

STRUCTURAL FACTORS FOR A THIRD-GENERATION PORT: PLANNING INTERVENTIONS FOR AGRI-FOOD LOGISTICS IN GIOIA TAURO, ITALY

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ABSTRACT

Ports play a decisive role in the economic system of countries, but also in the economy of the territory where they are located, acting as gates for the exchange of people and goods. Gioia Tauro is one of the main commercial ports in Italy, located in Calabria. Today, it is specialized in container transshipment operations and it has a great expansion capacity to become a third-generation port. In Calabria, there is a demand for logistics relating to different sectors present in the regional economy; however, this demand remains unsatisfied due to the presence of different problems. The agri-food sector, in particular, is one of the most important in Calabria and it is a distinctive element of regional productions. The main problems hindering the expansion of agri-food sector are: low innovation, small and poorly structured companies, limited availability of specific transport and logistics infrastructures. The completion of Gioia Tauro as third-generation port could allow to solving these problems and boost the regional agri-food sector, also in the context of improving the other economic sectors. This paper proposes an agri-food logistics scenario for Gioia Tauro as third-generation port, according to the Regional Transport Plan of Calabria and to the strategic report of the Integrated Logistics Area. The scenario is aimed to encourage the development and integration of existing supply chains, to enhance the Gioia Tauro hinterland in order to attract agri-food factories, operators, transport and logistics companies, encourage agri-food production for the local and the international markets. Furthermore, the paper proposes the set of planned interventions for the realization of the agri-food logistics scenario. These interventions are located in the hinterland of Gioia Tauro port, where there is a large industrial area suitable for the expansion of the sector. The interventions are mainly aimed at the realization of a cold-pole, and other related interventions.

Keywords: *third-generation port, agri-food logistics, cold-pole, Gioia Tauro port.*

1 INTRODUCTION

From ancient times until the first half of the 20th century, ports were merely the interface of freight transport between land and sea. They were built in proximity to the city and they were the gate for the exchange of freight (first generation port). In the second half, ports were built in proximity to great industrial areas, offer industrial or commercial services to industrial plant (second generation port). During the 1980s third-generation ports emerged, principally due to world-wide large scale containerization, combined with the growing requirements of international trade. Ports became integrated transport centres and logistic platforms. From the economic point of view, ports increase their added value of the goods that transit through them, not only due the traditional advantage of position, but due also to the manipulations that are placed in the goods [1], [2].

The objective of the paper is to identify the structural factors, in terms of scenarios and interventions, of agri-food logistics, in order to let the port of Gioia Tauro fully became a third-generation port. The port of Gioia Tauro is today the first container (lo-lo) port and one of the most important one for the (ro-ro) traffic of road vehicles (automotive) of Italy. The planned scenarios and interventions should encourage the creation of added value from other port-related activities different from the core one: the transshipment of containers [3], [4].



This implies that transshipment activities must be consolidated and strengthened, on one side; and the settlement and consolidation of agri-food manufacturing, which is one of the pillars of the regional economy, should be attracted and facilitated encouraged through interventions on agri-food logistics.

The scenarios and the infrastructural interventions in the agri-food logistics are defined inside the Regional Transport Plan of Calabria (see [5]–[7]) and inside the strategic report of the Integrated Logistics Area (ALI) [8]. The ALI programme was developed after the Partnership Agreement 2014–2020 between Italy and the European Commission for the use of European structural and investment funds to improve the competitiveness of the port of Gioia Tauro [9]. The Italian National Operational Programme for Infrastructures and Networks 2014–2020, according to Partnership Agreement, foresees that the program strategy should be implemented through the definition of the ALI [10]. This element is in line with the strategy of Gioia Tauro port defined by the Italian Strategic Plan for Ports and Logistics [11].

The ALI of Gioia Tauro defines, among the others, a cluster of interventions in order to enhance the development of agri-food logistics to support the regional agri-food sector.

