Freight transport in Europe : policy issues and future scenarios on trans-border alpine connections

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FREIGHT TRANSPORT IN EUROPE: POLICY ISSUES AND FUTURE SCENARIOS ON TRANS-BORDER ALPINE CONNECTIONS

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ABSTRACT

This paper presents an overview of European policy on interconnected cross-border transport networks as well as of severe problems in estimating empirically the avalanche of goods movements in the European Union (EU). In particular, it deals with the Transalpine freight transport case, which represents one of the most challenging operational and policy issues of the present and future - both international (EU) and national (the Alpine countries) - freight transport developments. The paper is organised to briefly describe the main objectives of EU transport policy, to generally introduce the concept of intermodal transport with particular emphasis on intermodal freight transport and to describe past, present and future developments of the Trans-Alpine inter-modal transport. Various scenarios on the future development of Trans-Alpine intermodal transport are analysed as well.

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1. THE BACKGROUND SCENE

In the past decades a transition – both locally and globally – towards a network society in which central nodes of human activity have become prominent socio-economic players dominating the scene has taken place. The connectivity configuration of modem transportation and communication networks has not only increased economic efficiency, but also the monopoly power of nodes in a network. Clearly, the modem information and communication technology (ICT) has even further increased this trend towards multi-layer network infrastructures, often of a multimodal nature. In addition, a world-wide trend towards reduction of policy interventions (deregulation, privatisation, etc) has strengthen and stimulated important transport markets such as Europe, USA and Canada. Under such conditions, traditionally protected positions have been challenged and many actors had to find the appropriate "market-survival" strategies on the basis of their own strength. In such a context, complex network configurations have emerged as promising options for market survival as well as for developing creative competitive behaviour.

Many illustrative examples of the above tendencies can be found in Europe, where after several decades of "muddling through" a new orientation has emerged, which is expected to lead to one of the largest integrated free markets in the world by the beginning of the new millennium. One of the obvious consequences of this new development is a rapid increase in transactions and trade, which generates a rapid rise in transport flows.

The present paper provides an overview of European policy on interconnected cross-border networks as well of the severe problems in estimating empirically the avalanche of goods movements in the European Union (EU). In particular, it deals with the Transalpine freight transport case, which represents one of the most challenging operational and policy issues of the present and future - both international (EU) and national (the Alpine countries) - freight transport development. The paper is organised as follows. Apart from this introductory section, the paper consists of five sections. Section 2 briefly describes the main objectives of EU transport policy. Section 3 introduces the concept of intermodal transport in the broadest sense. Section 4 describes the main lines of development of freight transport in Europe with particular emphasis on intermodal freight transport. Specifically, Section 5 describes the past, present and future development of Trans-Alpine intermodal transport. The last section contains concluding remarks.

2. OBJECTIVES ON THE SHORT-, MEDIUM- AND LONG-TERM DEVELOPMENT IN INTERMODAL TRANSPORT IN THE EU

During the last ten years, the EU has carried out some important steps towards creating a single market by breaking down the barriers between the 15 member states. The free movement of people and goods within the Union's member states has emerged as the main objective, but also as a pre-condition for overall future balanced growth of the single market. To be fully effective, both objectives need a transport system that is able to fulfil such a task. The most important action carried out at the EU level has been the creation and implementation of the CTP (Common Transport Policy). It has aimed to establish the institutional conditions for sustainable development of the European transport system as well as an efficient integration of transport infrastructure and transport means through their simultaneous complementarity and competition.

2.1 The Objectives of Common Transport Policy

The EU Common Transport Policy (CTP) has the following three main objectives (EC, 1998a; *b*):

- Stimulation of further development of the Trans-European Transport Networks (TENs) including favouring the development of peripheral regions (the Commission's White Paper on Growth, Competitiveness and Employment, 1993);
- Further liberalisation of the transport markets to the maximal extent possible (market regulations should be equalised in each Member State and the national product market should be opened up for agents of each EU country); and
- Progressive movement towards "sustainable" development of the transport sector.

It can be seen, that the above objectives have contained elements from transport policy, transport economics, transport technology and transport scenarios (see Janic, 1999). First, these elements are closely involved in the CTP. Second, their real-life implementation is dependent on the investments concerned. Third, new technologies and other forms of innovations are expected to support their fulfilment of these objectives. And finally, traffic scenarios have been designed as the basis for exploring the future.

2.2 The Sustainable Development of the Transport System

Apart from dealing with the "new" infrastructure and the development of a more liberalised transport market, the most recent CTP (from 1995) has placed a special emphasis on sustainable development of the transport system in the EU. Behind such a development, there has been a permanent challenge on how to create a "better" market balance between road and other transport modes (for both passenger and freight). This challenge has had two dimensions and both have been elaborated in a qualitative sense: First, in freight transport, the road market share should be significantly reduced in a favour of an increase in market shares of non-road modes (rail, inland waterways, short sea shipping, pipelines). In passenger transport, the use of public transport in both urban and rural (inter-city) transport should be significantly increased in exchange for a reduced use of individual cars. Such a re-balancing of transport modes is expected to further increase the overall efficiency of transport operations on one side, to reduce air pollution and congestion and to increase safety on the other. In other words, sustainable mobility through integration of transport infrastructure and transport means (i.e., through developing and spreading *intermodality* over Europe) in the broadest sense is an important policy goal in the EU.

2.3 Integration of Transport Infrastructure and Transport Means

For the attainment of integration of transport infrastructure and transport means it seems logical to start with the following activities **(EC, 1997):**

- Setting up the basis for integrated Trans-European transport networks and nodes;
- Harmonisation of regulation and competition rules in the transport sector;
- Identification of various types of barriers to intermodality; and
- Implementing the notion of Information Society in the transport sector.

All these activities have to be carried out at the European, national and regional level in order to implement a European intermodal transport system, in which the user (customer-) oriented transport services will be provided as mode-independent door-to-door connections. They will be based on a use of different modal transport alternatives, which allow a new, more efficient utilisation of transport capacities, thus reducing transport costs and generating added value. At this place three specific elements of integrated transport systems will be discussed: integrated transport networks, added value and barriers or "critical success" factors.

2.3.1 Integrated transport networks

Generally, integrated transport networks consist of the physical infrastructure represented by the network links and nodes, the services and their organisation and management, and information and communication infrastructure, which have emerged as an essential component for efficient provision of the customer-driven services. The transport links connect concentrations of people and economic activity centres (the so-called nodes represented by uni- or multi-modal freight and/or passenger terminals). In such networks, different actors (transport operators and integrators of transport services like, for example, logistic suppliers) may provide both competitive and complementary (integrated) services through co-operation of transport modes and competition of the service providers (operators) (Bithas and Njikamp, 1999). With respect to the number of transport modes taking part in intermodal transport, they may be uni-modal and multi-modal (or inter-modal) networks. Uni-modal networks are operated by a single transport mode. The multi-modal networks are operated by any combination of at least two different transport modes. The interfaces of different transport modes (i.e., freight and passenger interchanges) have to be provided in multi-modal networks. In regard to freight transport, these are the inland uni-modal and multi-modal terminal and seaports. In regard to passenger transport, these may be the multi-modal passenger terminals such as rail stations and airports. The integration between modes in multi-modal networks should be carried out at the level of infrastructure and other hardware (loading units, vehicles, and telecommunications), operations and services as well as the regulatory conditions.

