition, the purpose of interoperability is to improve the integration between modes of transport by promoting the use of compatible technological systems and the cooperation between different actors, and by reducing the political and cultural barriers, thus allowing for intermodal transport services at a sustainable level (EU Extra Project, 2001).

As a consequence of the above-mentioned definitions, interoperability can be considered as a prerequisite for intermodality because of its influences on the quality of the transport system as whole.

In order to identify the proper variables for the assessment of the level of interoperability of a transport chain, it is necessary to highlight three different perspectives of analysis, which respectively refer to: dimensions, levels and scales.

As far as the dimensions are concerned, interoperability can be technical, corporate, juridical and cultural.

Technical interoperability mainly deals with operational efficiency of infrastructures, transport means and loading units. The lack of infrastructures or links between modes can hamper the integration between transport modes and generate friction costs² on operators.

In addition, individual operators have a tendency to acquire rolling stock and/or vehicles which suit their operations and choice of loading unit. The presence of a variety of vehicles types for different operators is a source of congestion at terminals and causes of inefficiency in the intermodal transport chain. Finally, the wide variety of loading unit dimensions across modes is another factor which reduces interoperability between modes (Peterlini, 2001).

The second one, e.g. corporate interoperability, occurs when one or more organisations are willing and able to co-operate in the provision of transport services for the users. Many transport firms progressively extended their business from providing an undifferentiated point to point service, to providing more complex service packages. This has strongly encouraged the search for an optimal governance structure between market (strategic alliances) and hierarchy (internal governance).

The third dimension of interoperability, juridical, comes from the need of harmonise transport documents, safety and labour rules, and regulation in the international trade. Currently, it is difficult for intermodal transport users to determine who is the responsible for the shipments (that may be handled by different carriers), given that

² Friction costs are a measurement of the inefficiency of a transport operation. They are expressed in the form of: higher prices; longer journeys, more delays, or less reliability on time; lower availability of quality services; limitations on the type of goods; higher risk of damage to the cargo and more complex administrative procedures (European Commission, 1999).

international transport is generally regulated by different regulations and liability conventions. Moreover, technical specifications for transport means are often regulated differently by Countries and modes, which also raises further problems in the process of modal integration within the transport chain and between different transport systems.

Finally, cultural interoperability stresses the importance of reducing linguistic and cultural barriers, as they can condition the smooth interaction between the actors of the transport chain.

All these dimensions are important for smoothing intermodal transport but, depending on the specific context of application, one dimension may be the priority to be taken in to account. At macro level, technical interoperability, is generally considered more relevant than the other dimensions; for example, the European Transport Policy, gave great attention to the quality issue of links and nodes, (especially harbours and inland terminals) as obstacles to an integrated trans-European transport network. On the contrary, at a micro level, corporate interoperability strictly depends on operators strategic choices (e. g. governance structure, scope and range of services, ecc),and it is therefore critical for the qualitative attributes of supplied intermodal services.

With reference to the level, interoperability can be:

- a) horizontal if there is compatibility or interconnectivity between transport infrastructures, means or ICT, within the same transport system;
- b) vertical if the compatibility or interconnectivity deals with different transport markets.

Finally, interoperability can be distinguished on the basis of different scale:

- The Company scale, which simply examines the interoperability which individual companies experience;
- The Sector scale, which only includes the interoperability between companies using the same mode in the same or different countries;
- The Geographical scale which encompasses the interoperability between companies from different modes within a certain Region.

2. Methodology

In accordance with the key concept discussed above, the analysis of the most representative transport chains between Maghreb and Western Europe countries is based on the adoption of an integrated system perspective. Rather than considering each stage of a transport chain as an independent activity, the study analyses the interactions among all the key elements of a transport chain, including different transport systems, terminals, and the strategies of the operators involved.

To this end, each chain being analysed is investigated at three stages:

- (1) Structure, e.g. the legs and nodes, transportation means and the other stages of the transport chain;
- (2) Strategy, e.g. the transport operators governance structure in the supply of

logistics and transport services.;

- (3) Interoperability, e.g. the interaction between the different transport modes within the transport chains.

Concerning (1), e.g. the identification of the transport chain structure, origin and destination of the goods flows are only the traditional elements; information on transport modes, loading units used and other stages of transport chain (infrastructures involved and interchange points such as seaports, land intermodal yards and terminals) are also needed. What is really new in the identification of transport chains is the supply chains in which they are involved. Indeed, each of supply chains represents specialised segments of the transport market which require different handling techniques and specific logistics and transport services. In other words, these specialised segments of transport market can be considered as the service systems required for:

- the procurement of raw materials and intermediary products or components of a single manufacturing sector (i.e. Automotive, etc.);
- the distribution of the final product to the market.

Accordingly, the global transport market is the sum of the single supply chains, i.e. of the single specialised transport segments.

Regarding (2), i.e. the strategies undertaken by transport operators for the effective and efficient management of transport chains, the analysis focuses on the following issues:

- Structure of the market in each segments of the transport chain, e.g. the level of competition between the actors;
- Scope of Transport & Logistics Services range supplied by several operators; e.g. unimodal or intermodal transport services, value added logistics services (warehousing/distribution or supporting services to the products);
- Make or Buy strategies, e.g. the type of relationships between the actors (spot, short term or long term relationships);
- The use of ICT along the transport chain, e.g. the technological tools currently used (EDI, Intranet, Internet, email and others traditional tools).

With reference to (3), the level of interoperability of the transport chains has been assessed by considering their technical, corporate and juridical dimensions. The cultural interoperability has not been considered at this stage of the analysis because of the hard difficulties in its assessment. Accordingly, we used the following macro attributes for each of the interoperability dimensions:

- Technical interoperability: Compatibility of transport means, equipment and infrastructures; standardisation of loading units (containers, swap bodies, semi-trailers) and operating procedures (e.g. ICT systems); availability of required infrastructures (terminals, access roads, rail services, etc.); and organisational aspects (Co-ordination of transport timetable, etc).

