

**European Cooperation
in the field of
Scientific and Technical
Research**

COST 328

**Integrated Strategic Infrastructure
Networks in Europe**

Final Report of the Action

**European Commission
Directorate General Transport**

Cover picture : European Commission
Transeuropean Transport Network Outline Plan (2010 Horizon), Section : Railways

LEGAL NOTICE

Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use which might be made of the following information.

The views expressed in this publication do not necessarily reflect the views of the European Commission.

A great deal of additional information on COST Transport is available on the World Wide Web. It can be accessed through the CORDIS server (<http://www.cordis.lu/cost-transport/home.html>)

Cataloguing data can be found at the end of this publication.

Luxembourg : Office for Official Publications of the European Communities, 1998

ISBN 92-828-4573-7

© European Communities 1998

Reproduction is authorised, provided the source is acknowledged

Printed in Belgium

PREFACE

COST 328 has been a very ambitious Action in terms of the complexity of the envisaged objectives, the number of signatory countries (17), the large number of researchers who have participated in the work undertaken during almost 4 years and a number of other factors.

Consequently, in consideration of the above, and in order to give a comprehensive description of the research undertaken, the decision was taken to structure the Final Report in four different parts, as follows:

- Foreword (Chairman)
- Report of the four WGs (WG Chairmen)
- Report on Intermodal transport
- A Policy statement paper: 'Recommendations and Lessons'

The reader is therefore invited to take this into account, when using this document.

—

TABLE OF CONTENTS

Foreword

(Author : Mr. Michel Frybourg)	7
---------------------------------------	----------

Actors and Factors

(Authors : Profs : David Banister, Rico Maggi, Peter Nijkamp, Roger Vickerman)

1. Introduction	11
2. The Evaluation Framework	11
3. The Working Groups	14
3.1 Working Group 1 : Peripherality and Accessibility	14
3.2 Working Group 2 : Trans Alpine Freight Transport	19
3.3 Working Group 3 : Competition and Complementarity	23
3.4 Working Group 4 : The Role of Actors	27
4. Conclusions	29
4.1 Networks and Integration	29
4.2 Evaluation and Methods	30
4.3 Globalisation and Internationalisation	31
5. References	32

Intermodal Transport

(Author : Mr. Bryan Stone)

1. Introduction	35
2. Background to ISINE	37
2.1 Networks and Integration	38
3. The main objective of COST 328	40
4. COST 328: The issues reviewed	40
4.1 The basis of the research programme	40
4.2 What should be evaluated? What is a measure of success?	41
4.3 Interoperability, interconnectivity, and intermodality	43
4.4 Policy and Methods: Institutions and Actors	46
4.5 Telecommunications and information networks	48

5.	Internationalisation of trade: European Networks in a Global Environment	49
5.1	The influence of liner shipping on use of inland infrastructure networks	49
6.	Methods of Evaluation	53
7.	COST 328: Organisation of the Studies	55
8.	Conclusions of the Study COST 328	60
9.	Appendix:	63

Recommendations and Lessons

(Author : Dr. Ing. Milan Janic)

1.	Introduction	69
2.	Background	70
3.	Identification of an operational assessment/ evaluation framework on the integrated networks	72
3.1.	The requirements	73
3.2.	The method for assessing/evaluation the network performances	73
4.	The application of the findings of the COST 328 Action	76
4.1.	Proposal of the 'policy guidelines'	76
4.2.	Proposal for a 'Good Policy Practice' in assessing/evaluating the European network development	80
5.	Conclusions	82
6.	References	83

Appendix 1: Memorandum of Understanding	85
--	-----------

Appendix 2: Management Committee members	103
---	------------

Appendix 3: COST Transport Overview	109
--	------------

FOREWORD

An exceptional political effort of the European Union is aimed at accelerating the development of Trans-European networks (TEN). The official objective is to give “**added value**” to the development of these networks taking into account, on the one hand, the budget limitations and, on the other hand, the economic and social needs spelled out in the Commission’s *White Paper on Growth, Competitiveness and Employment*.

Where is “**added value**” in a network? : is it in co-operation between modes or in co-operation with customer ?, is it in a better use of the infrastructure or in the improvement of supply chain management ?, is it in engineering or in marketing ?. Probably in both, but the specialisation in research and administration, the lack of multidisciplinary research (engineering and social science) and the division of responsibilities *put the emphasis on horizontal integration* and not on vertical integration, that is between upstream and downstream, industrial economics and transport economics.

Information Technology, the Web, Electronic commerce, virtual worlds give new opportunities for such integration. *Logistics providers* are booming with the concentration of firms on their core business and are able to improve interlinking between transport, production and distribution. They provide the « missing link » between the vendor and the customer with capabilities of adapting global products to local markets *and opening local products to global market*. It is not a surprise for a service industry.

The openness of major railway infrastructures in the US boosted the creation of intermodal transport operators, but not in Europe. To understand the reason, we have to go further in the *analysis by market segments*, which in the future will be more meaningful than by modal split. This is what will bring forth third party access and user charges. *Value Added Networks* mean a twofold integration, horizontal and vertical.

There is an urgent need for more global evaluation methods for large projects. The assessment of performances of transport networks developed through strategies of integration has to take account of network effects including concepts of barriers, peripherally, multimodality, complementarity and the role of actors. The aim of Clause XII of the Maastricht Treaty is not to increase mobility per se, but to support the single market. So the transport sector has to be considered from the “outside” as the component of the logistics chains connecting the suppliers of the raw material and the consumers of the final products. To the “horizontal” integration (components of the Common Transport Policy) including the three “inter” (Interconnection, Interoperability and Intermodality) and the three “E” (Efficiency, Equity and Environment), we have to add the “vertical integration” including transport in the Supply Chain Management and facilitating the appearance of a new breed of

operators: the logistics suppliers and to substitute a “demand led” transport market to the previous technology-driven market with its modal split.

Further difficulty arises because, when the Maastricht Treaty, Clause XI sets out European objectives, it supports the single market through integration of services, which contribute to European economic growth through competitiveness and trade. However, this has two components, of which one is the stimulation of the inner-European economic activity, and the other is the increased European trading activities in global markets.

Europe is not alone, and its infrastructure is a part of its economic resources. While this may appear clear, its relevance has greatly increased through global trading and communications, and through the generalisation of integrated intermodal transport chains, which now, through **horizontal integration**, involve European inland transportation into world-wide logistic services. Those offering such services (mainly the global shipping lines) have also a high degree of vertical integration. It follows that certain effects of strategic networks, where the nodal interchanges are for example container ports, must be seen in terms of value-added impact upon a global network, operated by others, of which European networks are only part. Europe’s competitiveness in global trade is a function of the effectiveness of its part in these global networks.

Both the COST 328 study and present transportation market experience show that the transportation markets in Europe fall short of optimisation of integration of modes or operations. Fragmentation, incomplete deregulation, especially of rail and air, a lack of coherence between national interests, non-competitive behaviour by various players, and incomplete harmonisation of conditions under which third party access might be made economically attractive, are all reasons why network performance is less than optimal and why actors’ behaviour has not yet developed clear trends. This would be the case even if the existing infrastructure networks were at an appropriate European standard, which, for reasons described in the report, they at present are not. The development of demand is that of users, that is, traders and manufacturers, increasingly exploiting European trading opportunities, who are at the end those whose efficiency, competitiveness and opportunities most reflect the added value of integrated transportation networks. This demand is however dictated by local, European and global market conditions of manufacture, demand, competition and distribution. These give a basis for the ‘outside’ consideration of network efficiency, which is referred to above. If transport integration has a value, it will be measurable in response to a measurable demand, to be satisfied ultimately by an integrator of modes and suppliers of services, including the information-led logistic chain, in a competitive market. This is not yet assured.

ACTORS AND FACTORS

Prepared by

David Banister
Rico Maggi
Peter Nijkamp
Roger Vickerman

Contents

1. Introduction	11
2. The Evaluation Framework	11
3. The Working Groups	14
3.1 Working Group 1 : Peripherality and Accessibility	14
3.2 Working Group 2 : Trans Alpine Freight Transport.....	19
3.3 Working Group 3 : Competition and Complementarity	23
3.4 Working Group 4 : The Role of Actors	27
4. Conclusions	29
4.1 Networks and Integration	29
4.2 Evaluation and Methods	30
4.3 Globalisation and Internationalisation.....	31
5. References	32

1. Introduction

The main objective of COST 328 has been to contribute to a strategic definition of the integration of the Trans-European networks and to stimulate thought on the development of methodologies for the assessment of performances of transport networks and for strategies for their development and/or integration. This very ambitious objective has arisen out of the realisation that strategic infrastructure networks have in the past been looked at as mainly physical networks. Although physical networks are important, in highly advanced economies it is other characteristics which are also important. COST 328 started by taking the five dimensions of the pentagon of concerns where finance, organisation and regulation, software and ecological factors are added to the physical hardware of the infrastructure.

One part of the COST 328 research has been to concentrate on the necessary components of the evaluation process that includes all aspects of the infrastructure. The second main strand of research has been to examine these processes in more detail through specific case studies in the four COST 328 working groups. In this Final Report the main findings are brought together.

2. The Evaluation Framework

New perspectives on evaluation are important as individual links all form part of the network. In the past there has been little evaluation carried out at any level above the individual link where an improvement was taking place. COST 328 proposes that evaluation should be carried out at three separate levels. In addition to the individual project level where the methods and procedures are well known, evaluation should be carried out at the programme and the policy level (table 1).

Different methods are required for programme and policy evaluation as it is important to establish how new links fit in with wider programme objectives (e.g. EU cohesion) and how Common Transport Policy objectives on sustainable mobility and the environment can be achieved. This means that analysis should not be restricted to particular sectors, or the functioning of the networks in particular well defined contexts. Eventually it could be extended to explore the implications for employment, the local and regional economies, the use of resources and the quality of life.