2.3.2 Added value

At both classes of integrated networks, the conditions for complementarity and competition are expected to provide the added value. Complementarity should provide the added value through the network synergy. Competition should provide the added value through the network operation under the most cost-efficient conditions at the European scale.

Intermodal (i.e., integrated) transport network(s) possess(s) the performance, which can be analysed and measured by the characteristic features determining and influencing their overall quality (Bithas and Nijkamp, 1999; EC, 1998*a*). Generally, these are quality and capacity of the individual links connecting transfer points and capacity and quality of transfer and terminal points themselves on the one hand and three cohesiveness factors such as inter-modality, interoperabilitv and interconnectivity on the other (see also Nijkamp, 1995, as well as Figure1):

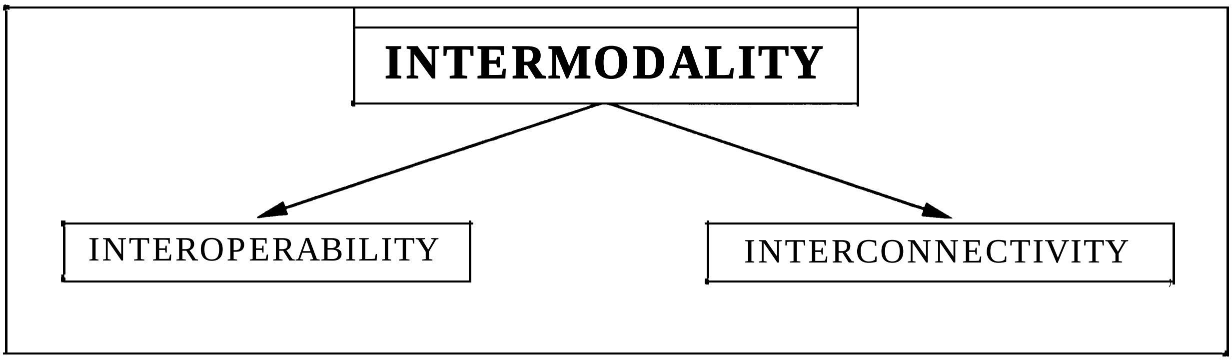

FIGURE 1 - STRATEGIC OBJECTIVES OF THE EUROPEAN UNION TRANSPORT POLICY (5th FRAMEWORK ACTION)

2.3.3 Barriers or "critical success factors"

For each of the three factors of cohesiveness, inter-modality, interoperability and interconnectivity, five types of barriers (or "critical success factors") preventing further development of integrated transport networks and thus intermodal transport services may be identified: "hardware", "software", "orgware", "finware" and "ecoware" (Nijkamp, 1995; EC, 1998*a*)[1]:

Each type of barrier may have a specific content and meaning when dealt with in the scope of the network cohesiveness factors. In term of *intermodality,* "hardware" includes inter alia compatibility of technologies, uniform standards of rolling stocks, intermodal competition and complementarity. "Software" includes compatibility of information systems, informatics services and telematics. "Orgware" contains management and design of the main-ports, terminals and transfer points. "Finware" comprises matters like cost effectiveness and user charges. Finally, "ecoware" relates to the sustainability of transport behaviour.

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[1] In general, hardware refers to physical aspects of transport infrastructure used to provide integrated transport service(s). Software refers both to control and guidance computer-based systems and to information, booking, reservation, communications, etc. Orgware comprises all regulatory, administrative, legal management and co-ordination activities and structures on both the demand and supply side, in both public and private domain. Finware refers on the socio-economic cost-benefit aspects of new investments and the way of financing and maintaining existing and new infrastructure, to pricing structure and public guarantee financing. Ecoware refers to environmental concerns, including transport externalities such as noise, air pollution, safety and congestion.

In terms of *interoperability*, "hardware" relates to the advanced transhipment and transfer technologies and equipment used at terminals and transfer points. "Software" includes sophisticated logistics, surveillance, guidance systems and training and education of personnel. "Orgware" involves co-ordination of transport operations, efficient control of transport of hazardous goods, and the logistics local delivery and distribution. "Finware" relates to competitive strategies. "Ecoware" comprises an efficient enforcement of environment regulations and particularly safety regulations. In term of *interconnectivity*, "hardware" relates to temporal and spatial accessibility of terminals and/or transfer points, the access to particular transport modes and standardised technology. "Software" includes tracking and tracing, ED1 and telematics. "Orgware" comprises inter alia localisation of information systems, development of hub-and-spokes systems, and establishment of the Trans-European connections, etc. "Finware" relates to efficiency of transport operations. Finally, "ecoware" may be concerned with savings in energy use.

It is worthwhile to mention that both factors and "barriers" (i.e., "critical success factors") may be dependent and sometimes highly interrelated. Therefore, a successful development of *intermodality*, *interconnectivity* and *interoperability* in each particular project (or action) should consist of the very precise identification of "barriers" (i.e., "critical success factors") and related problems, assessment of their "strength" and "influences", and creating and implementing the policy, technology, economic and traffic scenario-based solutions for either alleviating or removing such bottlenecks. Essentially, such an approach may constitute and represent the main short-, medium- and long-term objectives in the development of the European intermodal transport networks, i.e., to strengthen sustainability of the development of the transport sector through inter-modality (EC, 1998b).

The general objective(s) of the concepts of "intermodality", "interoperability" and "interconnectivity" is to establish a framework for an optimal integration of different transport modes so as to enable an efficient and cost-effective use of transport system through seamless, customer-oriented door-to-door services whilst favouring competition and quality between transport modes (EC, 1997; 1998). This should change the existing modal split through reducing the present growth of road transport in terms of both freight and passenger transport and increasing the use of non-road modes: railways, inland waterways and short sea shipping. Consequently, such change of modal split is expected to diminish severe negative impacts of road transport on the environment and thus to provide "sustainable" future development for the transport sector in the EU.

3. DEFINITIONS AND MEANING OF INTERMODAL TRANSPORT

In general, there is not a common accepted definition of the term "intermodal transport". Sometimes, the term "combined transport" and "multi-modal transport" is used to cover the same (or similar) issues in practical operations of freight transport*. At this place, the definitions provided by different international associations and institutions such as ECMT (European Conference of Ministers of Transport), EC (European Commission) and United Nations are presented.

[2] The term "integrated door-to-door service" has been applied as an equivalent term for passenger transport.

3.1 ECMT Definitions

ECMT has offered even several definitions. The three ECMT definitions of intermodal transport are between the term "intermodal transport", "combined transport" and "multi-modal transport". They have been sorted out as follows:

Definition I

Intermodal transport is the movement of goods (in one and the same loading unit or vehicle), which uses success-filly several modes of transport without handling of the goods themselves in transhipment between the modes (ECMT, 1998).

This definition is focused on the loading unit moving between different transport modes and the goods, which stay in the same loading unit all the time. In this context, the loading unit is a *container* ("a special box to carry freight, strengthened and stackable and allowing horizontal or vertical transfer") or *swap-body* ("freight carrying unit not strong enough to be stackable, except in some cases when empty, or top-lifted; it is used only in rail-road movements"). *Vehicle* can be a road or rail vehicle or a vessel (ECMT, 1998).