- Corporate interoperability³: Development of strategies based on vertical integration, or cooperation; scope of services range; availability of specialised logistics services; etc.
- Juridical interoperability. It deals with the harmonisation of: regulation, document and liability in the transport chain.

All these issues⁴ have been taken into account in the elaboration of a questionnaire for the empirical survey. The questionnaire has been structured in three parts.

The first one, related to the identification and reconstruction of the most representative transport chains, considers in a different way those related to the Export and those associated to the Import of the Maghreb Countries.

The second part is aimed at getting further elements on the level of integration along these chains, by the analysis the strategic choices of all the actors involved.

The third part of the questionnaire is mainly dedicated to the assessment of the interoperability of transport chains.

The interviewees have been the main operators involved in the inbound or outbound logistics activities. More precisely, we interviewed the importer and the exporter, the Port Authorities, the shipping companies, the hauliers and the railways transport operators involved in each chain. Given the complexity of the questionnaire administration activity - due to both the extent of our analysis and the reticence of the transport operators to answer to some questions – the contribution of Maghreb partners has been of crucial importance.

As far as the identification of the most representative transport chains is concerned, it has been used both quantitative information on goods flows by type and qualitative information on the existing chains for both import and export.

Based on this method, the transport chains showed in table 1 have been selected for the analysis. As it highlights, those chains refers only to the relationships between Maghreb countries and South-West Europe (Italy, France and Spain), because of the negligibility of the intra Maghreb traffic⁵.

³ It is worth mentioning that the analysis of the strategy (transport operators governance structure) and the corporate interoperability refer to different levels; while the former investigates the transport operators' strategic choices in the chains the latter deals with the level of organisational integration of the chain.

⁴ All the aforementioned macro attributes can be distinguish between those affected by logistics and service providers and those by Public Authority. For example, the juridical interoperability, the compatibility or the availability of the required infrastructures are Public Authority's matter, while the governance structure, the operating procedures and the organisational aspects of the transport chain depend on the strategic choices of the logistics and services providers

⁵ For more a complete description of both identification process of the most representative transport chains and the Maghreb transport system see De Martino M. and Morvillo A., 2004, "Multimodal chains and transport interoperability between Maghreb and Western Europe Countries: the results of the DESTIN project", Edizioni EA, Napoli

In this paper only three representative chains are discussed: the Citrus Fruit, the Cereal and the Textile and Clothing transport chains. Indeed, these chains present specific transport requirements which shape differently their structure and interoperability at technical, corporate and juridical levels.

Table 1: The most representative transport chains within the region

		Destination					
		Italy	France	Spain	Algeria	Tunisia	Morocco
Origin	Italy	Intra European Chains				Textile (Raw Materials)	
	France				Cereal Sugar Tr. Vehicle		Cereal Textile (RM) Metal prod.
	Spain				Cement		
	Algeria	Crude petroleum Gas Petroleum products			Intra Maghreb Chains		
			Coal Ch				
	Tunisia	Textile (Final Products)					
Morocco		Textile (FP) Citrus fruits Fertilisers	Non perish. Ferrous min Raw build. Fertilisers				

3. The empirical analysis

3.1. The Citrus Fruit Transport Chain

3.1.1. The chain structure

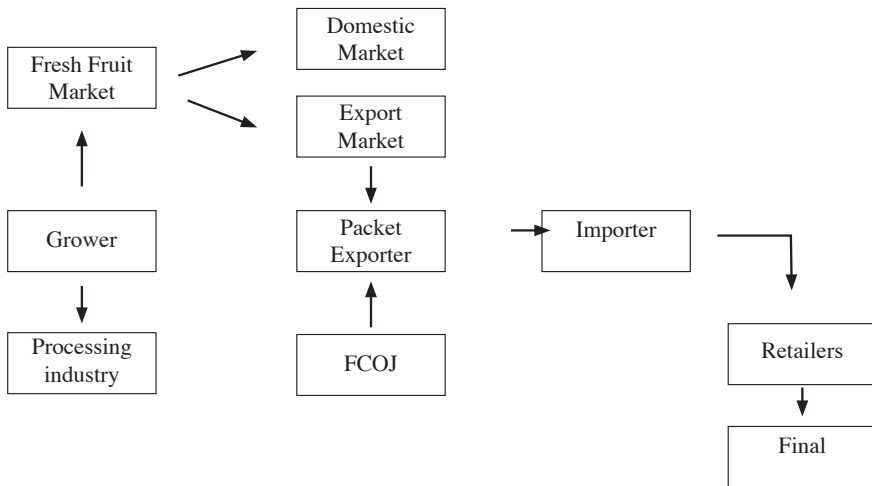
Citrus fruits are usually characterized by their perishable nature. Their conservation requires appropriate storing infrastructure, preferably in the production zones, to insure a better control of the demand.

The starting point of the analysis is the citrus fruit supply chain (figure 1). After the harvest, citrus fruits may go to the fresh fruit market (domestic and export markets) , or it may enter the processing industry in order to obtain orange juice (mainly in the form of Frozen Concentrated Orange Juice (FCOJ) for ease of transport in international trade) and other by-products.

The geographical context of the analysis is Morocco and France, given the outstanding weight of citrus fruits in the Morocco's exportation⁶.

Indeed, the volume of export to France is the most significant within the Western Mediterranean area: about 471.981 tons in 2001 (De Martino M. and Morvillo A., 2004).

Figure: 1: The citrus fruit supply chain



⁶ There are three major citrus production areas in Morocco (ranked by production volume): the Souss Valley, the Central area, and the Oriental region. The Central area has some of the oldest citrus groves, and used to be the largest citrus-producing area in Morocco. In recent years, however, the Souss Valley has surpassed the Central area in production. The Souss Valley is the southernmost citrus production area of Morocco, representing 50% of total agricultural exportation (fruit and firstlings)

As Morocco is a citrus fruit exporter, the stages interested to the analysis are those participating to the upstream process of the supply chain, e.g. from the grower to the export market.

The relevant activities carried out by the players involved in the upstream process (table 2) are described as follows.