In addition to the multi sector analysis, individual links should be assessed in terms of their direct and indirect effects on the transport network. For example, the Channel Tunnel is a major new link between the UK and France and has a direct impact on the transport networks of these two countries. It also has effects on the economies of Kent and Nord Pas de Calais. However, the Channel Tunnel has impacts that are much wider, including those on the airlines and ferry companies (competitors), on freight distribution systems (efficiency) and on other countries (Belgium, the Netherlands and Germany). It is necessary to trace all these impacts as part of the evaluation process, so that the individual benefits of projects can be matched to the

overall benefits viewed in combination - the superadditivity of projects and their contributions to programmes and policies.

Table 1: Evaluation Processes

Evaluation Level	Evaluation Methods	Other Components in Evaluation
Project	Financial Appraisal Cost Benefit Analysis	Environmental Assessment Social Impact Analysis Economic Impact Analysis
Programme	Multi Criteria Analysis Framework Approaches	Ensuring that the individual costs and benefits of projects conform to wider programme objectives, particularly on regional development and environment.
Policy	Strategic Environmental Assessment and Complex Objectives Analysis, including Meta Analysis	Fitting programmes into the national and international policy context, so that broad economic, social and environmental objectives are met

In addition to evaluation processes, there are important implications for decision making processes more generally. Throughout the COST 328, there has been a concern over the critical success factors within the European network of transport links and how value can be added to the network. Again, it is proposed that a three level approach be adopted that attempts to identify both the critical success factors and the nature of the added value (table 2). In the past, most attention has been focused on individual links, terminals and interchanges, often only for one mode of transport. At this local project level, it is argued that the critical success factors for added value would include the availability of finance, the commitment of different individuals (actors), and the levels of integration available (e.g. information and data support systems).

Table 2: Decision Making Processes

Level of Decision	Key Issues	Critical Success Factors
Local - Project	Individual Links, Terminals, Interchanges for Each Mode of Transport	Restrictions, Competition between Modes, Finance and Subsidy, Individuals, Levels of Integration - <i>adding value to links and nodes</i>
National - Programme	Logistics and Network Effects, including questions of Intermodality, Interoperability and Interconnectivity, including the crowding out of investment	Regulation, Competition, Finance (public and private), Companies, Integrators, New Actors, Mergers and Alliances - <i>adding value to the network and communications</i>
National and EU - Policy	Competitiveness, Cohesiveness and Environment, but also pricing competition, liberalisation and open access policies.	Regulations, Competitive Frameworks, Financial Institutions, Governments, International Agencies, Multinational Companies - <i>adding value to the competitive position of countries and the EU</i>

At the programme level, the broader issues of logistics and network connectivity become more important in determining the levels of intermodality, interoperability and interconnectivity. Here again, the critical success factors depend on the availability of finance and the linkages between companies. Financing is often perceived as a problem, but worthwhile projects and programmes will be financed if there are clear benefits. Difficulties are more likely to occur in the organisational and regulatory framework within which transport has to operate as competition is limited by some modes not paying their full social costs. Investment in one location or for one mode may also crowd out other initiatives, and this in turn has implications for efficiency. The means to reduce levels of uncertainty and to permit continuity in finance and investment seem to be the two key conditions for success here.

It is at this scale of activity that new actors and integrators have appeared in the market to assist in obtaining the greatest efficiency from a given (or enhanced) network. The importance of the new technology in facilitating this process cannot be underestimated. In addition to the instrumental role played by technology, the restructuring of companies and the globalisation process (through mergers of companies and alliances between companies) has meant that the use of the network has increased over and above the expected levels. The high quality transport infrastructure has facilitated the use of the new technology and the globalisation process. This is the value added.

At the EU and national policy levels, the transport network in Europe has an important role to play in moving towards the objectives of balanced competition, social and spatial cohesion, and environmental objectives. A high quality network is also a crucial element in maintaining and enhancing Europe's position in the world as well as ensuring regional development objectives and social inclusion. It may have a less important role in achieving environmental or sustainability objectives as transport is a major consumer of resources and producer of pollution.

The critical success factors here are the clear support of financial institutions, governments, international agencies and multinational companies in ensuring that the competitive position of the EU is maintained and developed. It is in the interest of all parties that the use of and access to the network is efficient and equitable. This requires agreement on priorities, on investment and on the means to pay for the use of that infrastructure. It is here that the decision processes are sometimes inconsistent, and the means to finance investment or to charge for the use of the infrastructure needs to be established.

In the past, a demand led approach has been followed with heavy investment in the network to meet expected growth. This approach has been modified through management based policies (traffic management and more recently demand management), but even here inefficiencies are increasingly occurring as demand continues to grow and congestion is created. New strategies are required that mix both the physical and financial options in combination with the opportunities that spatial development strategies and technology offer. Location policies and the increasing use of telecommunications can reduce the demand for travel so that the use of the network is improved.

In summary, it is important to make evaluations of new links, particularly strategic ones, at different levels. It is also important to include *a wider interpretation of links and networks* so that the supporting infrastructure (finance, regulation, competition, organisational factors, communications etc.) are also included. *The dynamics of the processes* are both interesting and informative, as the use of networks has changed radically, as businesses and people react to congestion and new opportunities. Underlying much of these changes are *the decision making processes* used by all interested parties at all levels. Further investigation is merited of the actors and the critical success factors.

As a result of these preliminary findings, COST 328 established four working groups to explore particular important issues in greater detail, where it was expected that the actors and the critical success factors would be found. In the next section some of the findings from each of the four groups are presented.

3. The Working Groups

3.1 Working Group 1 : Peripherality and Accessibility

Background - The drive towards the completion of Trans-European Networks (TENs) as an instrument in the removal of barriers to a more competitive infrastructure network in Europe, and a promoter of greater cohesion, has emphasised the role of improving accessibility with implications for Europe's more peripheral regions. It is, therefore, clear that any attempt to improve the evaluation and policy making process for infrastructure networks in Europe, has to address the problems posed by the less accessible and more peripheral regions. This raises sets of questions, both for the peripheral regions, and for European level decision making.

At the European level, there is clearly a difficult balance to be struck between those improvements which are seen to be necessary for the greater development of competitiveness of the European Union as a whole, and the recognition that these may imply an uneven development of networks. It is tempting to believe that this issue can be addressed through the development of a set of indicators which can capture both of these dimensions. The search for a perfect indicator of accessibility is thus a key element of the development of both the evaluation process and the policy making procedure. We return to this point below.

At the national level, the more peripheral countries of the EU also face some difficult issues. The peripheral countries are those which generally enjoy infrastructure which is both less well developed as a total network, and poorer in the quality of service it offers. This can be measured by the density of both the road and rail networks, and such indicators as the proportions of the road network which are motorways, the extent of electrified rail track, or double track railways. It is also found in the development of airport and port networks. With the latter, the level of service is seen to be particularly important, with lower densities of services linking these regions to the core regions of Europe, customers facing less frequent services, less direct services and higher prices.

The peripheral countries also face problems within their national territories. The distribution of accessibility varies substantially, typically between their major cities, and more distant poorer rural regions. The choice facing these countries is one of an appropriate distribution of resources between the development of the infrastructures at the higher European level, which will tend to increase inequalities within the country, and to concentrate on raising the level of accessibility in the poorest regions.

Accessibility Indicators - The work of Working Group 1 concentrated first on appropriate indicators of accessibility. It became clear that the variety of experiences in peripheral regions made it unworkable to determine a single universally applicable indicator of accessibility, despite the advances which have been made in the definition of accessibility over the last few years. Indicators still tend to be either geographically, or mode, specific. The varying geographic circumstances of the European periphery, ranging from the sparsely populated Nordic countries, through the outer peripheral Atlantic Arc, into the Mediterranean, to Greece and the eastern periphery, clearly poses a major problem for any attempt to define a single accessibility indicator. Critically, improvements in accessibility cannot be unequivocally taken as an indicators of improvements in economic performance or welfare. Thus simply improving the absolute accessibility of a peripheral region does not guarantee improved cohesion within the EU, and may in fact reduce cohesion.

A key factor which emerged during this part of the work was the concept of linking accessibility to that of choice. In all dimensions of travel and transport choice structure, peripheral regions face a more restrained offer, and greater constraints than those in the European core. This choice affects the availability of modes, the range of destinations served directly, or with a single interchange, and perhaps most significantly, the range of choice and competition between different operators and carriers. Defining accessibility thus becomes a question both of a range of factors, and the behaviour, particularly the competitive behaviour, of actors.

Case Studies - In order to develop this concept further, a series of four case studies was undertaken by different members of the group on contrasting peripheries.

- The Nordic countries demonstrate the problems faced in sparsely populated regions which also suffer major physical barriers of sea links to the rest of Europe, whilst at the same time being close to a number of the countries in transition in eastern and central Europe.
- Ireland represents the particular case of an island nation highly dependent on sea and air links, with the particular concern that it faces a choice between longer sea routes to the European continental mainland, or a sequence of shorter crossings, using the routes through the United Kingdom.
- Portugal, like Ireland, is part of the outer periphery of the Atlantic arc, dependent on links across another member state for its connection by land to the European core, but with strong sea trading links outside the European Union.
- Spain is an example of a country with substantial variations in regional degrees of peripherality, but strongly affected by the growth of one industry, tourism.

Summary of Findings - These four studies emphasise the variety of accessibility experiences in different parts of the European periphery. Tables 3 and 4 provide a summary of these findings in terms of the evaluation processes, and decision making processes identified above. Three particular factors stand out from this which are crucial to future development in the periphery.