Definition II

Combined transport is inter-modal transport where the major part of the European journey is by rail inland waterways or sea and any initial and/or final leg carried out by road are as short as possible (ECMT, 1998).

This is a definition for policy purposes. It is focused on the use of "non-road" transport modes in carrying out the main portion of freight journey over Europe (i.e., the movement of containers and/or swap bodies between intermodal terminals). Pre- and end-haulage is carried out by road (ECMT, 1997).

Definition III

Multi-modal transport is a carriage of goods by at least two different modes of transport (ECMT, 1998).

This definition emphasises the use of different transport modes for carrying out the movement(s) of goods between their origin and destinations. It does however not say anything about the level of consolidation of goods (loading unit, palette or other forms of packing). Therefore, it may be considered as the most general definition of "inter-modal" transport (ECMT, 1998)[3].

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[3] There has not been the ECMT definition(s) of "integrated service" for passenger transport, but it could be easily synthesised from the above definition of "multi-modal" transport.

3.2 EC Definitions

The European Commission (EC) has applied a broader term, "intermodality", in order to cover all aspects of the use of different transport modes in providing "door-to-door" service for both freight and passengers.

Definition IA

Inter-modality is characteristic of a transport system that allows at least two different modes to be used in an integrated manner in a door-to-door transport chain. In addition, it is a quality indicator of the level of integration between different transport modes. In that respect more intermodality means more integration and complementarity between modes, which provides scope for a more efficient use of the transport system (EC, *1997).*

According to the above definition, *"intermodality"* emphasises the use of different transport modes and represents a quality indicator for the integration of these modes at different levels for both freight and passenger transport. In addition to the term *"intermodality"*, also terms like *"interoperability"* and *"interconnectivity"* have been applied to the same context to emphasise the integrated service in the scope of door-to-door transport chains (EC, **1998a).**

Definition IB

Interoperability mainly refers to the use of standardised and compatible[4] *infrastructure technology, facilities and equipment, and characteristics of vehicles (dimensions) and involves technical and operational (procedural) uniformity that may be applied by transport enterprises to provide efficient door-to-door service. Consequently, this reduces barriers between transport systems (e.g. institutional, legislative, financial, physical, technical, cultural or political barriers). For example German and Belgian rail transport systems are highly interoperable. Road freight transport systems of Austria and Switzerland are less interoperable due to tolling and weight restrictions/differences* (EC, **1998a).**

Definition IC

Interconnectivity concerns horizontal co-ordination of transport modes for obtaining integrated door-to-door service. A precondition for establishing such co-ordination is the existence of transhipment/transfer technologies, facilities and equipment, sophisticated surveillance and guidance systems and trained and educated personnel **(EC, 1998a).**

3.3 UN Definition

United Nations has provided a definition of "multi-modal transport" in the document called *"Convention on Multi-modal Transport of Goods"* as follows:

International multi-modal transport is the carriage of goods by at least two different modes of

[4] This may refer to the situations in which two or more interacting transport systems do not register any technical impediments in co-operation. Compatibility occurs when technical aspects have reached a maximum of interoperability.

*transport on the basis of a multimodal transport contract from a place in one country at which the goods are taken in charge by the multimodal transport operator to a place of designated for a delivery in a **different** country* (ECMT, 1997)

This definition emphasises the existence and responsibility of multi-modal operators in providing services for international freight transport.

It is thus clear that different definitions do exist; they discriminate between tchnical and organisational aspects of multi-modal transport. We will now address the question how such concepts are introduced in the EU transport markets.

4. DEVELOPMENT OF INTERMODAL TRANSPORT IN THE EU

Generally, the transport sector has played an important role in the integrating economy of the EU Member States. According to the figures for 1996, it has created about 4% of total GDP (Gross Domestic Product), which is equivalent to EURO 270 billion (or 7% of GDP or EURO 470 billion including private/own accounts). The sector has employed about 6 million persons (or about 4% of total employment). In addition, 2 million persons have been employed in the transport equipment industry and over 6 million in transport related industries. In the same year, the investments in transport infrastructure have been about EURO 70 billion, of which 65% in road, 25% in rail and 10% in other modes, which has been about 1% of total GDP (EC, 1999). At this place, only some important developments of goods transport and inter-modal freight transport will be presented.

4.1 Goods Transport

Goods transport by means of road, rail, intra-EU sea services, pipelines and inland waterways has amounted to 2640 billion tkm (tonne-kilometre) of which 44% has been carried out by road, 40% by sea and about 9% by rail. Passenger demand has reached the level of about 4700 billion pkm (passenger kilometre) of which about 87% have been carried out by road (80% by individual car), about 7% by air and 6% by rail.

Goods transport has grown by an average rate of 2% per year, or for more than 75% during the period 1970-1996. Passenger transport has increased for more than 110% during the same period (the average rate has been about 2% per year) (EC, 1999).

External costs of transport have been estimated to be about 4% of GDP (or EURO 260 billion) They include the cost of air pollution (0.4%), accidents (1.5%), noise (0.2%), and congestion (2.0% of GDP) (EC, 1999).

4.2 Intermodal Transport

Intermodal transport has increased during the past decade too. As can be seen from Figure 2, in terms of the volume of transport work, it has approximately doubled from about 113 to about 214 million tkm per year. In addition, Figure 3 shows that the market share of inter-modal transport expressed in tonne-kilometres (i.e., the transport work carried out) has generally increased more than proportionally, from 5% to 8% during the same period. However, in terms of total amount of freight (tonnes), the market share of inter-modal transport in the total quantity of transported goods has always been low and modest, only 1.63% in 1987, with expectations to increase to only 2.6% in 2010 (EC, 1997; 1999). On the basis of the above figures, it may generally be concluded that inter-modal transport has primarily gained its market share by carrying a relatively small quantity of goods (in comparison to the total) on longer distances and not by an increase of these quantities themselves.

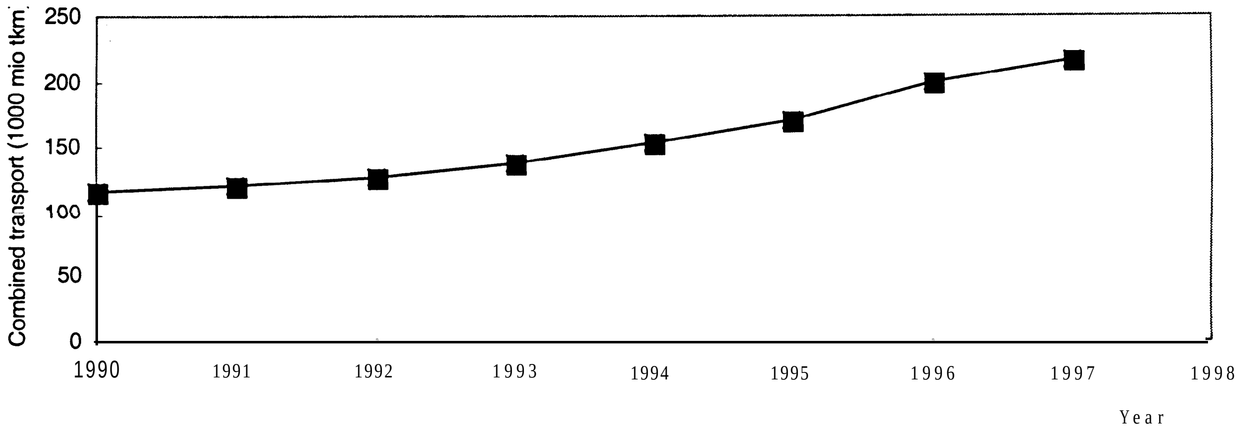

FIGURE 2 - DEVELOPMENT OF FREIGHT COMBINED TRANSPORT IN EU
(Compiled from EC, 1999; Table 4.1 la)