The remaining part of the paper is articulated as follows. Section 2 presents the conceptual elements of the methodology adopted in the paper. Section 3 presents the current situation and the critical elements in Calabria (Italy), as far as concerns the agri-food sector and logistics. Section 4 reports the structural factors, in terms of scenarios and interventions, for the realization of Gioia Tauro as a third-generation port, with a focus on agri-food logistics. Finally, the conclusions and the perspectives.

2 METHODOLOGY

The methodologies for the identification of interventions for agri-food logistics in a container port belong to two main categories:

1. methods to estimate transport and logistics costs of food products (fresh or processed), along the international containerized (cold) supply chain (see [12]–[14]);
2. methods to estimate the value added, and other economic variables (e.g. employment) of handling operations of (fresh and processed) food products in the port region (see [15], [16]).

A containerized cold supply chain is schematically composed by the main following elements (Fig. 1) [13]:

3. production/processing place, where the freight is produced, or grown and harvested, and eventually processed;
4. consolidation centre, where the freight is consolidated into a reefer container;
5. port of origin, where the reefer container (swap body) is loaded on a container, or on a ro-ro ship [17];
6. port of destination, where the reefer container is unloaded and transported;
7. distribution centre, where the freight is unpacked from the reefer container and distributed in smaller parcels;
8. selling/consumption place, where the freight is sold by retailer and/or finally consumed.

The elements 2 to 5 are part of the containerized cold supply chain, during which the temperature integrity is important as the freight often travel along great distances.

As far as concerns the maritime shipping services between port of origin and port of destination, they may be deep-sea or short-sea. The maritime services may be operated by

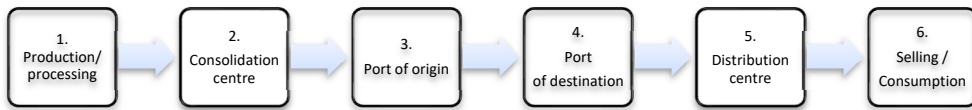


Figure 1: Main components of a cold supply chain [13].

means of lo-lo ships, where the container is loaded-unloaded with vertical movements, or ro-ro ships, where the container (or the swap body) is loaded-unloaded with horizontal movements; there are also lo-lo/ro-ro ships where the container (swap body) is loaded-unloaded with a mixture of both movements.

The competition between ro-ro and lo-lo services depends on the distances covered, due to the following characteristics of the two services [17]: container (lo-lo) ships generally have higher handling costs (and time) and lower transport costs (per unit of distance) compared to ro-ro ships. Accordingly, the container service tends to be more convenient than the ro-ro one for greater distances. The higher cost of tare associated to ro-ro implies a higher cost per net unit of transported freight than lo-lo service. While the simpler loading and unloading ro-ro operations (without any quay cranes) make ro-ro service more convenient on short distances.

As far as concerns the terrestrial transport and logistic services, a scheme of the functional structure of a distribution centre is reported in Fig. 2 [14]. The distribution centre receives the freight, consolidated in one cargo unit (reefer container), from the port of destination and deconsolidates it into several smaller parcels to be delivered to one (or more) selling/consumption area(s), where retailers (consumers) are present.

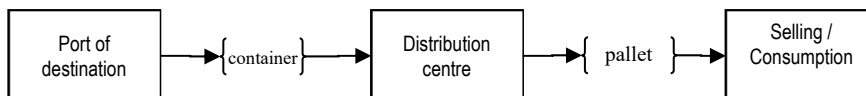


Figure 2: Scheme of a distribution centre.

The distribution centre has some inputs and provides some outputs.

The input of the distribution centre is the reefer container, which arrives at the port of destination from abroad. The output is a set of pallets (of freight), which are delivered to a number of retailers/consumers. Each retailer generally demands a small amount of freight: the minimum quantity is generally one pallet.