Table 3: *Evaluation Processes with respect to Peripherality and Accessibility*

Evaluation Level	Evaluation Methods	Other components in Evaluation
Project	<i>Financial appraisal and CBA</i> - Financial appraisal limited given traffic flow levels; need for careful analysis of wider economic factors in CBA; reliance on accessibility indicators can be misleading; many regions already have healthy economies which are protected by inaccessibility rather than constrained by it	<i>Environmental assessment</i> - new physical infrastructure may be seriously ecologically damaging in some remote regions; <i>Social impact analysis</i> - some remote regions may have fragile social structures where greater integration is damaging; <i>Economic impact analysis</i> - difficult problem of evaluating appropriate forward and backward linkages arising from new transport infrastructure
Programme	<i>Multi-criteria analysis and framework approaches</i> - needs a view of overall development of economy to ensure consistency with infrastructure programme, need to consider non infrastructure aspects of transport on consistent basis with physical infrastructure.	<i>Need for clear objectives on regional development and environment</i> - programmes must avoid being too oriented to international links to the exclusion or detriment of internal distribution impacts
Policy	<i>Strategic Environmental Assessment and Complex Objectives Analysis, including Meta Analysis</i> - need to ensure that transport is treated consistently and transport policy is not being asked to shoulder too large a burden of non-transport objectives (e.g. employment creation through construction) and that non transport policies have been adequately assessed for their transport impacts (e.g. other spatial development policy, regional policy, rural development policy etc.)	<i>Programmes in national and international policy context so that broad economic, social and environmental objectives are met</i> - A better understanding of the role of transport in the development of the economy and society, especially the distribution of the benefits of growth and economic development, better understanding of the link between economic growth as measured by GDP and welfare (including distributional, social and environmental factors)

Table 4: Decision Making Processes with respect to Peripherality and Accessibility

Level of decision	Key Issues	Critical Success Factors
Local - Project	<i>Individual links, terminals and interchanges for each mode of transport</i> - need to determine most appropriate mode for many regions where conditions do not allow for choice, need to decide between complementarity or competition with adjacent regions (e.g. competing airports or developing surface link to airport in neighbouring region), but intermodality may offer an alternative.	<i>Levels of integration (adding value to links and nodes), finance - individuals</i> - the need to improve choice, concern about the burden of financing new infrastructure on individuals in sparsely populated areas, cost of tolls, fiscal burden, need for evaluation of relative benefits to local area and to external areas from scale economies, forward and backward linkages etc.
National Programme	<i>Logistics and Network Effects/Intermodality, interoperability and interconnectivity</i> - decide between network choice or preferred network development strategies, problems of linking peripheries directly or through core hubs, crucial role of the design and structure of networks ("network architecture")	<i>Companies, integrators, new actors, mergers and alliances (adding value to network) - public and private finance</i> - similar concerns as at local level on incidence of toll and fiscal burdens, need for analysis of "appropriate" network by mode for each country, concern about monopoly power of (often foreign owned) new actors and integrators, which act as limit to choice.
National and EU - Policy	<i>Competitiveness, Cohesion and Environment/ Competition, Liberalisation and Open Access</i> - fundamental conflict of competitiveness thrusts involving the search for scale economies and simplistic cohesion objectives, contradictions in accessibility indicators. Problem that competition and liberalisation requires flows large enough to achieve minimum cost operations by all operators, need for new small scale low cost alternatives	<i>International agencies, multinational companies (adding value to national and EU competitiveness), institution and government finance</i> - balance between available Structural Fund and EIB finance and fiscal burden/crowding out effects, distributional concern about competitiveness/ cohesion balance, need to identify comparative advantage of peripheral regions in external trade of EU e.g. through ports, development of major "transition" corridors, i.e. choice of destination/trading partner

1. The balance between links and networks, and the critical position of key hubs. This affects the way in which local and regional networks within peripheral regions relate to the higher level European networks. This requires a clear understanding of appropriate markets and the threats posed, wittingly or unwittingly, by actors in other regions. Such market opportunities and competitive threats are often sector specific and relate to the existence of scale economies and to the scope for the development of backward and forward linkages within the regions.
2. The relative importance of competition, both between and within modes. This requires a clear view of the way in which networks are to be viewed as competitive or complementary recognising the typically lower level of flows in peripheral regions. However, some peripheral regions in the EU may face substantial transit or corridor traffic to and from external borders of the EU or ports. Within modes the lack of competition between carriers and the relation of domestic to foreign carriers in strategic alliances may pose particular problems for peripheral regions. This includes the need for reliance for key links on hubs which are controlled by others.
3. The potential problems of the excess burden of new infrastructure on activities within peripheral regions. New infrastructure provided by the private sector or otherwise requiring the payment of tolls may place extra burdens on the local economy. The replacement of, for example, traditional low cost ferry routes by a new bridge or tunnel may reduce travel times and their variability, but at a high cost to local users. Even where direct charges are not made and where external subsidy is available through the Structural or Cohesion Funds or through EIB loans the local community will have to bear at least a share of the cost which places either or both a fiscal burden and some crowding out on the local economy. Thus the total costs to the local economy are not reduced by the extent which a simple measure of the enhancement of accessibility might imply. In this case neither competitiveness nor cohesion are improved.

For the development of an evaluation methodology the following features are critical:

1. The pentagon of concerns identifies the variety of issues which are present in all regions, but the lack of choice in certain dimensions creates particular tensions for its use as an evaluation tool in peripheral regions.
2. The structure identified in Tables 1 and 2 has been applied to our analysis of the peripheral regions, based on the four case studies. This does highlight the way in which the lack of choice and factors such as crowding out effects and the excess burden of new infrastructures act as critical success factors. However, it is too simplistic to think of these cases falling neatly into the cross tabulation.
3. There are clearly factors which cut across the issues identified here. A major issue is the role of actors. In peripheral regions these actors often come from outside the region, or are dependent on other actors outside the region. This blurs the neat distinction into local, regional and national decision makers. Projects in

peripheral regions which may have significant effects on local communities, such as the construction of bridges in coastal regions or new roads into inaccessible mountain areas are typically not viable as free standing projects, but only as part of a network of new developments. The benefits from a single project can thus only be realised in full if other projects, often in other regions, are undertaken. This super-additivity effect makes it difficult to ascribe precise costs and benefits.

3.2 Working Group 2 : Trans Alpine Freight Transport

The TAFT context - The structure of production, distribution and transport is going through a rapid transition phase. Globalisation, outsourcing and just in time are trends that lead to an increased demand for freight transport on the one hand, and to a change in the kind and quality of services demanded on the other. On a European level, these trends are reinforced by the political and economic process of integration and the increase in spatial interaction. The consequence is an increasing stress on the transport networks in form of congestion and bottlenecks.

The policy responses to these problems are inadequate and in many cases national regulations are at the source of the problem, for example the Trans Alpine freight transport (TAFT). Actually TAFT is not an outcome of market processes alone. On the contrary, the ways in which overall flows are split among the modes and the country is to a very large extent the result of policy intervention in different countries. In the case of Switzerland, the overwhelming role of rail freight, and especially combined transport, is produced by the regulation of road transit (28 tons limit) and subsidies for piggyback transport.

What holds for the European networks in general is even more true for the Trans-Alpine freight transport networks. TAFT is characterised by spatial frictions at national borders, incompatibilities between transport modes, capacity problems on roads, lack of competitiveness on rail, environmental problems etc.

Objectives, Approaches and Evidence - The TAFT group aimed at analysing problems of network integration in the Trans Alpine context by focusing on the functioning of the network rather than on its overall social impacts. This more narrow perspective permitted concentration on network efficiency and deficiencies and thus the identification of the critical actors and success factors.

The functioning on the network has been considered with respect to the five pentagon dimensions namely: infrastructure (hardware), software, market organisation and regulations, environmental and financial aspects. Analysing the functioning of the TAFT network with respect to the five dimensions implied the use of a variety of methods and instruments.

Hence, instead of developing a unified evaluation tool for overall impacts a sets of context, specific tools have been applied to evaluate various cases of malfunctioning.

More specifically, the group used the following approaches in the different contexts:

- Micro level (individual actors behaviour).
Stated offers analysis of freight forwarders' behaviour.
Policy network analysis.
- Aggregate level (network flow models).
Mode choice and freight distribution models.
Neural network models.
Qualitative flow forecasts.

The applications of this diversity of methods produced a number of significant results with respect to singular aspects of TAFT. The research illustrates how various influences, national, rail, environmental and political are preventing progress towards better use of the infrastructure, resulting in a focus on big infrastructure projects, which are only limited by increased funding problems.

In line with the COST 328 approach, which is concentrating upon value-added use by actors of infrastructure which is itself passive, TAFT has been viewed as flows, for which the modal links are part of the hardware, but other elements are also involved. There are significant differences in the features of flows by the various transalpine routes, as well as modal split between rail and road. Switzerland serves predominantly rail freight, while road use is concentrated on the French and Austrian routes. Combined transport has begun to play a role, mainly through Switzerland.

Infrastructure is not yet a bottleneck on the routes concerned. Although there is some congestion on road, there is theoretically a substantial capacity reserve which could be activated under other circumstances, such as reductions in regulatory restrictions. Although financing is clearly a barrier to realisation of substantial new links, which may be justified for other reasons such as ecological requirements or organisational shortcomings, this is not seen as a basic barrier to optimisation. The ongoing survival of some combined transport links is not a financial problem, but rather an organisational matter, since subsidy is an aspect of regulatory intervention on market functioning.

The conclusion reached is that the most critical barrier to efficient network integration in the Trans Alpine sector is Organisational. Two features of the findings are highlighted here :

1. The TAFT market is over-regulated, National, regional, local and mode-specific interests dominate over the interest of serving transport problems in an integrated way. This regulation reduces the capacity of the network through disintegration.
2. The national dimension has a negative impact on TAFT network integration. Most suppliers are local monopolies, and a market structure orientated on the national market dimension has developed. Small fragmented operators with inefficient use of scale are the result. Market access is difficult.

The TAFT studies suggest that the European discussion on the separation of track and operations reflects the need of free access because it is the only way to make competition work, even though in economic terms it is doubtful whether such a

disintegration returns higher efficiency and profit than an integrated operation. The existing 28 tonne weight restriction in Switzerland and the ban on night goods vehicle driving has been shown to have an impact equivalent to a 20% price difference, but to provide no incentive to greater efficiency, so inducing the known detours through France and Italy. The existing environmental capacity is used less efficiently. Pricing schemes with fixed and variable elements have an incentive to lower other costs and improve competition.