Moroccan fruit producers can be distinguished in two categories:

- The small farms, whose production is generally consumed by the family and/or sold on domestic markets;
- Small and medium-sized farms, whose production is export oriented. Some of them have their own packaging and storage facilities. Others sell their products to a larger organisation or subcontract for post-harvest and marketing services they are unable to provide themselves, such as packaging, freezing, storage and transportation.

Cooperative and groups of producers manage the intermediary activity between the producers and retailers. Their role is mainly the gathering of the products from the cooperative's members and the products' quality control, given that most of the producers do not have the financial resources to carry out all the logistics activities needed for the export. Besides the role they play in the selection of products and in the answer to the consumer's requirements (retailers), the cooperatives supply also product conditioning and packaging at the conditioning stations.

Groups of exporters mainly manage the commercial relation with the importer/wholesalers. Apart from defending the interests of associate members, their role is to group consignments together in order to define a single marketing strategy. These groups ensure the provision of logistics and transit services and this is for the benefit of the sites to which they are affiliated. In particular, they manage the export flows by defining:

- List of products authorised for exportation and packaging type, their name and code according to their variety;
- Packaging tables with shorthand and list of different periods;
- General information notice;
- Weekly exportation program to be then sent to the conditioning stations.

In this way commercial information concerning average price per brand and weight, and quantity available on the market, is reported every day by phone or weekly by fax.

After treatment and conditioning operations, the products are sent to ports. Citrus fruits and firstlings transport to port in the Souss-Massa region is exclusively by road, as there is no railway connections.

The road transport concerns ⁷:

- Citrus fruit transport to the conditioning centre and from there (after processing) right to the port. This activity is generally organised by the Cooperatives and groups of producers and exports' groups, and performed by local hauliers;
- The Transport International Routier (TIR), which is characterized by an increasing involvement of French and Spanish hauliers; these last have strengthened their presence since the signature of agreements on the agricultural products transit by road.

Once arrived in the port of Agadir, the Autonomous Establishment for the Control and Coordination of Exports (EACCE) - a public establishment under the aegis of the Ministry of Agriculture - is responsible for ensuring a qualitative and quantitative follow-up of exports of fruit and vegetables⁸. The main activities of the EACCE are related to:

- Definition of minimal rules for quality and presentation;
- Preparation, application and control of regulations relating to norms;
- Control and advice for production and packaging;
- Coordination of exports' activities in relation to supply to the market;
- Promotion abroad of Moroccan goods

The maritime operator is the COMANAV (Moroccan Navigation Company), that has currently undertaken a reorganisation process (increase of the capital thanks to the participation of the French financial society) with the aim to modernise the fleet. The conditioning modes are mostly by conventional cargoes (pallets), a small quantity by refrigerated lorries (Ro/Ro) and an increasing share in container. The use of pallet is a consequence of the technical characteristics of road trailer, not yet adequate for the transport of ISO containers.

⁷ With reference to the road transport, before the application in 2003 of the law 16.99, the regulations distinguish two kinds of transport: transport on own account and transport on behalf of others. For each kind of transport, rules have been defined according to the total weight and freight of camions:

- On own account: transport has been free for lorries of less than 8 tons. On the contrary a transit permit was compulsory for lorries of more than 8 tons.
- On behalf of others: for lorries whose tonnage is between 20 and 40 tons, a permit from ONT has been necessary and freights must pass through ONT.

⁸ Following the liberalisation of external trade, the EACCE is acting in a framework organised for the regulation of Moroccan exports of fruit and vegetables. This regulation is both qualitative and quantitative, as it concerns the prevention of effects which would be prejudicial for the profitability and the competitiveness of Moroccan exporters.

Table 2: The structure of the upstream process of the Citrus Fruit Supply Chain in the Souss – Massa region

Supply Chain	Transport Chain	Actors	Activities
		Producers	Collection
		Cooperatives and prod. groups Exports' Groups	Collection, washing, pre.-drying and quality control
		Local Hauliers French and Spanish Hauliers	Road transport from the Souss-Massa region to the conditioning centres and from these to the port of Agadir International Road Transport (TIR)
		Cooperatives and prod. groups Exports' Groups	Selection, weighing, quality control and conditioning in palettes in conditioning centres.
		Agadir Port Authority	Handling and temporary storage
		EACCE	Definition and application of the framework for the regulation of Moroccan export fruit
		CO.MA.NAV	Only transport by conventional cargoes (palettes) to the port of Marseille - Fos
		France Importer	

Source: Own elaboration

3.1.2. The Transport Chain interoperability

The main weaknesses of citrus fruit transport chain arise from the port of Agadir, not sufficiently adequate to support the efficiency along the supply chain. In fact, the main problems are related to the technical/operational interoperability (table 3.)

In details, the port of Agadir imposes several obstacles to the exporters in terms of:

- Long transit time in upstream stages of the transport chain due to the low interconnections between road and maritime transport;
- Unavailability of “reception” infrastructure, as there are no refrigerated warehouses capable of storing the products for the export;
- Difficulty in connecting production area, conditioning station and port by railways.

Table 3: The Citrus Transport Chain interoperability

		Weaknesses
Interoperability	Technical/ Operational	Long transit time at ports (especially Agadir); Lack of interconnection (especially railway) between production areas, conditioning centred and loading ports; Low diffusion of ITC; Lack of refrigerated warehouse at ports.
	Corporate	Low frequency of maritime services and inadequacy of geographical network; Low flexibility in the organisation of the transport services; High control of foreign operators of VA logistics services and international road transport (TIR);
	Juridical	Lack of harmonisation

Moreover, the port of Agadir is threatened by the improvement of the road network to Tangier (the motorway Tangier – Settat and soon Marrakech-Tangier), that could capture a great share of future traffic.

With regard to this assessment, it is also important to highlight the low diffusion of ICT along the chain that causes additional logistics costs; as it is well known, data transmission and real time information about the position of goods can lead to a stock reduction both in the production and in the physical distribution.