Nowadays, firms and logistic companies operating in the agri-food sector tend to locate their consolidation/distribution centres, which are mainly refrigerated warehouses, inside port areas, in order to reduce or eliminate the transport costs (Fig. 1) connected to the trips from to consolidation centre to the port of origin (link 2–3), and to the trips from to the port of destination to the distribution centre (link 4–5). They look for a third-generation port as a generator of value added, rather than a centre of cost. If the port is adequately equipped with material infrastructures (e.g. refrigerated warehouses, intermodal centres, last-mile connections) and immaterial infrastructures (e.g. tax incentive tools, research and training

centres, ICT), the port is candidate to become fully embedded inside the (containerized) cold supply-chain.

The paper presents an aggregate approach to define the development directions and the planned interventions for the agri-food logistics in Gioia Tauro, articulated in to the following steps (see also [4]–[7]):

- current characteristics and critical elements of the agri-food in Calabria (reported in Sections 3.1 and 3.2);
- potentialities of the agri-food sector, in order to determine the reference market of the port (reported in Section 4.1);
- strategic development directions and planned transport interventions (reported in Section 4.2) and estimation of the future logistic capacity of the port (reported in the conclusions).

3 CURRENT SITUATION OF AGRIFOOD SECTOR IN CALABRIA

3.1 Agri-food sector

The specificities of agri-food production in Calabria concern the olive oil and citrus sectors, as well as the cereal and bakery, animal husbandry and viticulture sectors. Calabria produces, if compared to the total production in Italy, more than 50% of clementine, more than 30% of oranges, more than 25% of mandarins, all the bergamots and cedars, about 25% of table olives and of fresh figs [19].

The agri-food sector in Calabria is the most important for regional exports, of which it constituted the 47% of share in 2011, directed almost exclusively to the countries of the European Union. It also accounts for an important part of the region's total imports, amounting to 42% in 2011.

The food industry in Calabria is the first one in the manufacturing sector, with a share of added value of 23%. There are 3,401 active companies in the regional food industry, equal to 26.6% of regional manufacturing companies, a higher share than the national average (equal to 10.9%) and 10,000 employees working in Calabria, equal to about 26.4% of employment in the manufacturing sector. It is higher than the national average, equal to 10.9%, and it is also the first among Southern Italian Regions (Sardinia 24.5%, Sicily 23.8%, Molise 22.9%, Campania 18.3%) [20].

Among the most important industries in the agri-food sector, there are: Callipo and Intertonno (tuna), VegItalia and GIAS (frozen food), Liquirizia Amarelli (licorice), Capua1880 (citrus) which are well-known all over the world [19].

Callipo is a historic industry that produces canned and in glass tuna, exported all over the world. The Callipo Company had a revenue of 46 million euros in 2015 and it is leader of six companies of the group, operating in the production of ice creams, in the tourism and sport, for a total of 350 employees and a revenue of 57.6 million. Intertonno is another important company in Calabria in the sector of tuna industry.

VegItalia produces frozen foods and had a revenue of 5.0 million euros in 2015, it is controlled by Japanese capitals. GIAS Company is also important in the frozen food sector.

Liquirizia Amarelli was founded in 1731 and it is one of the world's largest producers of licorice. A company museum has been set up close to the factory. The company exports its fine products to various countries, with an annual revenue of 4.0 million of euros.

Capua 1880 produces oil from bergamot, a type of citrus that grows only in the Province of Reggio Calabria. The company stands out on an international scale for the quality and

innovation of its techniques and technologies and it supplies the world's leading perfume companies. The company currently employs 70 people across two separate sites: the headquarter and warehouse site, and the production site exclusively dedicated to processing Italian citrus.

Other important agri-food industries in Calabria are: Mangiatorella (mineral waters), Ilcar (meat processing), Fattorie Del Sole and Calabrian Milk Associations (dairy products), Distilleria F.lli Caffo (liqueurs), OP Interpiana and Agrumaria Reggina (citrus fruits), Antiche Vigne di Pironti, Ceraudo, Librandi, Statti, Tenuta del Conte, Tramontana, Val di Neto, Zagarella (wine).