Critical Success Factors (CSFs) - The critical success factors and the relevant actors found in the research can be listed according to the pentagon of concerns. From the results here, improving the functioning of the TAFT network primarily implies improvements in terms of regulation and market organisation. More specifically, the research pointed out that:

1. **Hardware** is not seen in the first place as a scarce factor; its extension is not an immediate CSF. Moreover, route and tunnel construction only creates potential, but does not itself improve efficiency. Critical actors in this field are national governments which define infrastructure strategies from a national perspective rather than taking a European view of Trans Alpine infrastructure needs and respective funding options.
2. **Orgware** (organisational and regulatory issues) are shown to be critical. After an examination of several alternative approaches, it was concluded that it is critical to improve the competitiveness of both the rail and the combined transport sectors, by intrinsic improvements following the removal of existing barriers. These include addressing the problems of national monopolies, inadequate internal flexibility, lack of market orientated behaviour, and confusion of aims through the superimposition of national policy goals. Measures which do so are the Critical Success Factors.

The available instruments are in general terms re-regulation, privatisation, market opening at a European level and free access. The last of these is the most relevant for the promotion of integrated and intermodal transport. Present operators cannot provide competitive services on today's fragmented market. New entrants require freedom from national policy restrictions and from a dependent relationship with existing railways. Clear rules for infrastructure use, market access, property rights for basic service providers, and an international harmonisation of norms would have an enormous impact upon integration of the networks.

The most feasible approach is probably deregulation, removing existing rules without imposing new rules. This would encourage new partnerships and a more incentive-oriented approach. It is in the orgware domain where we find most of the critical actors. These are the national railways, the national combined transport companies, the road transport sectors which all in one way or in another profit from the current overregulation of the TAFT market and the subsequent disintegration of the TAFT network. In addition, regulatory agencies have a limited knowledge of alternative modern options for re-regulation and also a limited interest to implement them.

3. **Ecoware** (Ecological aspects) has a role to play in that it is at present one of the sources of distortion of choice, and that the concept of ecological capacity is thereby introduced - but this is also a part of the organisational environment. The environmental interest groups represent another set of critical actors in so far as they combine, especially in the TAFT context, narrowly defined local interests with more general environmental concerns.
4. **Software** has a certain role, for rail and combined transport, where open harmonised systems are not yet operational, but this is not seen as a leading Critical Success Factor.
5. **Finware** (Finance) is not seen as a primary barrier to raising efficiency.

Presenting critical actors and factors this way makes it obvious that actors' behaviour cuts across the logic of concerns. But one important finding is that actors play a strategically critical part in the sphere of regulation and market organisation.

Summary - The TAFT market fails to function efficiently due to various policy failures. First, transport policies have been and are still following a national logic. Regulations in the transport sector on a national level together with national planning perspectives of the infrastructure hinder the emergence of an integrated TAFT network. Secondly, policies which have been designed in the interest of national players, such as railways and combined transport companies, are only slowly giving way to an integrated European approach. Thirdly, the newly arisen focus on environmental issues leads to un-holy alliances with the already existing interests. This leads to a situation where different stakeholders strongly support a transport policy focusing on national issues. Under these circumstances, the policy options are severely limited.

These results have been achieved through the application of a variety of methods and a synthesis of the evidence found. Aggregate flow models allowed for the quantification of the overall implications of specific strategies (e.g. the 28 tons limit), whereas microeconomic analysis has given more precision to strategic potentials in terms of price strategies for forwarders. The combination of this evidence has helped to identify critical success factors. Introducing actors analysis has permitted specific weights to be given to these factors in terms of relevant actors in the case of specific bottlenecks. Finally, the organisation of the arguments according to the pentagon dimensions has given a coherent overview on the findings. Thus, the pentagon perspective has been used as a reference for in terms of critical dimensions of the issue and not as an analytical device – which it is not.

The conclusion is that, in contrast to earlier expectations, organisational issues form the key Critical Success Factor for improving the opportunities of network integration on the Trans Alpine freight route networks. These findings are clearly not only confined to the Alpine routes, but their significance in the concentrated, highly political, and highly competitive environment of the Trans Alpine range is to be noted.

3.3 Working Group 3 : Competition and Complementarity

Background - Recent policy developments in the European transport sector suggest a high degree of deregulation, accompanied by and reflected in a trend towards decentralisation and privatisation. The general view is that the market ought to have a more pronounced place in transport decision making. A market system implies by definition more competition in order to increase the efficiency of formerly bureaucratically organised, overregulated transport systems (e.g. in aviation, railway operation, or inland waterways transport). However, at the same time, a drive towards the market may encounter two major stumbling blocks which would have to be overcome in order to achieve an efficiently operating market system:

- the danger that as a result of market competition a fragmented transport system will emerge, which suffers from lack of network synergy, critical mass and complementarity between different modes which altogether make up a socially desirable transport system.
- the danger that a strict obedience to market principles will favour those transport modes which are economically most efficient, but fail to incorporate the social costs accruing from externalities such as environmental decay, congestion and fatalities.

The main task of the COST 328 Working Group on Competition and Complementarity in Road, Rail and Waterway (CoCoRoRaWa) transport was to set out the principles for an evaluation methodology in the transport sector by investigating systematically the usefulness of the pentagon of concerns for policy assessment regarding the competitive-complementary of transport decisions. An important focal point of this working group was to identify and develop relevant evaluation frameworks and operational assessments methods in order to judge the socio-economic meaning of extensions or adjustments in transport movements in Europe.

This analysis is crucially important as transport mobility has drastically increased in Europe. For example, in the period 1980-1990 freight traffic in Western Europe has risen with approximately 30 per cent. Car ownership has increased with some 40 per cent, and passenger traffic with approximately 35 per cent. The political developments in Central-and Eastern-Europe leading to a widening of the European transport market and the increasingly recognised need to take care of the environmental stress of the transport sector make it necessary to develop an evaluation system that would incorporate mobility changes, modal shift and environmental constraints in the mobile Europe. Thus, a balance has to be found between efficiency, equity and sustainability.

Objectives and Approach - The original objectives of the CoCoRoRaWa group were:

- to develop a systematic, comparative assessment methodology for road-rail-waterways competition and complementarity regarding intermodal transport in Europe, mainly seen from an actors' perspective in a liberalised transport market;
- to position the actual passenger and freight development in a contestable European transport market by means of suitable and measurable indicators

depicting the strategic demand and supply characteristics of the evolution of this market;

- to develop a cross-modal and cross-national comparative analysis - preferably in a quantitative sense - for the performance of various modes and their actors.

The CoCoRoRaWa group has next made an attempt to establish the following methodological and applied links with the general COST 328 approach:

- to focus on multimodal issues in Europe, with specific attention on the identification and operational definition of indicators for the measurement of integrated European network performance;
- to address the issue of synergy in European networks by paying attention to the efficient operation (added value) of interoperable networks;
- to analyse the role of different (new) actors in the European transport market, with a specific view on the strategic role of market-based initiatives in freight transport (including social costs).

The CoCoRoRaWa exercise has aimed to contribute to policy analyses of intermodal European freight transport by using the following methodological tools:

- policy scenario analysis based on exogenous futures, sustainability policies, and infrastructure options;
- assessment of bottlenecks in European transport via a strength-weakness analysis and an analysis of critical success factors for multimodality (based on the pentagon approach);
- development of a survey-based and actor-oriented methodology for setting priorities in intermodal freight transport infrastructures in Europe.

The pentagon prism introduced above was used as a general framework for setting up the methodology and for undertaking the empirical case studies.

Results - The methodological and empirical work was undertaken in two different, but complementary approaches.

1. First, using the five critical success factors encapsulated in the pentagon of concerns, a European survey was held among transport experts in order to identify the bottlenecks and the most promising elements of European intermodal transport policy, in particular regarding freight transport by rail and road. It turned out that financing and organisation were by far the weakest elements in a coordinated European multimodal policy. This means that in future multimodal infrastructure network plans such aspects would need prominent attention.
2. Secondly, a European commodity flow study on road-rail competition was carried out by maximising the benefits of network synergy in Europe. Here neural network analysis turned out to be a fruitful analytical tool. In addition, the environmental costs were introduced by assuming various user charge policy scenarios for European freight flows. Clearly, the implementation of such market-based environmental policies will have an impact on the spatial distribution of flows, but does not lead to a dramatic decline in transport flows.

The assessment and evaluation framework outlined above has been applied to the assessment of the efficiency and the state of transport modes in Europe and of the

network as a whole. This has been pursued at two levels. First, the technical elements and their operational aspects have been evaluated. Secondly, the operational-managerial characteristics (environmental, economic, service/ network) of a “good” or satisfactorily operating freight transport network have been assessed. Such desired trends have been defined for each mode and for the entire system.

At the more disaggregate level, the study has tried to trace, identify and assess the decisive barriers that prevent a well-functioning operating of the freight road-rail network. These factors have again been traced at two levels, namely the national level and the European level. In addition a distinction between intermodel transport lines and terminals has been made.

The issue of achieving a satisfactory freight transport network has also been examined. For designing the necessary policy the crucial success factors have been carefully studied and their relative importance systematically assessed. For the identification of both current barriers and success factors the pentagon of concerns has again been used. This model distinguishes the relevant barriers into five main categories: financial, organisational, hardware, software and ecological barriers (table 5).

The conclusion reached is that the development of a well functioning multi-modal transport framework emerges as a promising solution for several current transport problems and related externalities. However, it appears that the existing state of multi-modal networks is lagging far behind the desired level, especially in the case of road-rail cooperation. The survey exercise performed in the framework of the present study showed thus clearly that transport experts in Europe attach a high desirability to the development of an efficient and effective multi-modal network, and this will be beneficial to the transport sector and society as a whole.

Table 5: Survey of the Results

	Crucial Barriers	Medium Barriers	Low Barriers
Gap between existing and “desired” intermodal transport. National level	financial hardware	organisational	software psychological meta-variables
Gap between existing and “desired” intermodal transport. European level	financial hardware		organisational software psychological
Gap between existing and “desired” intermodal terminals. National level	financial hardware		software psychological
Gap between existing and “desired” intermodal terminals. European level	financial hardware	organisational	software psychological

However, this evolution is burdened by serious obstacles. It seems that there are prohibitive financial, technical, organisational and other problems. In particular, the cooperation level between European countries for the development of a fully interoperable railways system is rather weak at present. Moreover, railways have an

important role to play in the development of an effective network. Other technical problems, such as those related to the existence of specific rolling stock emerge as a decisive barrier and should be taken into account. Financial issues involved in the creation of sufficient rail infrastructure and intermodal terminals seem to be a rather prohibitive obstacle in almost all European countries and relevant institutions.