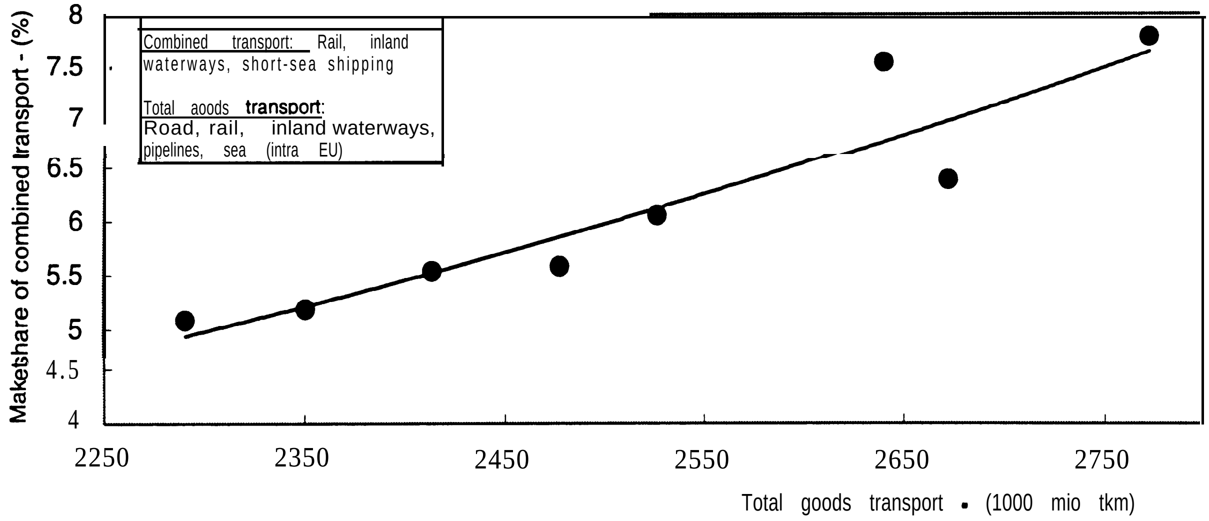

FIGURE 3 - RELATIONSHIPS BETWEEN THE MARKET SHARE OF FREIGHT **COMBINED TRANSPORT AND THE TOTAL GOODS TRANSPORT IN THE EU**
(Compiled from EC, 1999: Table 4.1b and 4.1 la)

5. EVOLUTION OF INTERMODAL TRANSPORT IN THE TRANSALPINE SECTOR

Given the general pattern of the European goods transport developments, which has been illustrated above, it is particularly interesting and important to draw the attention on interesting specific European cases of development of intermodal transport mainly because of their peculiarity in terms of geo-political barriers. One of such regional cases is the Trans Alpine area, which represents an important example of a physical/political/economic ***"arena*** ", where the development of intermodal freight transport network(s) could be a crucial solution for the attainment of transport sustainability.

5.1 Development of the Trans Alpine Freight Transport

In the last years profound political, economic and social transformations such as the achievements of the European single market, the opening up of Eastern Europe opening and the enlargement of commercial relationships with EFTA[5] Nations, in particular with Switzerland, have contributed to a high growth in mobility, particularly in the sector of freight transport. At the same time, the awareness that the competitive power of the European system requires a common strategy in economics and politics – in contrast to national tendencies – has come to the fore. In this framework the Alpine-chain crossing problem has become an important part of the integrated vision of a free European market and it is of particular importance for various countries involved, specifically Italy. Several background reasons may explain this interest.

a) First, the Alpine arc represents the fixed "gateway" for South-Eastern European regions – as well as for Asian and African countries – towards Central and Northern Europe (see the map of Europe in the Annex);
b) Second, Italy – given its geographical situation surrounded by the Alpine arc from the Northern side and by Mediterranean sea from the other side – represents the critical "image" of this crossing situation (see Cattaneo, 1999);
c) Third, in 1997 the rest of Europe has absorbed about 71% of the Italian commercial exchange value. Particularly, the share of EU Member States has corresponded to 57.4% of total trade flows. In this context, the 'preferred' partners of Italy appear to be Germany and France with a share of 17.1% and 12.7%, respectively, while commercial relationships with the bordering countries of Switzerland and Austria have remained below the rates with Central Europe (e.g., compared to with The Netherlands)[6] (see Table 1);
d) Fourth, transport in Italy has always reflected a great peculiarities: the freight volume of freight traffic between 1975 and 1996 has recorded an increase of about 57%, passing from 242 million to 378 million tons transported by the transportation enterprises of Italy and other countries. The percentage increase of the freight value imported and exported by Italy in the period 1990-96 can be illustrated to underline moreover its international transport development (see Table 2 and Figure 4);

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[5] EFTA: European Free Trade Association
[6] In this form of relational exclusivity, the importance of the North-Central areas -against the Southern Italian regions – in the Italian foreign trade should be underlined (see, e.g., Camagni, 1991).

e) Fifth, the existing physical links/gateways for these European commercial relationships are the Alpine passes, which are mainly oriented to the road transport mode. Since the Alpine arc represents an essential corridor connecting the North and South of Europe, it inevitably plays a strategic role for the Italian economy (see Figure 5);
f) Finally, national borders have always incorporated undeniable physical and institutional barriers among different countries and moreover among the Alpine countries whose borders are almost mountainous, thus obstructing transport infrastructures to balance the increasing international freight mobility trend, while evidencing the existence of bottlenecks in terms of missing links and in suffi cient networks.

The above facts clearly illustrate why the efficient and sustainable passing of Alps has always represented a challenge for the freight transport operators independently of the mode. On the one side, they are confronted with a limited capacity of the Trans-Alpine transport infrastructure and with environmental constraints. On the other hand, there is a permanent need to serve the growing demand in a more efficient manner. In other words, the requests for sustainable development of the Trans-alpine freight transport system have been permanently present. As a result, different transit modalities have been developed, which include traditional road and rail and the new (more efficient) combined transport. Two alternatives of combined transport have been developed (Table 3). The first one relates to the option of "combined transport with driver", in which the driver moves his vehicle on railway carriages and follows it during the spatial relocation. The other has been the option of "combined transport without driver", in which only haulage units are moved on rail carriages. However, despite of "innovations", a significant general imbalance between road and rail has sustained. As an illustration, about 62% of the total freight transport crossing the Alpine-arc "Ventimiglia-Brennero" is transferred by road and only about 38% by rail. In regard to the country, Switzerland has accoutred a high percentage of combined transport (see Table 4). This has been caused not only by the local and global freight transport market forces themselves, but also by different regulations introduced by the Switzerland authorities[7]. Table 5 shows the evolution of the road freight transport flows from Moncenisio to Brennero in the period 1980-94. As can be seen, a huge increase of about 13 1% in road traffic through the Alps recorded. Particularly, the three French/Austrian passes (Moncenisio, Monte Bianco and Brennero) appear to have absorbed about 73% of the total flows crossing the Alpine arc in 1994 (see also Figure 6).