With reference to the corporate interoperability, the analysis of the Souss-Massa transport chain allows for the identification of the following specific problems:

- Low frequencies of shipping departures;
- Low flexibility in the organisation of the transport services;
- Low reliability of shipments of the road haulage (if the lorry misses the ship,

the waiting time for next ship is very high);

- Lack of referee lorry (too expensive and under the monopoly of the European operator) as a consequence of the low level of technologies applications;
- Maritime lines limited to some destinations;
- Maritime transport inadequate to the new tendencies of the distribution in Europe (lack of reliability due to the irregularity of the supply).

In particular, the shipping company supplies services characterised by a low level of quality in terms of flexibility, frequency and reliability. The poor circulation of information have important consequences on products competitiveness, especially in terms of time (product deliveries at importer premises and waiting time of the ships in the ports) and logistics costs.

International transport by road (TIR) and refrigerated transport are generally performed by companies belonging to foreign companies (that control the market through their own branches).

Finally, the juridical interoperability suffers from the lack of adequate regulations and lack of standardisation of the transport procedures along the chain. Although the entry in force of law 16.99 on 13.3.2003 contributed to partially reduce the inefficacy of regulations that hindered transport on third parties hauliers, the taxation system still remains relatively heavy. In general the juridical framework built up several barriers that do not incite investments in the transport sector; such a situation generates high social costs and a loss of gain for all economic operators.

3.2. The Cereal Transport Chain

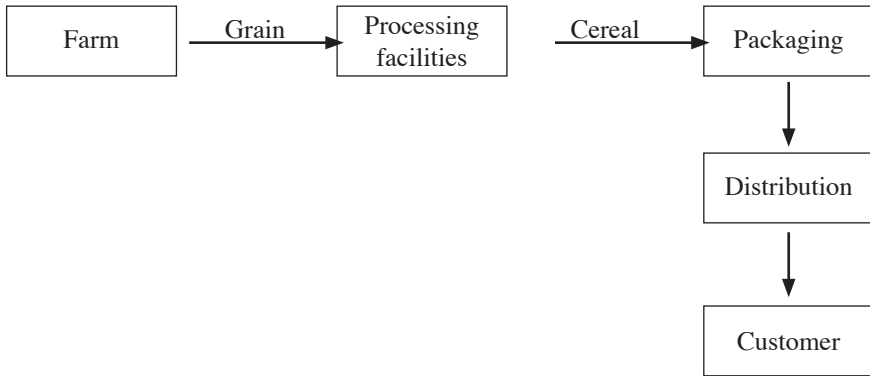
3.2.1. The Chain Structure

The Cereal Supply Chain is the ensemble of the activities including grain procurement, processing, packaging and distribution of the cereal to the final customer (figure 2).

The transport chain analysed refers to France and Algeria relationships, due to the outstanding weight of the France's exportation to Algeria, about 1 million tons in 2001⁹ (De Martino M. and Morvillo A., 2004).

⁹ The 70% of the cereal importation is concentrated in 4 Algerian ports: Alger, Oran ,Djen Djen et Bejaia

Figure: 2: The cereal supply chain



As Algeria is an importer of cereal, the analysis focuses on the downstream process of the chain, e.g. all the activities carried out to import the cereal from the port of Marseilles (after the grain processing) to the final distribution. The chain structure is described in table 4.

The importers - Office Algérien Interprofessionnel des Céréales (OAIC) and Office National des Aliments du Bétail (ONAB) - have the whole control of the outbound logistics: they outsource the maritime transport to third parties, while the road transport is managed and controlled by their own resources and structures.

Once the cereals are unloaded at the port of Alger, they are transported by road or rail to the OIAC’s silos or to the ERIAD’s (Enterprises Régionales de transformation des céréales) processing facilities for the production of flour and bran.

These flows are directly managed by the importers by short term relationships for what the maritime transport is concerned while for the inland distribution the internal growth (by its own resource and structure) is the preferred form of control. Regarding the railway transport (accounting for 12% of the inland distribution), the importers set up only spot relationships with STG¹⁰ as the market is still under the monopoly of SNTF (National Railways Company).

With reference to value added logistics services, the importers prefer to directly control the warehousing and distribution services such as storage, order processing, stock control and custom documentation.

¹⁰ Société de Transport de Grains (STG) is a joint venture between SNTF and OAIC

The main national shipping company, CNAN (Compagnie National Algérienne de Navigation), has undertaken an important process of re-organisation ending with the creation of a new company SNTM/CNAN (Société National Transport Maritime).¹¹

More specifically, within the cereal supply chain, SNTM/CNAN supplies port to port services between the port of Marseille – Fos and Alger. There is no further involvement of this shipping company in other steps of the supply chain.

The track and trace are not supplied because of :

- The kind of the goods transported (Bulk)
- The low level of diffusion of ITC in this chain.

The final distribution of cereals concerns mainly two flows:

- The OIAC's distribution network from the stocking points to the point of sales;
- The delivery from the ERIADs' processing facilities and to the point of sales.

Both services are mainly performed by local hauliers (generally belonging to the importers) or by STG. The latter is increasingly becoming more specialised in the distribution; besides the inland transportation, it supplies the cross-docking for the distribution of cereals to different regional points of sales.

¹¹ In the past CNAN was involved in the hydrocarbon transport and in the towing activity.

Table 4: The Structure of the downstream process of the Cereal Supply Chain

Supply Chain	Transport Chain	Actors	Activities
Harvest	Inland	ONAB	Cereal Import
		CNAN	Bulk transport from the port of Marseille - Fos to the port of Alger
Export	Port	Alger port Authority	Handling
		OIAC	Storage
Export	Maritime	ONAB	Road Transport towards processing facilities (ERIAD), stocking and packaging sites,
		OIAC	Value added logistic services (<i>storage, order processing, stok control and custom documentation</i>)
		STG	Rail Transport towards processing facilities (ERIAD), stocking and packaging sites,
Export	Export	OIAC	Distribution from stock of point o processing facilities to point of sales Through its own account o by STG
		STG	Rail Transport and cross docking for the distribution to regional point of sales

Source: Own elaboration

3.2.2. Cereal Transport Chain interoperability

Two factors affect deeply, among others, the technical/operational interoperability in the chain (table 5):

- the lack of inland connections especially railways;
- the lack of common standard interface for EDI.