On the other hand, the importance of proper intermodal terminals is considered as fundamental by most European experts. They indicate that there is a great lack of intermodal terminals which otherwise could facilitate an effective rail-road network. The development of proper terminals is also burdened by serious financial and intra-European cooperation obstacles.

Conclusion - It turns out that the socio-economic added value of networks in Europe can be assessed by operationalising the pentagon elements and by using environmental policy scenarios for European freight flows. In this context, our final recommendations emerging from our study concern the development of a policy for removing the financial and hardware technical barriers, since multi-modal freight transport emerges as a promising evolution in economic, social and environmental terms. Such a policy may have a European (international) perspective which takes into account the particular national characteristics in each country. In this framework, the adoption of common technical standards for railways operation and the introduction of new financial schemes emerges as prerequisites. On the other hand, such development requires new legislation and social adjustments concerning the market structure, the management and the ownership of enterprises and infrastructure in the transport sector.

In conclusion, in the light of the capacity of the current European networks for commodity transport in an integrating economy and in the light of the unacceptably high environmental stress of road transport, new logistic systems based on combined transport as a blend of different modalities are necessary. This will increase capacity, reduce congestion and environmental decay, and make the European network economy more efficient, but this outcome requires dedicated policy strategies on both intermodal transport and on transshipment terminals.

A more liberalised transport market may increase the efficiency of intermodal transport operations, while also environmental externalities may be included. The critical success factors of such a market may be mapped out by the application of survey methods among experts and stakeholders, while using multicriteria and disaggregate choice analysis. The resulting transport flows may be gauged by using neural network analysis.

3.4 Working Group 4 : The Role of Actors

A comprehensive survey was carried out through a questionnaire survey of all COST 328 countries on the actors' strategy towards the integration of networks. It was designed to include all those currently involved in decisions relating to the use and integration of networks, and to elicit concerns and opportunities about the future.

At the national level the state still has a dominant role in determining investment priorities for the infrastructure, even though powers are being devolved to regions and to autonomous agencies. It is not just in decisions on investment, but the state controls finances (or access to finance, regulations and taxation. This strategic role also affects the level of integration in networks, but here the experience of different countries is very variable with some having clear central direction, whilst others take a more permissive role as integration and other leave it to the market. The role of autonomous agencies is fairly widespread with respect to ports and airports, but less common for railways and roads. The state has a key role here in ownership and the provision of services, although in some countries the use of contracts and tendering procedures are become more common as the state gradually withdraws from service provision.

The role of the regions reflects that of the state at the more local level. Rather than investing in the network, the regions' primary concern is in the maintenance of the network and in the provision of services on the network. In some countries, the regions have powers to raise capital, but in others they are restricted to seeking state funding. The regions have only a minor role in the integration of networks as their powers and financing opportunities are limited. Perhaps there is a major role that the regions could play in providing information and advice on the optimal use of the networks to passengers and freight hauliers.

The role of financial institutions and private capital in the construction of infrastructure is limited, except where there are government guarantees. Some potential exists on small to medium scale projects where the risks are low and there are good prospects for returns on investments (e.g. bridges and tunnels). The greatest potential for private sector involvement in infrastructure investment is through joint ventures between the public and private sectors.

The survey has not found an important role for the major transport operators in the integration of networks. The tendency has been towards greater fragmentation as operators seek to increase their market share at the expense of their competitors. This lack of integration is particularly apparent at the interfaces between modes, but there are some promising examples of greater cooperation through such schemes as park and ride, combined transport and better transfer facilities (including interchanges). The role of the trade unions is very variable as their power is considerable in some countries, but it has been substantially reduced in others. Modernisation is supported by the unions provided that jobs are safeguarded and working conditions improved.

The power of environmental lobbies is again variable between the countries surveyed. Their general influence may be limited, but they are still powerful when focused on particular issues (e.g. a new road or new runway capacity). Similarly, the industry lobbies are still influential when economic factors are debated, particularly jobs, but it is the environmental lobbyists that seem to be more effective in their methods and in influencing opinion on the choices to be made in the transport sector.

The role of shippers is substantial in achieving network integration and in providing door-to-door services, and they have been effective in providing intermodal services. This change has been facilitated by the new logistics, the new integrators (e.g. express delivery) and the requirements of the service sector for immediate response, but often it is provided at a premium price.

Another set of new actors has arisen in the leisure sector through multi-modal tour operators. Services are again becoming more tailored to the individual at a premium price, rather than being offered as a cheap package. Quality seems to be a key objective. Individual companies are also providing their own integrated distribution networks: making optimal use of their own vehicles, the information highway and the relatively low costs of transport.

In summary, the survey found:

1. The role of the state (and the EU) is crucial in providing the framework and direction for policy, including regulation, finance, investment, integration and operation of the network;
2. The regions have less of an instrumental role, but more responsibilities for the *maintenance of the infrastructure and provision of services*;
3. The private sector has a limited role in investment, unless in partnership with the state or in particular projects where risks can be shared. It has a much greater role in the provision of services;
4. Operators are more concerned over their own market share, rather than the integration of the network. Recent changes (e.g. deregulation and privatisation) have led to fragmentation of services;
5. Environmental and industrial actors are powerful, particularly when focused on single issues or on the employment implications of actions;
6. Shippers have an instrumental role in providing effectively door-to-door services, particularly where intermodal services are required. This is a major growth area with the use of logistics and the emergence of new integrators;
7. The growth in leisure-based activities again offers new opportunities for integrated service provision to a new market.

More generally, one of the main findings of the survey was the increased flexibility in the use of the network. Patterns of use changed daily as requirements of travellers and businesses also changed - this has resulted in the emergence of a large number of small scale creative new actors. The market is in a transition phase from one based on more traditional actors based in manufacturing and highly structured forms of distribution, together with regularised travel patterns, to one that is flexible and based on the new service and information economy, with flat slim-lined organisational structures and very variable patterns of travel demand. The new operators will be the

customers themselves as supply chains and demand patterns become increasingly personalised. Interactions will take place directly with the providers of goods and services (e.g. through the internet) - the whole system is customer driven.

If these revolutionary changes take place, then the concepts of integration also changes as infrastructure networks become more varied and as general networks are replaced by individual ones. Integration has been seen as a collective responsibility to provide the most efficient service for all users. But now it may be an individual responsibility that requires a particular service to a particular user at a particular time to meet a specific set of requirements. The requirements are the use made of the network will change according to internal and external factors in a dynamic way.

The role of the actors in determining the access to the network and the use made of it is reflected in the figure at the end of this report. The dynamics of change have been underestimated and the role of existing and new actors is also in the process of transformation. Traditional views of a small group of influential decision makers are being replaced by an infinitely flexible arrangement where each person, in each location on each day is an actor in determining both how they use the network, and as a consequence of their individual actions they affect the decisions of others on how they use (or do not use) the same network. Actors, individual and collectively, are instrumental in our understanding of how networks are used.

4. Conclusions

Inevitably, as a result of the work carried out under COST 328, there are a wide ranging set of conclusions that have arisen. In the previous section (Section 3), the individual results from each of the four working groups have been placed within the evaluation framework (Section 2). In this section, the overall conclusions are presented where the findings cut across the four working groups.

The net result of these changes and the dynamics of the processes has meant that the use of the European strategic transport network is in a state of rapid adjustment. The value added is not from the physical use of the transport network as this forms a declining part of the total production process, but value comes from flexible production processes, new users of the network, out-sourcing and decentralisation, together with fundamental changes in organisation and management processes. Transport intensity has grown as both tonne-kms and passenger-kms are increasing at a greater rate than the growth in the European economy. Three main sets of conclusions are presented.

4.1 Networks and Integration

Throughout the activities of COST 328, it has been realised that networks are much wider than the physical infrastructure which is conventionally considered within evaluation. COST 328 started with the pentagon of concerns, but this has been extended to cover evaluation of policies, programmes and projects, and the crucial role that actors have in the construction and use of all forms of networks. Actors have a key role to play in network efficiency and the new range of actors, particularly the integrators, add value to the networks.

Network integration is demand led within a market environment. Although the actors can facilitate integration through regulation, price, location and other complementary policies, it is the user of the network which primarily determines the level of integration. The freight sector best illustrates this conclusion through its reorganisation - value added is in the form of the new flexible production processes with outsourcing and decentralisation, together with new management structures. It seems likely that other sectors (e.g. passenger) will adapt in the same way so that the integrated services will respond to the demand of users for high quality “seamless” travel (e.g. in the leisure sector) - this is the customer driven network.

Full network integration requires a linking of transport networks, together with economic, cultural and other networks. All of these networks interrelate, and it is difficult to apply one form of evaluation. Even if it was possible to develop a unified evaluation tool for network integration, the product is likely to be technocratic and only able to tackle part of the problem. This is a feature of current methods which mainly address a single mode in the context of a single project with only one (or a few) impacts (e.g. the physical infrastructure). COST 328 proposes a multiplicity of approaches and methods (Section 4.2) and the analysis carried out concentrates on the functioning of networks in particular contexts. In particular, it is the organisational dimension of the pentagon of concerns which is crucial in the evaluation of the value added from the European transport network.

One unresolved issue is that a necessary condition for the efficient use of networks is the requirement for high quality data, so that decisions are based on the best possible information. Within competitive markets, this is difficult as data have a high value and as competitive advantage may rely on exclusive access to information. Further research is required to assess the overall EU-wide benefits of decisions being made on full knowledge and the best available data, as compared with individual actions based on partial knowledge and information. It is increasingly important that decisions are based on full knowledge and information, and that the most appropriate technology is used if network efficiency is to be improved. The maximum societal value added could then coincide with the maximum individual value added.