3.2 Critical elements

The agri-food sector and the related logistic infrastructures in Calabria present several weaknesses, described below. As far as concerns the agri-food industries, the main critical elements concern the low innovation, small and poorly structured firms, limited availability of dedicated transport and logistics infrastructures [19].

In Calabria entrepreneurs have low propensity for innovation. While the most important Italian Regions in the agri-food sector are high positioned in the ranking of more than 200 European Regions, the Southern Regions of Italy, and Calabria, were placed in the last positions, according to European Innovation Scoreboard in 2011 [21].

The companies of agri-food sector are small and poorly structured. In most cases, they have few employees, and have a poor degree of horizontal and vertical integration. The production chains are sometimes incomplete and companies are forced to import local products (figs, citrus fruits, olive oil) from outside the Region, due to the high prices deriving from the regional production and the inefficiencies in the primary sector [19].

The limited availability of dedicated transport and logistics infrastructures does not allow to respond to the needs of the regional agri-food production. In particular, there are no cold-poles for the logistics of agri-food products, with refrigerated warehouses that allow the storage and the manipulation at different temperatures. The lack of specific infrastructures, that guarantee the cold chain, does not allow to manage large quantities of perishable products, which characterize the production of Calabria, nor to manage seasonal products deferred over time, as in other Italian regions (e.g. port of Salerno in Campania).

The effects of the above critical elements were emphasized in the last year, when the Covid-19 pandemic heavily impacted the agri-food sector. In Italy, companies in the food sector, which have logistical difficulties, few employees and are unable to guarantee health protection, are the most penalized by the emergency. Rural farms appear to be less penalized by the Covid-19 crisis, particularly those of cereals and olive oil [22].

4 FULL THIRD-GENERATION PORT

This section presents the case of the port of Gioia Tauro (see Fig. 3), where some scenarios and interventions are proposed in order to let adding value to the handled freight, according to (see [1], [2]) and to further publications ([3], and the references included).

The scenarios and interventions are design to capture the demand of logistics, presented in the previous section, of the agri-food sector of Calabria, where few companies are able to operate in international markets and a number of small local companies operate in the local and domestic ones.



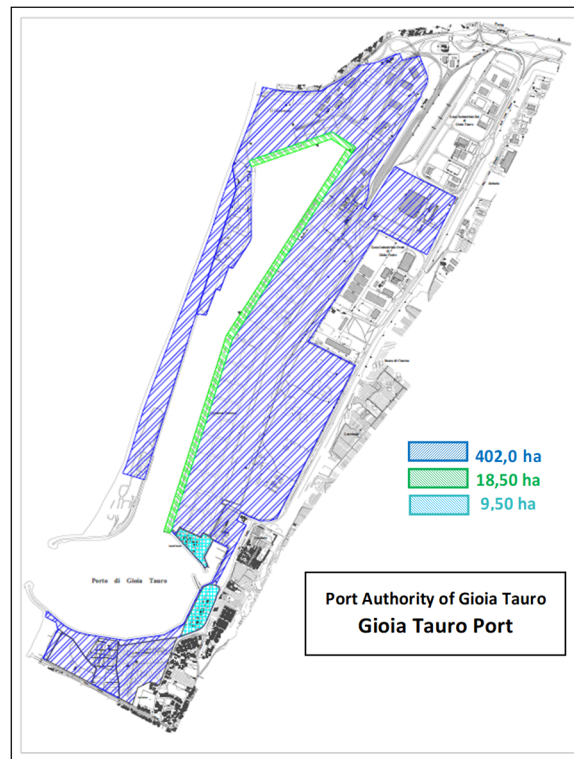


Figure 3: Port of Gioia Tauro. (Source: www.portodigioiatauro.it.)