The lack of inland connections, especially between ports and the railway system, is perceived as the main weakness of the chain as it poses constraints on the cargo delivery to the final destination and affects the performance of the whole transport chain in terms of reliability and logistic costs. In more detail, the main critical factors of the railway systems are:

- the infrastructure dimension and adequacy;
- the commercial strategies of the main operators;
- and the adequacy of the transport means to the user needs.

The last two are mainly a consequence of the market structure (monopoly) and they highlight a lack of customer oriented strategies of rail companies.

With reference to the lack of common standard interface for EDI, technological advances in ICT significantly improve information exchange in terms of lead-time, completeness and transparency. Clearly ICT can enhance chain integration, but it requires systems compatibility within the port community and among the actors of the chain. The establishment of common interfaces for EDI system could provide many benefits to the operators, such as reductions in document processing costs and lead time.

Table 5: The Cereal Transport Chain: main weaknesses

		Weaknesses
Interoperability	Technical/ Operational	Lack of inland connections (especially railways) Lack of common standard interface for EDI Inadequate structure and old equipments Lack of space within ports (for the supply of value-added logistics services)
	Corporate	Lack of specialised logistics services Low quality of basic and V.A. services at terminals (that impose high costs) Structure of supplier's market (monopoly of railway and port services) Low quality of the supplied services (reliability, frequency, flexibility; etc.)
	Juridical	Lack of harmonisation Hindrances of administrative and bureaucratic procedures

Source: Own elaboration

The other weaknesses concern port infrastructures and equipment, such as:

- the lack of space for the handling (and temporary store of the goods) and the supply of value added logistic services;
- the wharf depth that poses constraints for the ships dimensions.

In particular, the physical location of logistics infrastructures (i.e. districkpark¹²) is becoming very important because of their contribution to the improvement to operational effectiveness and the increasing the range of value-added logistic services.

With reference to the corporate interoperability, the main weaknesses are related to the maritime and basic terminal services (handling, storage). This is mainly a consequence of the structure of the maritime and port market that, even though different efforts have been carried out to open the market to private participation, it is still characterised by monopolistic situations. As a result, the high handling and port costs, as well as the low qualitative level of maritime and logistic services, affect the whole transport chain in terms of effectiveness and reliability.

Finally, regarding the juridical interoperability, the main problems seem to be related to:

- the hindrances of administrative and bureaucratic procedures (different permits and authorizations related to transport, custom, port,...);
- the lack of cooperation and coordination between customs and non customs-officer, creating frequent “break” of load along the transport chains.

3.3. Textile and Clothing Transport Chain

3.3.1. The Textile – Clothing Chain Structure

The textile and clothing supply chain embraces several different sets of activities. Indeed, designing, styling, cutting and assembling clothing and the wide range of ways in which they can be combined, have an important impact on the organisation of the chain. From this point of view, organisation essentially depends on the extent to which these activities are integrated within individual enterprises and where these activities are located.

Some companies of the sector directly manage fabric procurement, product design and marketing while outsourcing manufacturing to third parties. With specific reference to Europe and Morocco relationships it is worth mentioning that:

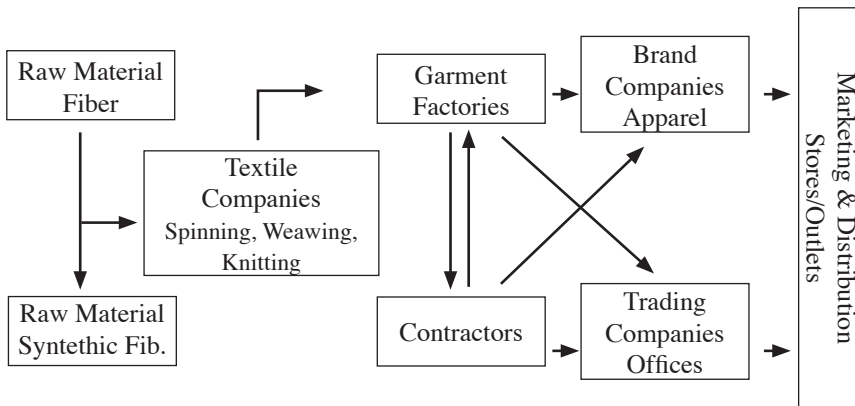
- Companies in EU countries export fabrics or parts of garments to Morocco and then import semi-finished and fully-formed clothes to be then re-exported.

¹² Distriparks are logistics areas where the commodities are sorted, submitted to treatments that add value (assemblage, packaging, quality control, etc.) and then.

- The EU control of the supply chain has brought in Morocco considerable foreign investment and a skilled industrial workforce over the years. However this country has not invested in developing its own competencies, such as high value design and marketing skills.
- In order to smooth the chain, most exporting companies have their own hauliers and custom offices in Morocco.

An example of a textile and clothing supply chain is shown in figure 3.

Figure 3: The Textile and Clothing supply chain



The importance of textile and clothing trade between Morocco and Spain is underlined by very high volume of traffic developed in 2001: the raw material import from Spain was about 147.000 tons while the final goods export to Spain was about 61.000 tons (De Martino M. and Morvillo A., 2004).

With reference to the management and control of such a supply chain, the Spanish firms have a leading role (table 6).

Moroccan clothing companies tend to provide only the key manual assembly operations (cut, make, and trim - CMT) to Spanish companies, which design garments and source raw materials from overseas. Some local companies provide all CMT operation in-house; others outsource some of this activities to subcontractor services to better meet Spanish clients' demands.

Within such a context, the port of Algeciras has a central role, accounting for the 80% of the total export of raw materials and 88% of the total import of semi-finished and finished products.

In Casablanca and Tanger there are 10 branches of big foreign groups for the TIR services, such as Gefco Morocco and Tibbett & Britten, working on the behalf of the Spanish and others foreign clothing companies. These offer truck and sea transportation of textiles to/from Morocco, and also process customs clearance, offer bonded warehousing and local delivery.