[7] For example, due to environmental problems, in 1994 Switzerland imposed the weight-limit of 28 tons on heavy vehicles in transit through Swiss land and a circulation prohibition for them during the nights and on Sundays, thus provoking a consistent deviation of transit flows to other Alpine passes (Reggiani, 1998).

TABLE 1 - INTERNATIONAL EXCHANGE BETWEEN ITALY AND THE REST OF THE WORLD

Source: Minister of Transport - Italy (1997)

COUNTRIES	IMPORT - EXPORT VALUES (Italian million lire)	% Total
European Union	436.368.696	**57,4** %
Germany	130.050.645	17,1%
France	96.156.163	12.7%
United Kingdom	52.575.755	6.9%
Spain	37.7 16.064	5,0%
The Netherlands	33.362.629	4.4%
Belgium and Luxembourg	27.494.097	3,6%
Austria	17.330.914	2,3%
Greece	10.176.615	1.3%
Sweden	8.979.827	1,2%
Portugal	7.000.748	0.9%
Denmark	6.332.091	0,8%
Ireland	5.030.338	0.7%
Finland	4.162.809	0,5%
Others European Countries not belonging to EU:	**55.810300**	**7,3%**
Switzerland	27.647.668	3,6%
Turkey	10.047.319	1.3%
Norway	3.755.336	0,5%
Eastern Europe	**46.505156**	**6,1%**
Total Europe	**538.684.151**	**70,8** %
Total World	**760.187.315**	**100%**

TABLE 2 - EVOLUTION OF TOTAL IMPORT-EXPORT MOVEMENTS (ITALY/THE REST OF THE WORLD)

Source: Minister of Transportation - Italy (1997)

YEARS	QUANTITY Tons	%	%	VALUE Mio It. lire	%
1975	241.697.773			48.066.025	
1978	288.623.767	+19,4	+56,6	95.373.200	
1981	272.805.347	-5,5		189.746.761	
1984	278.49 1.708	+2,1		277.192.390	
1987	305.525.926	+9,7		312.050.726	
1990	339.875.665	+11,2		421.219.349	+67,7
1991	346.325.155	+1,9		435.5 12.496	
1992	353.063.025	+1,9		451.388.651	
1993	346.127.253	-1,9		499.205.648	
1994	362.675.097	+4,8		580.427.279	
1995	377.47 1.486	+4 1		709.201.419	
1996	378.508.7 12	+0,3		**706.342.499**	

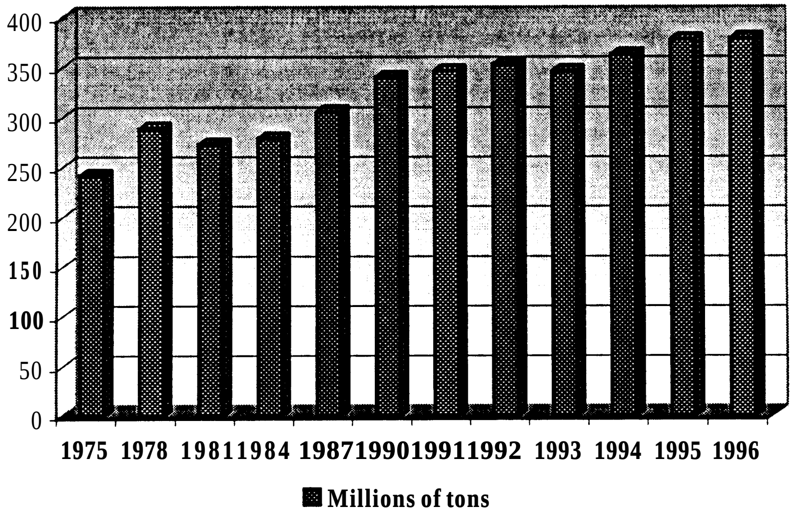


FIGURE 4 - EVOLUTION OF TOTAL IMPORT-EXPORT QUANTITIES (ITALY/THE REST OF THE WORLD)

Source: Minister of Transportation - Italy (1997)

FIGURE 5 ▪ THE MAIN ALPINE PASSES

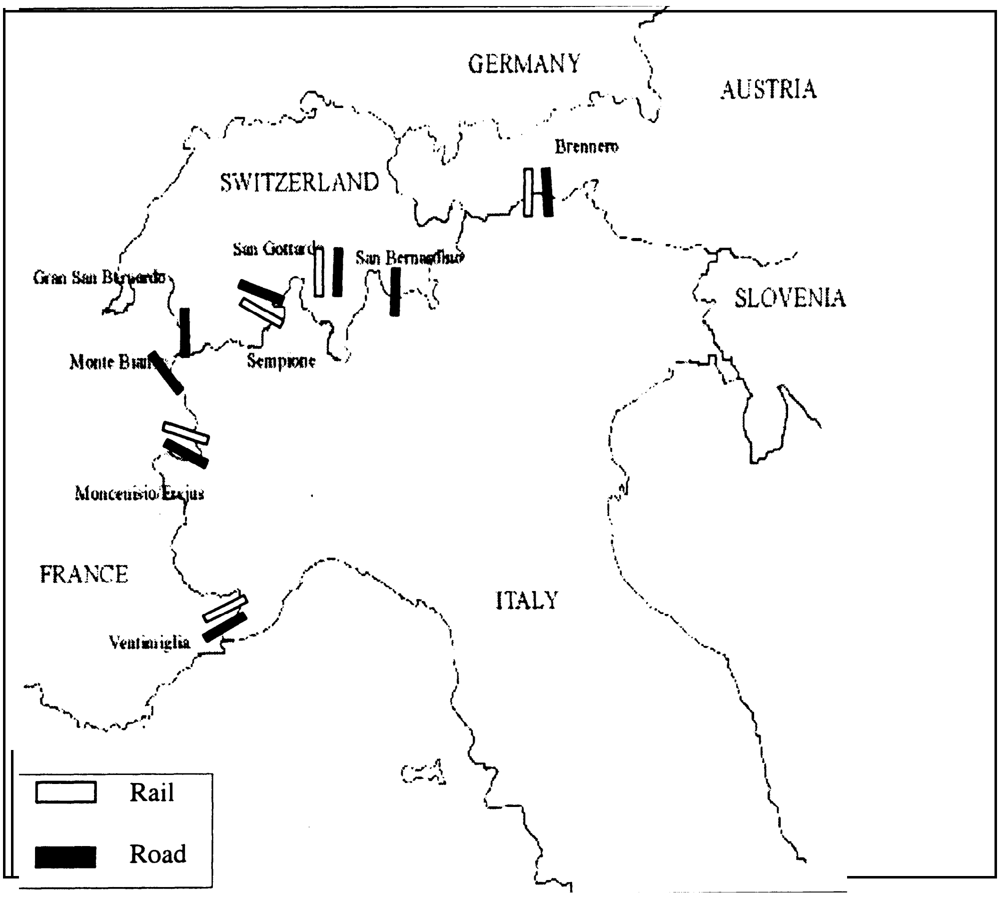


TABLE 3 - THE TRANSPORT MODALITIES AT THE MAIN ALPINE PASSES

THE ALPINE PASSES	ROAD	RAIL	COMBINED TRANSPORT	
			With Driver	Without Driver
Ventimiglia	X	X		X
Moncenisio/Frejus	X	X		X
Monte Bianco	X			
Gran San Bernardo	X			
Sempione	X	X	X	X
Gottardo	X	X	X	X
San Bernardino	X			
Brennero	X	X	X	X