4.1 Agri-food sector

Food products constantly increase their shares in global markets, so that today the European food industry is subject to competitive pressures due both to the strong concentration induced by the development of large-scale distribution in European countries and to the internationalization processes.

The European market is composed by large multinational groups, on the one hand; and by a corpus of small and medium-sized enterprises that employ over 60% of the employees of the entire sector, on the other. The related supply chains and clusters are different from each other, in terms of territorial and regional location, structure of the companies and links with regional, European and international markets.

The Italian food industry plays an important role in Europe. Italy is the second country in terms of number of food businesses, after France. The sector has a strong relationship with the agricultural one and it is clustered into agri-food districts, which are today changing rapidly towards new organizational forms, with some companies assuming the local leadership [19]. The food industry is export-oriented, and in fact, international trade has marked a constant improvement in the trade balance concerning food sector. The most significant component of Italy's agri-food exports is represented by processed foods products, followed by beverages and products of the primary sector. For agri-food imports, also in this case, the most significant component is that of processed food products, followed

by the ones of primary sector. Agri-food trade of Italy is well-positioned, if compared with competitors of the international market. Despite this, there is the risk in the next future not to catch the opportunities to growth, due to both the average small size of Italian companies, and due to the lack of logistics and distribution facilities and of Italian logistic companies operating in the international markets, necessary to support the promotion and the internationalization of Italian agri-food products.

4.2 Scenario for agri-food logistics

The scenario for the agri-food logistics in Gioia Tauro is based on the development of a cold-pole, considering the current conditions and the potentialities of the agri-food sector of Calabria in a general framework of a synergic development of other existing leading regional sectors (see [23]–[25]). The agri-food logistics scenario, defined in the ALI of the port of Gioia Tauro, is related to the potentialities of the international market, according to the core productions of Calabria already present in the international markets, such as that of tuna of the other productions (Section 2.1).

This agri-food logistics scenario should allow to overcome the criticalities present today in Calabria (Section 2.2) and contribute to the realization of Gioia Tauro as third generation port. The scenario foresees the definition of a logistic network inside the Region, that is based on several logistic platforms. Today, logistic platforms are of various types and sizes, public, private or public and private, and consider the production processes of the main sectors such as grapevine, olive, citrus, vegetable; but also the livestock sector and related productions.

It is necessary to consider the potential of a logistics platform as a node capable of increasing the supply of products at various territorial scales. According to Regional Transport Plan [5], the logistic network for agri-food sector in Calabria will include (see Fig. 4):

- intercontinental nodes, complementary to the European nodes active in the Northern Range (Gioia Tauro);
- international nodes, for international production, such as tuna, and for international distribution (Lamezia and Sibari);
- national nodes, for regional or interregional productions in Southern Italy and for national distribution (Vibo Valentia, Locri, Crotona);
- regional nodes, for regional or interregional productions and for regional or interregional distribution.

4.3 Interventions for agri-food logistics (port of Gioia Tauro)

The realization of agri-food logistics scenario takes place through different planned interventions, that are located in the industrial area close to the port of Gioia Tauro (Fig. 5).

The location of the planned interventions guarantees their connection with the motorway A2 and with the railway line, belonging to the TEN-T core network and in the ScanMed corridor [26].

The industrial area lies in the municipalities of Gioia Tauro, Rosarno and San Ferdinando; and it is included in the Special Economic Zone (SEZ) of Calabria, established in 2018 (the first SEZ established in Italy). This area, and the port itself, constitutes the centre of the SEZ, which incorporates several regional areas functionally and economically linked to Gioia Tauro port (including the logistic network for agri-food sector presented in Fig. 1 (see [27], [28])).