The trailers are directly loaded on the vessels at the port of Casablanca and Tanger towards the port Cadiz and Algeciras. The shipping companies ensure the following daily connections:

- Casablanca – Cadiz; Ro/Ro services supplied by Comanav and Comarship;
- Tanger – Algeciras; Ro/Ro and car/ferry services supplied by Intercona, Comarit, Limadet and Comarship.

The Tanger – Algeciras service is the most important in the textile and clothing chain given the high frequency of the services and the transport capacity of trailers.

With reference to the maritime transport, COMANAV offers the following services: Ro/Ro and conventional between Casablanca and Tanger with a frequency of 5 rotations a week. The travel time is about 16 hours.

Comarship, Intercona, Comarit offer the following services:

- Ro/Ro between Casablanca and Cadiz, and between Tanger and Cadiz;
- Car/ferry between Tanger and Algeciras.

The last services is particularly important within this transport chain given the high frequency of the services - 15 rotations per day - allowing a trailers transportation of 70.000 units per year.

Table 6: The Structure of the Textile – Clothing Supply Chain

Supply Chain	Transport Chain	Actors	Activities
	Maritime	Spanish Clothing company	Design garments and source raw material to Moroccan company
	Port	CO.MA.NAV. Comarship, Intercona, Comarit	Ro-Ro services from Cadiz to Casablanca (COMANAV and Comarship) Ro-Ro service from Algeciras to Tanger (Intercona and Comarit)
	Inland	Casablanca Port Authority Tanger Port Authority	Port Handlinh
	Inland	Gefco Morocco and Tibbet & Britten and other 8 branches	Operate on the behalf of big foreign Groups to provide the following services: Int. Road Transport process custom clearance, bonded warehousing , mar. transport organization and local delivery
	Port	Local textile company	Key manual assembly operations (Cut, make and trim)
	Inland	Gefco Morocco and Tibbet & Britten and other 8 branches	Operate on the behalf of big foreign Groups and provide the following services: local pick up, Inter. Road Transport process custom clearance, bonded warehousing, mar. transport organization
	Port	Casablanca Port Authority Tanger Port Authority	Port Handling
	Maritime	CO.MA.NAV. Comarship, Intercona, Comarit	Ro-Ro services from Cadiz to Casablanca (COMANAV and Comarship) Ro-Ro service from Algeciras to Tanger (Intercona and Comarit)
		Spanish Clothing company	Domestic and International distribution

Source: Own elaboration

3.3.2. The Textile Transport Chain interoperability.

The critical factors of the interoperability are shown in the table 7; in detail, the most important weaknesses of the chain are those affecting the transportation and handling costs and the reliability in supplying door-to-door services.

The lack of inland connections poses serious problems in the organisation and synchronisation of material flows to the manufacturing plants and ports.

Currently, most of the Moroccan ports are not connected to the railroad system.

The port of Tanger, which has most of the traffic to European destinations, has serious constraints in relation to the railway connections because the wagons can not enter into the port and the station of Tangiers-Port has been suppressed.

The Port of Casablanca has railway connections, but the road transport is more convenient in terms of costs and flexibility as the time for the loading/unloading operations and the customs clearance are too unpredictable for the coordination of a transport timetable. Thus, the haulage is the preferred mode of transport both for the delivery of raw materials (unloaded in the port of Tanger and Casablanca) to the production plants and for delivery of semi-finished products to the port of Tanger and Casablanca for exports.

Table 7: The Textile and Clothing Transport Chain interoperability

		Weaknesses
Interoperability	Technical/ Operational	Lack of inland connections (especially railways) Lack common standard interface for information and data exchange (EDI, etc.) Lack of unitisation of loading units along the transport chain; Lack of logistics platform
	Corporate	Low quality of Maritime services (frequency and high costs)
	Juridical	Lack of harmonisation of transport procedures

A part from the problems related to the inland connections, the issue of the common standard interface for information and data exchange is of crucial importance.

The Textile-Clothing supply chain is characterised by great number of actors (clothing manufacturers, fabric suppliers, darn services suppliers, etc.) who work together for realising the final products. As the production lots are becoming smaller, more customised and with shorter time requirements then the past, the need of Information and Communication Technologies are determinant for the management

of the inbound and outbound flows of the chain.¹³

However, the size of the Moroccan enterprises and their cultural tradition seem to prevent to find out a common exchange format (standards). For this reason, the foreign companies have located their own production plants and branches in Morocco, implementing their own technological systems for data exchanges.

Regarding the lack of unitisation of the loading units along the chain, it refers to The changing of the load unit (such as from container to pallet) between the different modes of transport; this increases time and costs, and reduces the reliability of the whole supply chain.

The lack of logistics platforms is the last factors hampering the technical/operational interoperability¹⁴. Such platforms would generate higher value added through the supply of a complex package of logistics and transport services such as consolidation and deconsolidation of the cargo, labelling and pricing, custom, banks, insurances, and they could constitute an ideal hub for the information and data exchange among all the actors of the chain.

With reference to the corporate interoperability, the low quality of the maritime services is the main weakness. The current monopolistic situation of the port services (towage, pilotage and mooring) and the inefficiency in the handling of the goods impose higher costs on the shipping companies and therefore on the final client of the supply chain. In addition, these factors have also impact on the services quality in terms of reliability and frequency.

Finally, even though progresses have been done to harmonise the procedures among the two shores, the customs and transport documents are still complex and generate delays and costs. Cross-border cooperation between custom authorities and ports could reduce the number of document and minimise clearance time.

4. Conclusions and recomtendations on interoperability

The empirical analysis of the most representative transport chains has highlighted a low level of integration due to problems arising in relation to the technical/operational, corporate and juridical interoperability.

¹³ The producer has a strong interest in knowing when the cargo will be available and whether the announced date of delivery is reliable. The former has repercussions on operating costs while the latter is an essential input in the production planning process (especially for flows synchronisation). Therefore, the development of common standard interface for EDI affects competitiveness of the company on international markets and favours the pursuit of J.I.T. strategies and the efficient management of the inventory level

¹⁴ It is important to mention that multiple projects for the creation of logistics platforms are in progress, both undertaken by private offices (ONCF, HAVE, ONDEA), and public communities (ODEP, Port of Tangier-MED).