TABLE 4 - PERCENTAGE DISTRIBUTION OF FREIGHT TRAFFIC ON THE MAIN ALPINE PASSES - YEAR 1994

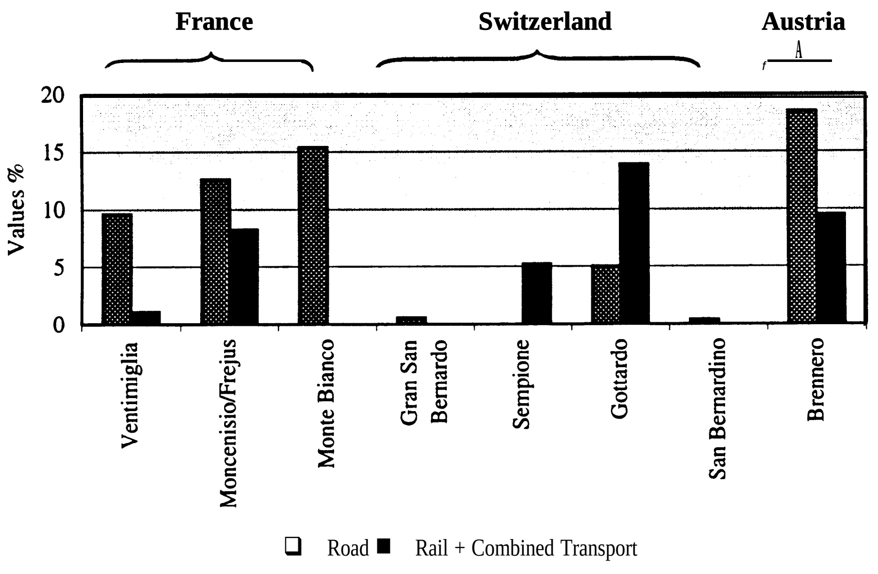


TABLE 5 - DYNAMICS OF THE ROAD FREIGHT TRANSPORT FLOWS IN THE ALPINE SEGMENT

(Thousands of heavy vehicles)

	1980	1981	1984	1989	1994
PASSES					
France					
➔ Moncenisio/Frejus	53	150	230	487	742
➔ Monte Bianco	544	468	456	685	822
Total France	597	618	686	1.172	1.564
Switzerland					
Gran San Bernardo	63	57	48	58	40
Sempione	11	11	14	21	19
Gottardo	21	171	298	538	807
San Bernardino	149	73	71	82	119
Total Switzerland	244	312	431	699	985
Austria					
➔ Brennero	765	794	852	991	1.159
Total road	1.606	1.724	1.969	2.862	3.708

+ 130,9 %

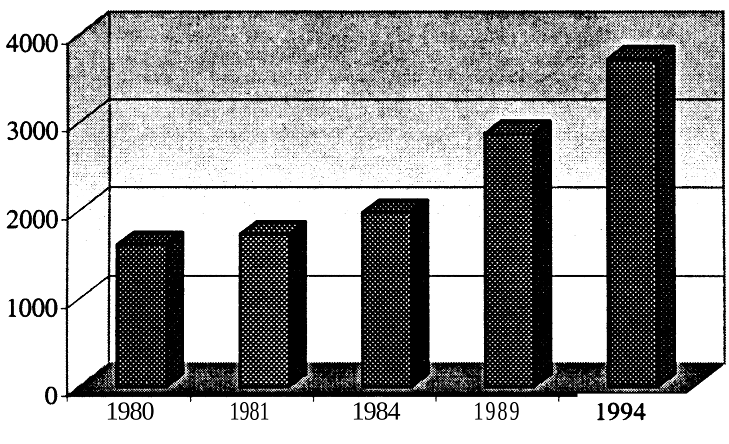


FIGURE 6 - DYNAMICS OF THE ROAD FREIGHT IN THE ALPINE SEGMENT (Thousands of heavy vehicles)

Such an “uncontrolled” growth of road haulage has caused a lot of environmental problems (air pollution, noise and congestion) at both a local and global level. As a result, the EU on the one hand and the Swiss Confederation on the other have developed recently new solutions to deal with the problem situation in a more sustainable way. They both have decided to support a further development of combined transport as an “sustainable” solution. However, despite a wide range of support measures, the development of combined transport has not yet reached the desired level. Even though there has been an annual increase in combined transport through the Alpine arc “Ventimiglia-Brennero” during the period 1985-95, its share in the total Transalpine transport (road and rail) has still remained more or less stable, with the exception of the Swiss volumes, which have significantly increased. (see Table 6). Actually, such an imbalance between road and rail has emerged as one of the critical elements in the future development of the Trans-Alpine freight transport system, particularly in the light of the evolution of an efficient European communication network. Consequently, it has been important to consider the uncertain “future” of the Alpine arc by means of a closer analysis of the patterns offered by different scenarios, based on recent existing studies.

5.2 Forecast Scenarios of Freight Transport Flows in the Alpine Sector

Many studies on the developments of demand in the Alpine-arc have emerged in recent years. They have been conducted with different methods and on the basis of macroeconomic hypotheses and have consequently produced different results (see also Nijkamp et al., 1997; Reggiani et al., 1997). In general, two types of scenarios may be distinguished (Table 7):

a) A “high” scenario (scenario A), based on such hypotheses as ‘high economic growth’, ‘favourable position of rail on the market’, ‘improvement of rail capacity’ and ‘imposing strict restrictions on the heavy traffic’ in order to reach environmental targets); and
b) A “low” scenario (scenario B), based on ‘moderate economic growth’ and on a ‘less favourable rail mode position’ due to a proper response of the road mode to environmental restrictions.

In the context of an paper, the European scenarios have been investigated. The scenarios and their results from these studies labelled DFTCE[8], PROGNOS[9] and C.A.R[10] are presented in Table 7 and Figure 7.