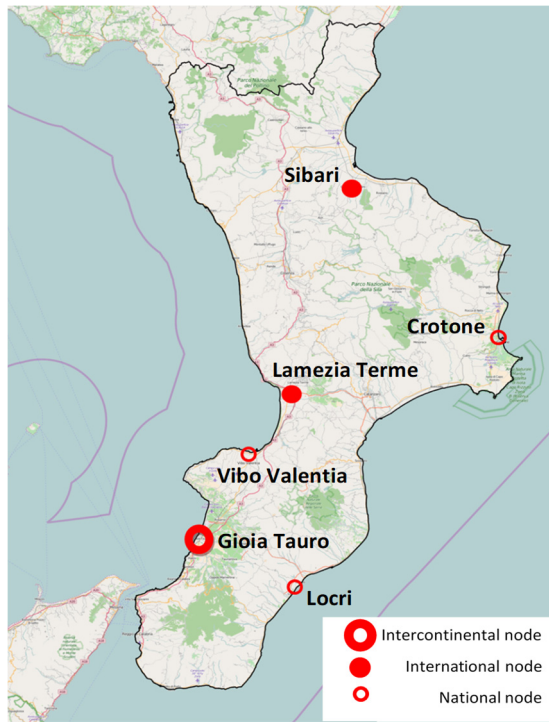


Figure 4: Schematic representation of the potential locations of the agri-food logistics nodes at intercontinental, international and national scale (elaboration from [5] and [8]).

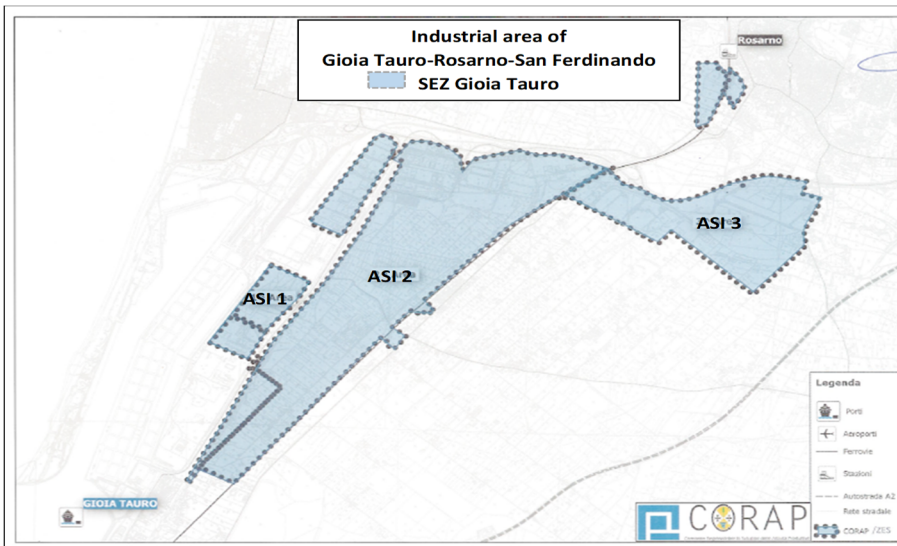


Figure 5: Industrial area of port of Gioia Tauro (elaboration from [27]).

The core interventions on agri-food logistics are mainly aimed to the realization of a cold-pole. The cold-pole concerns the construction of several refrigerated warehouses for the storage and manipulation of goods at controlled temperature, in order to allow the operation of combined railway-road transport and all-road transport.

The railway connection of the cold-pole, which allows to operate the combined rail-road transport, is the existing last-mile railway track connecting the closer railway station of Rosarno with the port of Gioia Tauro.

Two further classes of interventions are planned, in order to support and boost the logistics operations inside the cold-pole (see [5]–[8]):

- transport and energy supply interventions;
- general infrastructures interventions.

The whole interventions are reported in Table 1.

Table 1: Planned interventions for agri-food logistics in Gioia Tauro port.