4.2 *Evaluation and Methods*

Across and within the four working groups of COST 328, a multiplicity of evaluation methods have been used. This is in stark contrast to the starting point of the action where it was proposed to develop a single evaluation tool. It was found that a unique evaluation method is neither feasible nor desirable. As all four working groups opted for a comprehensive evaluation of the various aspects of a network (project, program, policy level, and the pentagon of concerns), a single method could not comprehend the complexity of the evaluation task. Various individual methods are very precise on single aspects and it is not desirable to lose this precision.

Consequently, this multi method strategy has proven to be essential to our understanding of the key components of evaluation rather than a common logic for ordering the evidence. This has been found along the two dimensions

evaluation/decision level (actors perspective) and pentagon of concerns (factors perspective).

As can be seen from the final report, there is no single valued relationship either between evaluation/decision level and type of method, or between the diverse dimensions of the pentagon and the kind of approach used. On the contrary, a methodological conclusion from the work in COST 328 is that on any object level it pays to apply either more than one method or to use non orthodox approaches. In concrete terms, this means analysing actors' behaviour in a policy context using a policy network approach and a microeconomic approach, or evaluating aggregate impacts on a project level, as well as behavioural aspects on a programme level.

Obviously, the above implies that the action has taken a political economic view on the evaluation task in the case of networks. Evaluation needs to consider the potential for actors to exploit new opportunities to give them a comparative advantage or to profit by providing services – and this applies in both core and peripheral areas in Europe.

4.3 *Globalisation and Internationalisation*

One of the principle factors affecting the development of transport in Europe has been the increasing internationalisation and globalisation of economic activity. This acts as both a cause and effect of changes in transport. As a cause it leads to changing patterns of demand and flow as multinational companies alter their patterns of investment in the global market. Thus the transport system has to change to meet these changing needs, and governments at all levels are conscious of the need to respond in anticipation of new investment to ensure the investment takes place. As an effect, these changes in the transport system, which both confirm the centrality of some locations and open up others, present new possibilities to the internationalising firm resulting in new clusters of activity.

This internationalisation occurs both within Europe and between Europe and the rest of the world. Within Europe, firms from one country are involved in new investment in another country, but at the same time there are non European firms investing within Europe. In the latter case the investment is seen as evidence of the increasing attractiveness of European locations for production (i.e. increasing competitiveness). In the former case, it not only reflects changes in “competitiveness” between different regions within Europe, it also has effects on the process of convergence or divergence in the economic performance of these regions (i.e. cohesion). In both cases decisions which have a significant impact on the transport network in any region are being taken outside the region most affected, the distribution of power and control is thus crucial to efficient decisions about new investments, how they are financed, their detailed planning and their operation.

The restructuring of industry within Europe is part of a world-wide process of change, involving the introduction of new technology and new patterns of production to existing sectors, and the introduction of new, more customer oriented services.

This is seen in various ways. Traditional manufacturing is concentrated in fewer, larger plants, controlled by fewer multinational enterprises. Large investments are made depending on a variety of local conditions, of which good transport is only one. These are investments which can be less permanent than in traditional sectors, adding further to the loss of control by actors within a particular region or country. However, such investments may have very specific infrastructure requirements which become part of the package necessary to attract large investments into a region. Improved local transport, better telecommunications, airport and seaport investment all feature strongly in this, with new competition between regions being created.

Hence it is not sufficient just to identify the balance of critical concerns from the pentagon used as a starting point in this study, nor even a simple division into the scale of the impact and the identification of the responsible level for decision making. Actors and their influence cut across all of these concerns. These influences involve competition between actors for favoured locations and preferential access to improved networks, competition between regions within Europe and between Europe and the rest of the world for new investment.

In such a world, policy action and reaction by government authorities at all levels, local, regional, national and supranational (e.g. European Union) become as important as the physical environment and the structure of networks which were previously seen as the major barriers. Understanding the constraints placed on the choices available to policy and decision makers at all levels is likely to be the most critical success factor.

5. References

Nijkamp P and Vleugel J (1995) Transport infrastructure and EU developments, in Banister, D Capello, R and Nijkamp, P (eds) *European Transport and Communications Networks*, London: Wiley, pp 3-30.

OECD (1997) Meeting the Needs of Cities: Transportation, Infrastructure, Finance and Urban Development, OECD Urban Affairs Division, Paris, October.

INTERMODAL TRANSPORT

Bryan Stone

Contents

1. Introduction	35
2. Background to COST 328	37
2.1 Network and integration	38
3. The main objective of COST 328	40
4. COST 328 - The issues reviewed	40
4.1 The basis of the research programme	40
4.2 What should be evaluated ? What is a measure of success ?	41
4.3 Interoperability, interconnectivity, and intermodality	43
4.4 Policy and Methods: Institutions and Actors	46
4.5 Telecommunications and information networks	48
5. Internationalisation of trade: European networks in a global environment	49
5.1 The influence of liner shipping on use of inland infrastructure networks	49
6. Methods of Evaluation	53
7. COST 328: Organisation of the studies	55
8. Conclusions of the Study	60
9. Appendix : References and Research Papers	63

1. Introduction

COST 328 is a study which opens up a series of reflections on the benefits of, and the nature of, public and private investment into public infrastructure at a European level. It raises issues which are sometimes uncomfortable, and which sometimes suggest contradictory elements which will make policy and strategic infrastructure decisions even more difficult in future. In particular, however, it confirms that **it will not be possible to evaluate European projects such as the proposed TENs by traditional means**, usually national and modally based. While not yet proposing conclusively methods of evaluation which will reliably replace traditional approaches, it demonstrates that **actor behaviour will in future be the key** to use made of infrastructure networks. Open transportation markets, and a Single Europe, within a global economic environment, have created a drive to optimise use of modes and networks, and have engendered the call for effective 'integrators' who add value to network use by their own end-user-driven actions.

COST 328 does not in any way invalidate the concepts of network extensions as an instrument of greater cohesion or of European integration. It endorses the view that new infrastructure will be necessary to ensure that competitive opportunities within and throughout Europe are assured. However, it warns that infrastructure provision alone, and particularly national modal infrastructure planning, cannot produce an automatic and predictable integration response, from the new European deregulated user and supply markets. **Integration will be demand- and user-led**. Markets will develop around the available infrastructure, so as to use it in creative, added-value ways which imply user's choice and competitive freedoms. COST 328 concludes that **the infrastructure networks as illustrated by the TENs are not, alone, the whole answer to optimisation and economic efficiency**, since user behaviour will continue to determine how relevant the modal networks can be. The factors determining user behaviour have been studied. Ongoing research will however be required, if it is desirable to base future Trans-European investment projects reliably upon trends which, today in a newly and so far imperfectly deregulated environment, are scarcely established, are demonstrably unstable, and are not yet predictable.

The study COST 328 is therefore timely. There will be need of considerable follow-up research, some of which will be appropriate to Framework V of the European Commission. Publication follows the Helsinki Conference, which is seeking to advance the Network proposals of the Treaty of Maastricht. As we will see, COST 328 endorses infrastructure networks for cohesion and integration, but realisation should be reviewed in terms of overall cost and new objectives, given the radical change, indicated by the COST 328 study, of the effects of competitive actor behaviour, also on notions of peripheralality and accessibility, and of barriers to multimodal efficiency.

European integration requires trans-European transportation networks which enable European trade and markets to function. This is repeatedly confirmed. Present user attitudes suggest that **there is a high level of user dissatisfaction** with the incomplete, and nationally-based, networks which have resulted from previous

planning procedures. However, trade and transportation are between regions of cultural characteristics which generate desirable products and services. The proposed **Trans European Networks are Value Added Networks**, therefore, to be viewed as equivalent, in telecommunications terms, of a World Area Network WAN, supporting the Single Market and increased growth, competitiveness and wealth. Local Area Networks LAN involving cities, and local clusters, such as port regions, are the Hubs of the TEN. These have two purposes, the adaptation of global products to local markets, and, the local creation of new products for the global markets.

It has become clear with COST 328 that adequate infrastructure is in this context a necessity, but that, unless it is accessible, so as facilitate flexible use by competing value-adding operators, its benefits may not be realised. The study indicates that **there are considerable barriers at present distorting optimal, creative response to the value-added potential of networks**. These barriers prevent maximisation of potential network synergies. They are differentiated in the study by type, using a PENTAGON analysis approach of five areas, identified as financial, hardware, organisational, ecological and software. Financial considerations are clearly present, in investment needs, and in the cost of using certain modes, but particularly significant are organisational and hardware barriers between modes. In the Transalpine studies especially, but also in other surveys, **the inability of the rail mode to meet requirements of interconnectivity, and to create a coherent European network, is a particularly striking obstacle to optimisation** of multi-modal network efficiency. Rail use is therefore typically well below its potential performance. If the TENs are essentially planned as modal networks, it will be the interchanges between them and into them, the access conditions, and the ability of users to control the quality of events which are the driving forces towards creative, competitive optimisation. This optimisation will clearly be distorted if, as is apparently the case, individual modes, are prevented by national, open or concealed regulatory, or other obstacles from responding to market demands.

Because of the **geographical realities**, and the degree of **local adaptation to barriers, strengths and weaknesses** which is to be found in all situations, there is no homogeneous view valid throughout Europe on measurement values and quantifiable indicators of performance or efficiency. Moreover, incomplete and discrepant data on modal network use, also in the future, as user activity becomes more freely competitive, with less centralised data, means that approximate, fuzzy logic evaluation will require to be further developed. Modelling of case studies by **Logit and Neural Network models has given promising results**, and indicates an encouraging field for further exploration.

The need of economic cohesion and integration is today also being met in peripheral areas by the **Fonds de Cohésion of the European Union**, which is supporting, among other things, selective infrastructure improvements on the periphery of the European Union. This support is valuable to the regions concerned, and is not to be confused with the need for new approaches to evaluation of TEN proposals.