52.1 DFTCE scenario

In the DFTCE study (DFTCE-GS-EVED, 1991), two scenarios have been elaborated. In the first one (Scenario 1), the development of freight demand has been considered independently of the new infrastructure projects. In the second one (Scenario 2), the impact of a new rail line through Switzerland connecting North and South-Central Europe has been taken into account. In general,

[8] Federal Department of Transports Communications and Energies
[9] PROGNOS AG, REGIONAL CONSULTING
[10] Committee of Alpine Railways

TABLE 6 . DYNAMICS OF COMBINED TRANSPORT IN THE ALPINE SECTOR

Source: Minister of Transport-Italy (1997)

Millions of tons	1985	1989	1992	1993	1994	1995
CTD*			**3,0**	**2,9**	3.**0**	2.5
France	0	0	0	0	0	0
Switzerland	0,5	0.9	0,9	0,9	1,0	0,9
Austria	n.a.	n.a.	2,1	2,0	2,0	1,6
CTND**			**11,0**	**11,2**	**12,0**	**13,6**
France	**2**,3	2,5	3,4	3,4	3,0	3,7
Switzerland	2,7	4.4	5,2	5,3	6,3	6,9
Austria	n.a.	n.a.	2,4	2,5	2,7	3,0
TOTAL	**n.a.**	**n.a.**	14,**0**	**14,1**	**15,0**	**16,1**

Percentage of Combined Transport on Total						
France	**9%**	6,8%	8,4%	8,2%	6,7%	8,1%
Switzerland	19%	**25%**	**27%**	**29%**	31%	32%
Austria	n.a.	n.a.	18%	18%	18%	16%

* **CTD: COMBINED TRANSPORT WITH DRIVER (ROLLING ROAD)**

** **CTND: COMBINED TRANSPORT WITHOUT DRIVER (CONTAINERS, MOBILE BOXES, SEMITRAILERS)**

TABLE 7 - FEATURES OF SCENARIOS FOR FREIGHT TRANSPORT FLOWS IN THE ALPINE SECTOR

			DFTCE				PROGNOS		C.A.R.	
Million of	**1989**	**1992**	**2010**		**2010**		**2010**		**2020**	
annual			**SCENARIO 1**		**SCENARIO 2**		**SCENARIO 3**		**SCENARIO 4**	
tons			**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
RAIL	32,4	33,2	92,8	42,1	+5,8%	+4,2%	107,5	63,9	94,8	61,6
	44,4%	42,5%	77%	51,7%			76,2%	45,3%	80%	52%
ROAD	40,5	45	27,7	39,4	-5,8%	-4,2%	33,6	77,2	23,7	56,9
	55,6%	57,5%	23%	48,3%			23,8%	54,7%	20%	48%
TOTAL	**72,9**	**78,2**	**120,5**	**81,5**	**120,5**	**81,5**	**141,1**	**141,1**	**118,5**	**118,5**
Increment with reference to the year 1989		7,3%	65,3%	11,8%	65,3%	11,8%	93,6%	93,6%	62,6%	62,6%
Increment with reference to the year 1992			54,1%	4,2%	54,1%	4,2%	80,4%	80,4%	51,5%	51,5%

SCENARIO 1: Without new infrastructure

SCENARIO 2: With new rail line (▬ ▬ ▬ see Fig. 7)

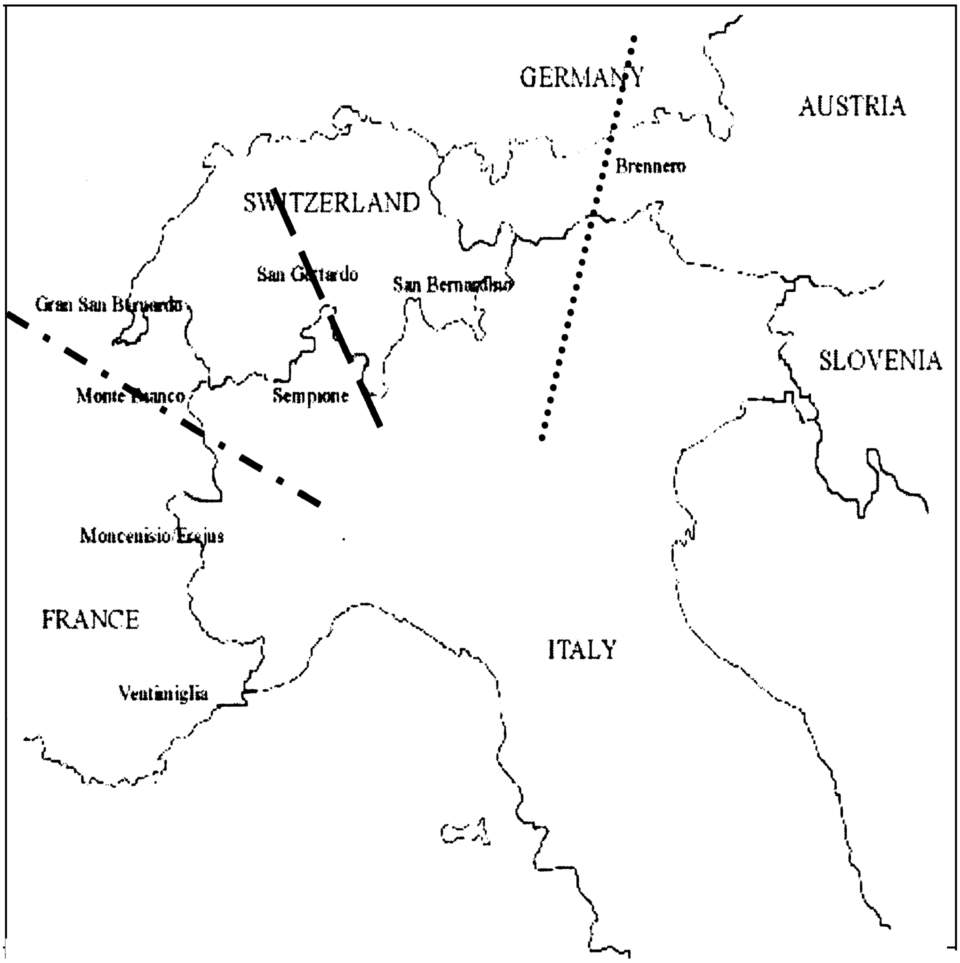
SCENARIO 3: New infrastructure projects (▬ . ▬ . ▬ see Fig. 7)

SCENARIO 4: New infrastructure projects (••••••••••••• see Fig. 7)

A: Favourable scenario for rail mode

B: Less favourable scenario for rail mode

FIGURE 7 - SIMPLIFIED SCHEME OF THE MAIN TRANSALPINE RAIL PROJECTS



New high-speed/combined transport rail line Lione-Torino

Nouvelle Tranversales Ferroviaires Alpines (NTFA)

New high-speed/combined transport rail line on Brenner Axis

the increased capacity and transport speed and the improved quality of service offered by new rail lines are expected to attract freight flows from other directions and modes.

With reference to the two years, 1989 and 1992, the volume of freight demand in 2010 for both scenarios 1A and 2A will increase with about 65% and 54%, respectively. For the two scenarios 1B/2B, the total volume is going to increase with about 12% and 4%, respectively (again with reference to the year 1989 and 1992). The new NTFA rail-line is expected to transfer the freight transport demand from road to rail with about 4% of the total at a "low" scenario B and 6% of the total at a "high" scenario A. It should be noted that the B scenarios, even though not so much favourable to the rail, still keep it in a very good market position (for example, in scenario 1B, the rail market share is expected to be about 52%). In conclusion, it is evident that the DFTCE forecasts certainly favour the rail mode.

5.2.2 Prognos scenario

The PROGNOS study (PROGNOS AG/REGIONAL CONSULTING/ISIS, 1998) has dealt with Scenario 3, which has forecasted a growth of freight transport through the Alpine-arc in the year 2010 with about 80% with reference to the year 1992 and with about 94%, if referred to 1989 (Table 7).