<i>Cold-pole</i>
Refrigerated warehouses
Expropriation of areas (warehouses)
<i>Transports and energy supply</i>
Intermodal terminal serving the agri-food logistics platform in area
Energy production plants
<i>General infrastructures</i>
Extension of the level of service in port area: civil works
Extension of the level of security in port area: civil works and technological systems

4.3.1 Core interventions on the cold-pole

The interventions on the cold-pole concern the construction of refrigerated warehouses, able to store and to manipulate agri-food products at different controlled temperatures (see Table 1).

- Cold-pole: Refrigerated warehouses:
 - two refrigerated warehouses (of approximately 10,000 square meters each) for rail-road combined transport (served by a railway track and connected to road network),
 - two refrigerated warehouses (of approximately 10,000 square meters each) for all-road transport (connected to road network),
 - railway tracks and road connections to the national motorway and rail networks, yards and service areas.
- Cold-pole: Expropriation of areas:
 - acquisition of areas for two refrigerated warehouses (of approximately 20,000 square meters) for rail-road combined transport,
 - acquisition of areas for two refrigerated warehouses (of approximately 20,000 square meters) for all-road transport,
 - service areas.

4.3.2 Transport and energy supply interventions

The cold-pole needs to be supported and boosted, respectively, by some interventions concerning transport and energy supply.

The main transport intervention concerns the realization of a dedicated terminal for agri-food logistics, connected to the national rail and road transport networks and located inside the industrial area (named as 'ASI2' in Fig. 5).

The energy supply interventions are finalized to achieve a standard of green port, as described below. They concern the construction of plants for the production of energy from renewable sources, starting from technologies experimented in Calabria. In particular:

- production of electricity from sea waves, using ReWEC systems [29];
- wind and solar energy production plants;
- hydroelectric energy produced from the closer dam along the Metramo river;
- regasification after its construction in Gioia Tauro.

4.3.3 General interventions on infrastructures

The general interventions on infrastructures concern the realization of civil works and installation of technological systems finalized to:

- increase the level of service offered in the areas dedicated to the agri-food logistics activities,
- increase the level of security of the port and of its hinterland.

Extension of the level of service in port area:

- civil works for increasing efficiency of street lighting, to reduce energy consumption and light pollution, through high-efficiency systems.

Extension of the level of security in port area:

- civil works to increase the level of security through the construction of fences, delimiting the areas dedicated to agri-food logistics;
- technological systems through the realization of 24-hour surveillance systems, including the use of drones.

5 CONCLUSIONS

Gioia Tauro is one of the main Italian commercial ports in Italy, located in Calabria. Today it is specialized in container transshipment operations of freight at international level [30], but it has great potentialities of expansion to fully become a third-generation port. These potentialities derive from the presence of regional productions belonging to different economic sectors (e.g. agri-food, mechanical...). Few regional companies belonging to these sectors produce for the domestic and international markets; the most part of the companies have local and regional markets.

In Calabria there is a high demand for logistics relating to these sectors, but this demand remains unsatisfied due to some critical elements.

As far as concerns the agri-food sector, the main critical elements are: low innovation, small and poorly structured companies, limited availability of specific transport and logistics infrastructures.



The paper proposes a scenario and interventions, planned inside the Regional Transport Plan of Calabria [5] and the strategic report of the Integrated Logistics Area [8], aimed to overcome the above regional criticalities in agri-food sector and to make Gioia Tauro a third generation port. Different types of interventions are necessary: the core set of interventions concerns the realization of a cold-pole with two refrigerated warehouses for rail-road, and two refrigerated warehouses for all-road transport. The estimations about their storage capacity is 40,000 pallets for the “rail-road warehouses” and 40,000 pallets for the “all-road warehouses” [6].

As regards the works relating to the agri-food sector, a series of interventions are planned that aim to reorganize an industrial area specifically identified with reorganization of the road and railway network and with the commissioning of security systems.

These interventions allow transshipment activities to be consolidated and strengthened, and allow the establishment and consolidation of regional agri-food productions, which is one of the pillars of the regional economy.

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