What COST 328 has also achieved is to demonstrate that peripherality and accessibility are not only a function of geography, distance or direct transport cost,

although these parameters influence economic prosperity. The behaviour of actors in a competitive situation, and the degree of local specialisation, will modify the perception and impact of these values. **Critical is the concept of user's choice**, and the interest of service providers to operate creatively and competitively.

Acknowledgements: The study has been conducted over a wide area and with a great diversity of situations to be considered. The results of the study reflect a very wide range of support and contributions, generated in the sixteen signatory countries to the study, some of which were able to make available funding for specific contributions to the work. The studies made available were channelled through the four appointed Working Groups and their co-ordinators, under the Presidency of Prof. Michel Frybourg. These contributions, which are available for detailed study and are listed with their authors in the Appendix, were essential, first, to review and establish the extent of the problem, and, then, to illustrate the breadth of behaviours and obstacles encountered in the present situation, and the diversity of the local, regional and national situations and their needs. Certain international survey studies were also undertaken to obtain a widely based European experience on the issues involved. The Study COST 328 is only meaningful in the light of all these contributions.

2. Background to ISINE

By 1993, there was developing a growing awareness in Europe, in both transport planning and infrastructure planning circles, that the means of planning and evaluation of investments in new, large transport infrastructure projects of European importance were not adequate. Conventional appraisal of the economic utility of these investments was unlikely to be effective, since a number of factors had changed or had been newly adopted. These changed the parameters for investment decision making. They included, in the context of the Treaty of Maastricht, the single market, the increased importance of European integration, and the multimodal nature of provision of competitive logistic services, with progressive liberalisation of the European transport markets. This problem of evaluation was likely to be a major obstacle to the realisation of joint publicly and privately financed infrastructure projects, such as the integration of Europe was seen to require.

COST 328 is designed, through research into new evaluation methods, to address the inadequacy of traditional methods of infrastructure investment evaluation.

Since its adoption in 1994, with a duration of the action for 3 years, the new factors described above have become general realities. Further factors have emerged, and in a dynamic and liberalised market environment the process of change has taken on a vigour of its own. Demand has also changed, and an increasing internationalisation, or globalisation, of European trade is also apparent. An early end of this process of fundamental change, both in the use made of transportation, and in the actors responsible for it, is neither foreseeable nor, indeed, desirable.

At the same time, the realisation of Trans-European Network projects as described in, and defined subsequent to, the Treaty of Maastricht, is seen as an urgent political and

economic necessity, and the Commission has actively pursued means of realising these, despite the recognised financial and political difficulties.

There is therefore an urgent and on-going need to establish better, forward-looking methods of infrastructure appraisal and evaluation, and this task has started with COST 328. It has not, of course, in this rapidly changing environment, been completed in this single three-year COST study. The first objective is to identify new approaches, and to identify the as yet unknown behaviour patterns and Critical Success Factors which will influence the effectiveness of these planned investments. Out of this will emerge new, as yet untried, but promising, lines of future research.

2.1 Networks and Integration

The **White Paper ‘Growth, Competitiveness and Employment’** of the European Commission (COM (93) 700 final) described the need for European networks in the following terms, as part of a programme to enhance competitiveness (Section II of the White Paper, Chapter 3): ‘Networks are the arteries of the single market; they are the lifeblood of competitiveness, and their malfunction is reflected in lost opportunities to create new markets, and hence in a level of job creation that falls short of our potential. The establishment of networks of the highest quality throughout the whole Community and beyond its frontiers is a priority task’.

Within the framework of **Title XII of the Treaty of Maastricht**, the objective of developing Trans-European Networks is to enable citizens, economic operators and regional and frontier communities to derive full benefit from the setting up of an area without internal frontiers, and to link the peripheral regions with the centre.

The creation of high-performance, economic networks for energy, telecommunications and transportation was therefore seen as a necessary part of an economically effective, competitive and creative Europe. However, it was necessary to note certain key factors:

- The financial resources of the Union and the member states could not support public financing beyond that already planned.
- The massive investments required especially in transportation infrastructures necessitates new types of partnerships between private and public financing.
- The absence of open and competitive markets hampers, to different degrees, the optimum use of existing networks, and their completion
- The inherent sluggishness of the preparation, planning, authorisation and evaluation procedures creates major obstacles to the implementation of large projects.

For transportation networks, the scale of the investments envisaged within member states was estimated in 1993 at ECU 30 - 35 million per year, to which came also investments required to extend networks beyond the Union’s boundaries. It was proving difficult to attract private capital involvement in this field, for two reasons:

the risk inherent in such projects dampens the enthusiasm of the private investor, this risk including feasibility, technical viability, authorisations, and competition from other modes, and

- uncertainty about the return on, and profitability of, the investments.

The Commission required each project to be evaluated within the public and private partnership principle, with focus on all the inherent risks of the project and the possibilities for covering these. Identification was required of 'the nature of the instruments which could be used to assess the expected revenue from the projected traffic', and 'evaluation of the risks presented by each project'. Economic benefit would also include employment creation and industrial impact, over and above the economic viability of the project as such'. Increased competitiveness of advanced technology products, and services, would merit special attention.

The decision to commission the COST 328 study recognised the need to introduce these, and perhaps other elements, into the economic evaluation of networks.

In particular, the lack of integration of existing national networks was identified in the **Memorandum of Agreement to COST 328** as an obstacle to economic and social cohesion in Europe, and to its performance. With regard to transport of goods, the increasing splitting up of activities between companies, and logistic integration of industrial and commercial processes, are clearly determined by the transport function in companies' activity patterns. For passengers, changing social patterns generate greater demand for mobility among European citizens.

European integration, the effective running of the internal market, and globalisation of trade appeared therefore to require a new frame of reference to assess infrastructure networks, on both a national and international scale. This was not being undertaken, nor was it known how it should be attempted. European transport infrastructure is historically composed of a number of national networks, for each mode of transport. Analysis and evaluation takes place within national borders, and even the limited international networks remain modal. A further consideration is that while the definition of infrastructure supply remains modal, and to a great extent intra-national, the pattern of demand for infrastructure is known to be changing, with the emergence of operators linked to market segments rather than to modes.

This introduces into the evaluation requirement the **behaviour of actors and players**, which, in a liberalised competitive environment, with international intermodal possibilities, was likely to be the decisive element to require new, and not yet existing, methodology. Infrastructure is passive; utility is now increased by a wide variety of 'value added' services, which co-ordinate and manage an increasingly large proportion of the traffic flow. The network operators providing such 'value added' services are demand driven, and no longer dominated by the transport mode. The demand to which they are responding is itself developing rapidly, as trading patterns, competition, global and supply-chain logistics, and the economic trading environment, increasingly influence the trading decisions which determine the demand for transport.

3. The main objective of COST 328

This is, then, in accordance with the Memorandum of Understanding of September 14, 1994, COST /315/94, 'to contribute to a strategic definition of the integration of the Trans-European networks and to stimulate thought on the development of methodologies for the assessment of performances of transport networks and for strategies for their development and/or integration'.

The COST 328 action has taken a new approach by examining the strategies of transport actors to make best use of the potential of infrastructure networks. It has examined performance indicators and Critical Success Factors for integration of Trans-European Networks.

The Action was planned to consist of two overlapping areas:

- Design of evaluation methodology: This involves identification of performance indicators such as productivity, spatial cohesion, harmonisation, externalities and yield management. There are links between such factors and critical factors of success or failure such as financing problems, institutional matters, and technological compatibility. Network operators drive demand and generate added value, through their ability to satisfy demand by exploiting the performance opportunities which these indicators measure.
- Validation of the evaluation method: this involves application of methods to various case studies.

The Action has been carried out in collaboration with NECTAR (Network on European Communication and Transport Activity). The proceedings of the NECTAR Symposium of September 1996 in Mons incorporated various research results and publications produced as part of COST328.

Seminars and Colloquia

The Study COST 328 ISINE organised a two-day Colloquium at Lausanne, on March 2-3 1995. Proceedings of the Colloquium were published by the European Commission as VII/169/96-EN, and have been taken into account in developing the Action. Working Group 2 of COST328, TAFT, held a seminar in Lugano in 1/97.

4. COST 328: The issues reviewed

4.1 The basis of the research programme

Interoperable, interconnected trans-European networks are one of the European Union's major objectives. To bring them about, the Commission set up a programme of activities involving the definition of networks, priorities for implementation of their constituent parts, financing options and arrangements, etc.

As this programme was beginning to materialise in 1993, the research proposed under COST 328 was put forward in the context of NECTAR, in the framework of the European Science Foundation. It drew upon various earlier studies of the significance of infrastructure and its relationship to economic activity.

4.2 What should be evaluated? What is a measure of success?

The approach which was adopted for COST 328 in general is illustrated by the **Research paper COST328/9/95 'Towards an Evaluation Framework for Integrated European Transport Network Operations'** This basic statement of the issues evolved over a period; it was presented in various forms at the Lausanne ISINE Colloquium in March 1995, and to the Transport World-Wide Conference in Sidney in August 1995.

The essential content of this paper is outlined here, since it is here that a first attempt takes place to define, in the new prevailing and foreseeable conditions, what can be measured and evaluated. The fundamental issue stated from the start was that:

- 'The evaluation of investment programmes related to a network should not be based on individual piecemeal projects, but upon the synergy created by **network operators** in an **interconnected infrastructure**..... The assessment and evaluation of such a network should therefore not only take account of the way such a network can be designed and developed, but also (how it is) operated.'
- The recognition that there can be no effective European integration without **efficiently operating networks** linking all nodes of the European network economy is not controversial, but **this cannot be limited** to the mere creation of physical facilities. Positive impacts of infrastructure derive from the services provided by those who operate on it. **A network is thus a value-added configuration** taking use of an essentially passive infrastructure. It is not infrastructure alone. Even less is it a map of the TEN proposals, or of existing facilities.

Various factors are modifying the ways in which value may be added to a passive infrastructure:

- internationalisation or globalisation of our economies, with associated changes in the nature of demand
- tendency to reduce regulatory regimes on transport markets
- increasing privatisation of transport chains or parts thereof
- increasing competition between modes, and need for complementarity between modes.