In particular, Scenario 3A has assumed that the EU transport policy will consider the implementation of the new Alpine-infrastructure as a relevant issue before 2010. That means that the new lines such as NTFA, Brenner Axis, and the new high speed/combined transport line Lyon-Turin will be operational. Scenario 3B has assumed that only the Brenner Axis will be operative and that an effective policy for the improvement of the rail competitiveness will not emerge following up an increase in the freight transport demand.

5.2.3 C.A.R. scenario

Finally, we discuss the C.A.R. study (C.A.R., 1994), to be considered here as Scenario 4 (Table 7). The time horizon has been extended to the year 2020. It hypothesises a more optimistic traffic growth and postulates the realisation of rail projects for both sub-scenarios 4A and 4B. Consequently, the rail is expected to absorb the growth of freight transport demand. This is more evident for sub-scenario 4A than for 4B. The final results have been very similar to those of DFTCE (see section 5.2.1). According to them, the rail market share is expected to increase to about 80% and 52% in sub-scenario 4A and 4B, respectively. At the same time, the increase in the total volume of traffic is expected to be about 63%.

This brief overview has shown that - although different hypotheses have led to different results - the traffic in the Transalpine-chain will continue to grow (see the last rows in Table 7). Especially the PROGNOS scenarios have indicated the highest increase in the total volume of traffic. Therefore, without significant actions aimed to improve the rail competitiveness (the A's scenarios), it seems evident that the road sector market share is not assumed to decrease, thus provoking unavoidable bottlenecks in the whole transport European system.

5.3 Concluding Remarks

The main concern of the European transport policy has been how to develop the Trans-European intermodal and interoperable transport networks for both passenger and freight. In such context, the Alpine-arc has been recognised as one of the "key" barriers to an efficient, "free" and sustainable movement of freight flows in Europe. Under such circumstances, the rail mode is targeted as a promising and sustainable option, which is expected to be able to accommodate future growth of the

Trans-alpine freight flows in a sustainable way. However, the above studies have shown that this will be only possible if huge investments including the building of the new high-speed rail lines that are suitable also for combined transport are carried out. Apart from supporting the operations of combined transport, these investments are expected to be able to save and/or even increase the rail market share and thus strengthen its position in the Trans-Alpine transport market.

6. EPILOGUE

Europe is in motion. This holds for both persons and commodities whose flows have been steadily growing. However, this has always been a two-sided process. On the one side, there have been no natural limits to the transport growth. On the other, many natural, economic, political, technical and technological barriers to such growth have arisen. The Alps in Europe is a clear example of natural barriers, as the Channel is. The EU Common Transport Policy (CTP), which has emphasised the sustainability of the development of transport sector in Europe in the widest sense, is another clear institutional (policy) barrier to an undisturbed growth of the European transport sector. The need for sustainable forms of transport has prompted many policy-makers (including the European Commission) to build policies aiming at reducing the negative externalities of transport through vehicular technology and/or market-based measures. There has been a long debate going on in Europe about the question how far the EU regulation should go. The current EU Fifth Framework contains an interesting thematic programme on “Sustainable Transport and Intermodality”, which addresses several of the above mentioned issues (see Table 1).

It goes without saying that much research would be needed to map out the trends, to understand the underlying driving forces and mechanisms, and to assess the foreseeable consequences of policy. Fact-finding will be necessary, based on common concepts, definitions and analysis frameworks. This paper has offered some first tentative contributions. Much more solid research work still has to be done.

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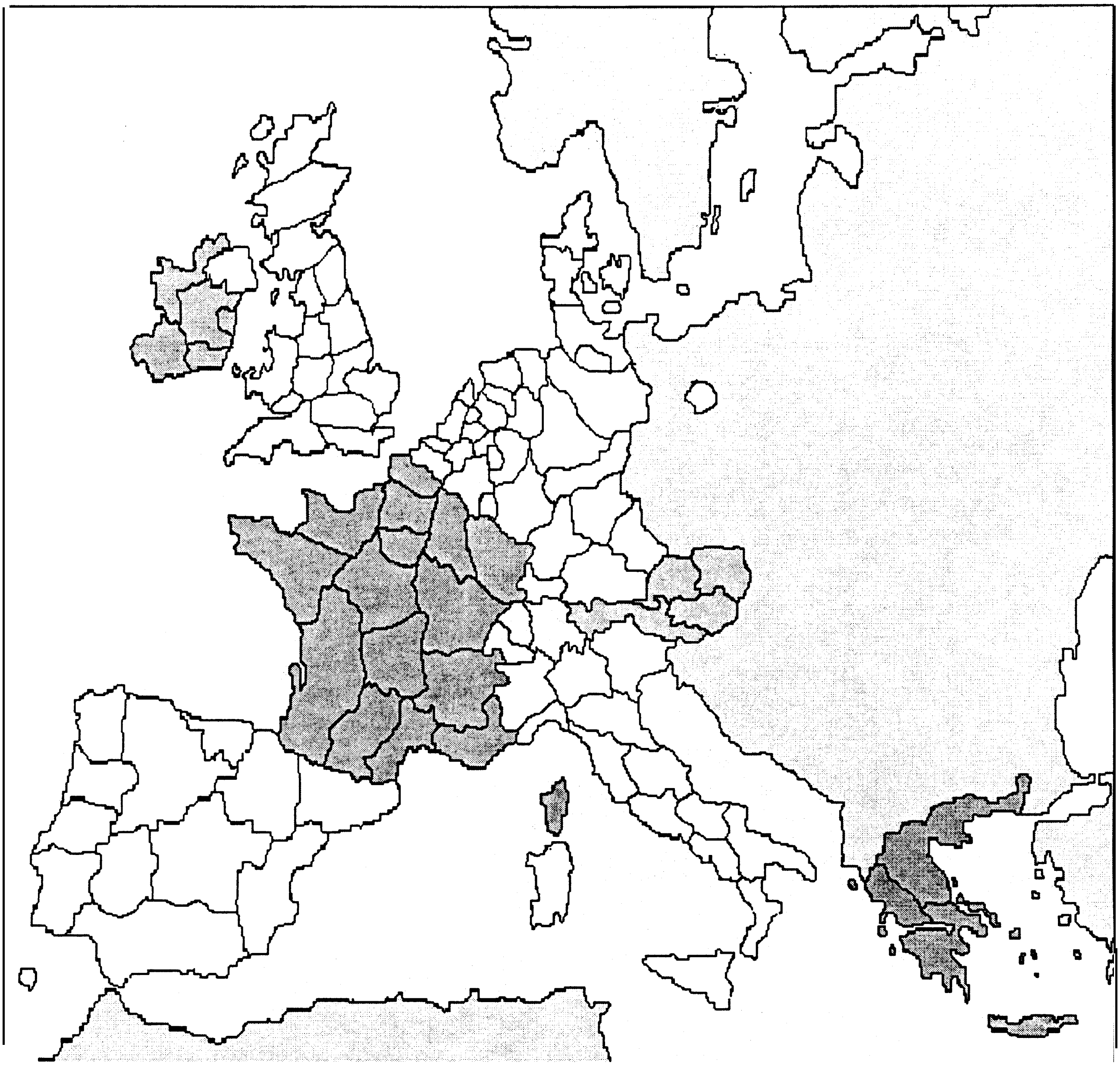
ANNEX : THE MAP OF EUROPE (1990)



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