First of all, ports are a major bottleneck in transport chains. Such an information, quite predictable given the predominance of the maritime transport in the EU- Maghreb trade, has been further detailed by the empirical analysis. Indeed the specific factors preventing ports to efficiently fulfil their role as primary modal interface in transport chains can be summarised as follows:

- Public owned and strongly protected by public monopoly;
- Highly inefficient and expensive port handling services generally with a bad coordination and monopolised by unions;
- Lacking of: customer orientation; modern infrastructures and handling equipment; competent management skills; IT infrastructures and know-how;
- Customs procedures.

In general, Government acceptance of Landlord Port model and Private Sector Participations (PSP) in ports has only just begun in the form of terminal concessions. In fact, the three Maghreb Countries have recently introduced private participation in port investment and operations. However the use of concessions is thus far largely confined to stevedoring concessions for new container and bulk terminals.

As a consequence of a market structure still with monopolistic situations, the inbound and outbound logistics are generally fragmented. In the transport chains analysed, the provision of port services is in the hands of public bodies and the lack of customer orientation (especially in terms of reliability, security and frequency) causes higher logistics costs to the final client.

For operational efficiency, vertical integration of port management and service provision is needed. Concessions should be awarded to private operators on the basis of competitive tenders and accompanied by transparent regulation to prevent an extraction of monopoly rents. To provide warehousing and storage services (often in conjunction with stevedoring services), private companies should be permitted to lease existing storage facilities or available space to construct their own warehouses.

Others bottlenecks stem from border-related controls, especially customs. Currently, significant progress has been realised to obtain faster and more efficient inspection and clearing procedures. In countries like Morocco, customs reforms have reduced delays dramatically and other MPs have now started to tackle border related frictions. While most of those reforms will have to take place at the national level, cross-border cooperation will also be needed.

Regarding inland transport, the haulage in most Maghreb Countries is rather competitive with respect to the railways. The industry is dominated by the private sector, but further deregulation of prices and market access would enhance efficiency.

In cross-border haulage, the harmonization of standards for equipment and personnel, as well as the liberalization of cabotage and rights of establishment would be desirable from an economic point of view. Nonetheless, further benefits would arise from liberalizing market access and tariffs, reducing formalities at border crossings, and reducing negative externalities through stricter environmental and

safety standards.

The railway system represents the weakest link for all the chains, due to of different factors, such as:

- Lack of dedicated railways terminals within ports;
- Capacity constraints on some lines due to the low level of technological development (in some corridors there are still single track);
- Inadequacy of railways lines within ports (generally these are aligned along the quays and so they are not suitable for container handling);
- Low network configurations both at level of single country and between Maghreb;
- Lack of interconnection with the major seaports

In this mode, opportunities for the introduction of private participation and competition are more limited. Morocco has implemented a comprehensive and successful restructuring program in recent years that other Mediterranean countries should be looking at. Railway companies lack modern commercial management and many are incurring heavy losses. Overstaffing and the outsourcing of maintenance work to the private sector are other issues to be addressed. The facilitation of equipment and personnel transfer at border crossings, and the opening of key routes to private freight operators could also yield significant benefits.

Finally, Information and Communication Technology (ICT) is of crucial importance for all the chains analysed. The effective processing of information and exchange of documents are a prerequisite for the smooth flow of goods. For instance, the effective application of Electronic Data Interchange (EDI) requires changes in the way the transport sector operates. In Maghreb, outdated sector structures still prevent the effective use of modern ICT tools. Infrastructural investments and commercial management and competition in all parts of the sector are needed, as well as the adoption of EDI by customs authorities and the reduction of bureaucratic frictions. The introduction of EDI (Electronic Data Interchange) in ports will allow remarkable improvement of the fluidity of the flows of goods. It has to be realised by operators in charge of the management of infrastructures and users (transport operators) in order to be really effective. Telematics is also necessary for improving security in each transport mode and relations between operators in the transport chain.

To conclude, some recommendations are given in order to improve the interoperability of the transport chains within the region.

As far as rail transport is concerned, there is a need for an improvement of sections capacity, their electrification and a modernisation of signalling and communication systems. All these actions will contribute to the enhancement of service quality and capacity and will be completed through:

- The creation of a Maghreb company for the exploitation of the railway network leaving infrastructure building to national firms;
- The implementation of an independent regulatory authority in charge with transport tariffs, the profitability and the effectiveness of the concession society.

In field of road transport, actions to be developed are:

- The improvement of road transport operator profile, through training programme and the certification of operators' competences;
- The harmonisation of the regulatory framework;
- The fluidity of TIR traffics through the creation of "freight village" in order to ensure customs and administrative procedures outside ports;
- The creation of logistics platforms, endowed with new technologies;
- The participation of private sector in the financing and exploitation of road transport infrastructures.

Regarding maritime transport, new actions should be concerned with, above all, the development of infrastructures and the modernisation of ports in order to increase their productivity and to catch significant traffics.

In relation to the TIR and intercontinental relations, the improvement of the port of Tanger is necessary given its geographic position as nodal point for hinterland. The Moroccan government decided to build a new port, Tanger Méditerranée .

Other projects are related to the "fluidification" of transport chains through the implementation of EDI and the improvement of maritime security through the construction of control towers and the support of VTS (Vessel Traffic System). In particular, they are concerned with the VTS project in Casablanca, Alger et Radès and EDI project in Casablanca and Alger as well as the container terminal in Alger, the transshipment terminal in Djen Djen and the extension of the container terminal in Oran.

Complementary measures are aimed at:

- Transforming ports in dynamic hubs in the international traffics;
- Implementing regulatory and institutional reforms for the redistribution of public and private sectors functions and the promotion of private operators participation;
- Harmonising and facilitating administrative and customs procedures;
- Liberalising progressively port services;
- Developing awareness of the rapid increase of container transport and creating a feeder system at regional level;
- Consolidating actions for maritime navigation security and marine environment protection;
- Modernising communication systems and appliances;
- Adhering and implementing international conventions (MARPOL, FAL, ..).

In order to harmonise administrative and customs procedures, the followings actions are required :

- The identification and analysis of regulatory and operational obstacles to transport fluidification as well as the implementation of actions aiming at their removal;
- The implementation of international conventions and agreements;
- The development of a regulatory framework in line with EU regulations;

- The introduction of the new information and communication technologies in ports;
- The organisation of training initiatives on procedures with the cooperation of competent institutions.

Finally the accessibility and capability to serve the territory represent remarkable obstacles for better exploitation of infrastructures. In fact, transport networks have to ensure not only appropriate capacity but also the capability to sufficiently serve the territory. In more detail, they have to allow the access of a great part of the population and economic sectors to international poles of exchange (ports, airports, etc.)

Currently, the access to economic centres (main cities) is relatively scarce. Accessible areas are distributed in a concentric way around these centres (Casablanca, Alger, Tunis). The construction of the trans-Maghreb motorway will allow the coastal areas to rapidly access these centres. Finally, the future realisation of the high speed routes from the French borders to Barcelona and Madrid and from Séville to Algéciras will lead to a significant increase of accessibility. Also, the modernisation of the Tanager-Tunis railway and the realisation of the fixed link across the Straits of Gibraltar will allow the supply of new, "high speed" services to southern Europe and the development of combined transport between Maghreb and Europe.

All these afore-mentioned measures are important for the development of integrated transport chains and therefore for the efficient and effective exploitation of all the potential of the multimodal transport system in the Maghreb.

The importance of the fluidity of multimodal transport chains is increasingly crucial, especially in the perspective of the development of performing logistics chains for value-added products.

To this end, it is necessary not only to improve the performance of the different transport modes but also to develop effective intermodal terminals or exchange nodes. In this respect, a major role is played by logistics platforms which can allow better connections between the different modes and ensure value-added logistics services, such as stocking, clearance and goods conditioning.

These kind of services are well developed in Europe, but are quite non-existent in the Maghreb where the only combined services are supplied by railway operators.

Currently, the volumes of containerised goods are still scarce and the quality of services for each mode of transport is relatively low. Furthermore, there are very few projects concerning the development of logistics platforms. Nevertheless, this situation ought to be analysed with particular reference to four main points:

- The fluidity of goods leaving big ports, with direct railway connections;
- The fluidity of TIR traffics, in particular across the Straits of Gibraltar, with the development of "freight villages" allowing to host vehicles and ensure customs operations outside ports;
- The development of combined transport services in order to include private transport operators in railway terminals;
- The introduction of information systems along the transport chain.

These last initiatives will undoubtedly have the quickest impact, reducing complexity of administrative procedures, especially in the case where information systems implemented are interoperable with European systems.

With regard to rail-road combined transport, current traffics are still very scarce and do not need huge infrastructural investments. In fact, attention should focus on the development of containers and trailers parks.

In conclusion, policy reform and infrastructures investment should be prioritised and coordinated between the Maghreb countries, with the objective to increase traffic flows efficiency (costs, time and reliability). The removal of political, administrative and tariffs barriers at the land borders will facilitate the south-south integration and it will extend the ports hinterlands beyond national borders.

Other than regulatory reform, physical integration through connecting infrastructures is needed. As discussed before, such investment decisions should be made by private operators. The role of policy makers should primarily be confined to the creation of an enabling regulatory framework. Modern infrastructures need to be developed in order to extend rail and road networks into ports.

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Multimodalni lanac i interoperabilnost između zemalja Maghreba i zapadnoeuropskih zemalja - neki empirijski dokazi

Sažetak

Cilj je ovoga rada analiza multimodalnoga prometnog lanca između Maghreba i zapadnoeuropskih zemalja.

U radu su opisani glavni nalazi Radnoga paketa 4 u okviru znanstveno-istraživačkog programa DESTIN (Defining and Evaluating a Strategic Transport Infrastructure Network in the Western Mediterranean – Definiranje i procjena strateške mreže prometne infrastrukture u zapadnom Sredozemlju) koji provodi INCO-MED Petog okvirnog programa. S metodološkoga stajališta, ovaj rad predstavlja jedan novi pristup u kojem analiza prometnih lanaca počiva na prepoznavanju odnosnih dobavljačkih lanaca.

Rad je podijeljen u četiri cjeline: prva utvrđuje ključne koncepcije (multimodalnost, intermodalnost i interoperabilnost) za empirijsku analizu; druga opisuje metodologiju analiziranja prometnih lanaca; treća iznosi glavne rezultate empirijske analize koji su usmjereni na tri prometna lanca. U posljednjoj su cjelini izneseni neki zaključci i preporuke u svezi s politikom za podizanje stupnja interoperabilnosti u odnosnoj regiji.

Cljučne riječi: prometni lanac, interoperabilnost, politika, zemlje Maghreba

L'interoperabilità delle catene multimodali tra i paesi del Maghreb e quelli dell'europa occidentale: alcune evidenze empiriche.

Sommario

L'obiettivo del presente lavoro è rappresentato dall'analisi delle catene di trasporto multimodali tra i paesi del Maghreb e quelli dell'Europa Occidentale. Il lavoro descrive i risultati più significativi del work package 4 del Progetto DESTIN finanziato nell'ambito del Quinto programma Quadro. Sotto il profilo metodologico, il lavoro si caratterizza per un approccio innovativo in quanto l'analisi delle catene di trasporto parte dalla identificazione delle supply chain che caratterizzano i settori di riferimento. Il lavoro si articola in quattro sezioni: la prima definisce i concetti di base (multimodalità, intermodalità, interoperabilità) utilizzati ai fini dell'analisi empirica; la seconda descrive la metodologia impiegata per analizzare una catena di trasporto; la terza presenta i principali risultati dell'analisi empirica focalizzandosi su tre catene di trasporto rappresentative della realtà indagata. Nell'ultima parte vengono delineate alcune interessanti indicazioni di policy tese a migliorare il livello di interoperabilità nella regione.

Parole chiave: catene di trasporto, interoperabilità, policy, paesi del Maghreb.