These processes are not complete, and are not necessarily inter-related.

Infrastructure network weaknesses limit the realisation of development potential, and therefore territorial authorities are sensitive to the impact of infrastructure on spatial, regional and economic area development. However, the evaluation of investment programmes related to a network should not be based on individual projects, but upon the synergy created by network operators in an interconnected infrastructure.

New policies will be based also upon

- customers' preferences, and not upon modal interests
- a basis of economic user charges (reflecting performance and willingness to pay)
- competitive third party access.

Traditionally, interest in networks in Europe is instigated by **modal supply side** motives. New competitive behaviour of firms in Europe requires much more focus upon those actors who co-ordinate, manage and operate flows in this network. Existing infrastructure management has not generally reflected accountability to users. Poor cost accounting has been general, and there has been little relationship between revenues, costs and service performance, while influence of market instruments, competition and pricing, has also been limited. National practice has displayed considerable differences.

As a result of new market forces, however, the role of public actors is now declining, while that of private operators is rising. The importance of transport and logistic costs in the transport chain leads to a need for cost improvement in the transport sector as a condition for an integrated European infrastructure network. The most important driving force in transport operations is therefore executed by those integrators/actors who fulfil best customers' wishes (cost, speed, reliability)

New roles in transport result from the observed shift from a physical shipment process to a value-added process. Value-added logistics are an increasing part of this process.

Central nodes of a transport system tend therefore to become places of strategic importance. Large nodes which attract high volumes tend to be more competitive as a result of economies of scale. Frequency also favours flows between large centres. Hub-and-spoke models reflect the 'natural' tendency to seek routes and modalities which ensure large volumes. These trends can already be observed in liner shipping and in civil aviation.

There are two main groups of actors in this market, the carriers and operators who offer capacity and facilities (trucks, ships, trains etc.) and the shippers and integrators who are responsible for a least-cost organisation of transport. There is **competition between modes on a route and between operators**, who have to provide competitive services on the same route, using the available modes.

The following developments in European are seen as influencing European (freight) transport operation:

- Intensification of transport (growth faster than economic growth)
- Increase in competition in freight transport: intense competition and falling margins
- Dominant competitive role of price-quality ratio
- The quality of logistic services, and their spatial concentration
- Trend towards Logistics Ports: favourable regions may become dominant actors

- Increase in intermodal competition and complementarity

There is a **significant conflict** between the need to address demand-driven aspects of Network functioning, resulting from the new competitive behaviour of firms in Europe, and the earlier lack of interest in a European orientation of users and integrators. Transport policy and planning were not generally carried out on this scale, and Intra-European infrastructure networks have not followed the rising trend in international mobility. Nijkamp, Maggi and others (1993) addressed problems of missing links and networks. Missing networks emerged because transportation systems continued to develop in a segmented way, each country seeking its own solutions for each mode. The net result is that current European infrastructure is becoming out-dated, thus failing to position European economies competitively.

A **European orientation towards needs and behaviour of key actors** for the integration of modes, and the strategic position of public and private actors, suppliers and users, has to enter into network policy. This includes the significance of global actors (European and non-European) for whom Europe is a part of their activities.

An awareness is growing that inter-connected networks, supported by information technology, can offer a high added value. However, interoperability between different modes seems to be very difficult in practice. There has to be complementarity between modes, to benefit from synergies, and competition between modes to operate at the most cost efficient conditions.

In a deregulated transportation network, the network performance is customer driven, so that ultimately customer/user value, benefits or cost-effectiveness, determine overall performance of a network. The role of integrators in generating added value over all the complex parts of a long transport chain is therefore decisive.

Given demand factors, capacity limits and network design, certain driving forces will be present:

- institutional organisation and management of a network
 - network configuration, structure, cohesiveness, synergy, accessibility, flexibility.
- Evaluation of Network performance will normally require to take place within a constrained domain, shaped by a force field of:
- environmental sustainability
 - institutional decision and managerial structures
 - spatial interconnectivity at various levels
 - degree of standardisation of technologies
 - management and control functions of operators
 - pricing policy for network use

4.3 Interoperability, interconnectivity, and intermodality

A network's quality, and its capability for generating added value, depend not only upon quality and capacity of links connecting transfer points, but also upon the quality of the transfer and terminal points. Interoperability, interconnectivity, and

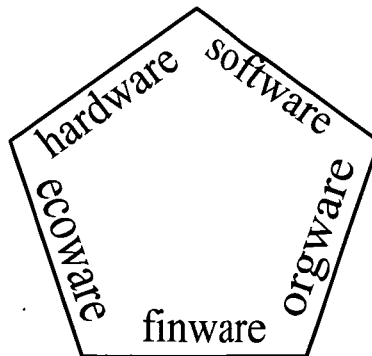
intermodality are therefore properly focal points of European infrastructure network policy. These concepts are crucial to enhancing the socio-economic benefits of European networks. The absence of means of assessment in a methodological framework of analysis is however apparent and has become therefore part of the basis of COST 328 research.

An **Evaluation Framework for European Networks** would therefore seek to identify meaningful and practical indicators, which would permit development of an appropriate analytical framework for assessment and evaluation.

Network performance may be measured as, for example, economic contribution, and be a function of **quantitative factors** such as **demand** (use, in relation to capacity) and **qualitative factors** such as **cohesiveness**, which can be summarised under the Maastricht headings of intermodality, interconnectivity and interoperability. The quantitative measurement of these concepts has to be recognised as a difficult research task. A theoretical **compound indicator of cohesiveness** would naturally allow the expectation that performance would rise, as measured cohesiveness of the network increased.

The absence of realistic data on such values requires that an approach be taken which resorts to **proxy indicators**. These, although incomplete, mirror some characteristic features of European Networks, and therefore permit partial assessment and evaluation of performance

The Pentagon model (Nijkamp et al., 1993) is used as a basis, as it allows a broader evaluation framework than a strict economic one, including also environmental and organisational/institutional aspects. Each of the five thematic areas highlighted can be a barrier to performance, or an enabling facility, up to the point of identification as a Critical Success Factor (CSF) for network performance.



- **Hardware** refers to the tangible, material aspects of transport infrastructure. These serve physically to facilitate transport services or flows generated by users

- **Software** refers both to control computer systems, and to information, booking, reservation, communications, guidance systems, etc.
- **Orgware** comprises all regulatory, administrative, legal, management and co-ordination activities and structures on both the demand and the supply side, in both private and public domains.
- **Finware** refers not only to the socio-economic cost benefit aspects of new investments, but also to the way of financing and maintaining new infrastructures, to pricing structures and public guarantee financing
- **Ecoware** refers to environmental and ecological concerns, including safety and energy questions.

The **PENTAGON** model gives an effective start. Types of indicators which permit, for each of the areas, subsequent comparable monitoring and planning of projects, have then to be found. However, using these as Critical Success Factors which determine performance, it is then possible to tabulate typical considerations for them in respect of the three various cohesiveness factors. A basis has therefore been evolved which permits not only the mapping of features of the structure of European networks, but also to monitor its evolution.

Cohesiveness features	Hard ware	Soft ware	Orgware	Eco ware	Finware
I. Intermodality	Compatibility of technologies; uniform standards for rolling stock; intermodal competition and complementarity	Compatibility of information systems; logistic platforms; informatics services; telematics	Management of mainports; design of transfer points	Sustainable transport behaviour	Cost effectiveness; user charges
II. Interconnectivity	Accessibility of terminals or transfer points; access to network modes; standardized technology	Tracking and tracing; EDI; telematics	Localisation of transfer points or terminals; development of hub-and-spokes systems; Trans-European connections	Savings in energy use	Efficiency; line haulage
III. Interoperability	Advanced transshipment equipment	Shopisticated logistics; surveillance and guidance systems; training and education	Coordination of transport operations; efficient control; hazardous goods control; local distribution	Efficient enforcement of environmental regulations, safety regulations	Competitive strategies

Table : Cohesiveness characteristics in relation to five critical success factors

H	Good	Overcapacity with high growth potential	High performance	Maximum performance	Lack of capacity
	Fair	Overcapacity with moderate growth potential	Moderate performance	Good performance	Missing links
	poor	Substandard functioning	Insufficient functioning	Reasonable performance	Severe congestion
		Poor	Fair	Good	excess D/C

Figure : 'Typology of Networks'

The Frybourg/Nijkamp paper, introduced and commented in some detail here, as a starting point for more detailed COST 328 research, provided a basis for subsequent examination of the various situations encountered in Europe, taken up in the work of four Working Groups. It anticipated the task of identification and use of evaluation indicators and the identification and quantification of Critical Success Factors for improving the performance of European transport systems. Attention had then to be given to the most environmentally acceptable package of modes, in an international network linking regions and countries in Europe, while taking into account the potential for various actors of using combined transport, telecommunications and intermodal interchanges.

Confirmation, that **interconnectivity, interoperability and intermodality** are **legitimate requirements of a European policy**, requires there to be a substantial change from the present situation, in which at best project-orientated modal solutions are realised. There is therefore a demonstrated need for a systems-based evaluation approach, that regards European space as a comprehensive window of transportation opportunities which may generate a substantial added value in a competitive global economy. The further pursuit of COST 328 addresses this issue.

4.4 Policy and Methods: Institutions and Actors

It is probable that the evolution of logistic added value operations will go ahead rapidly, involving actors and taking forms which are at present unknown. This is indeed a desirable consequence of the liberalisation process, since practically by definition the existing actors have been protected by the regulatory environment from new entrants to their areas of activity, or from new ways of conducting business and organising services. This implies, perhaps unjustifiably, a passivity of behaviour, whereas the nature and quality of transportation has indeed changed, as has been demonstrated by the on-going, and very competitive, shift from rail to road or the progressive introduction of intermodal methods in overseas sea transportation.

This manifestation of competitive initiatives has, however, been found inadequate for the even more rapidly evolving trade and user demand for logistic services, and it has also not been sufficiently powerful to address the issues of the costs of transportation, especially by rail. A consequence has been that even in high growth, priority areas of European freight transportation opportunity, such as the rapidly growing long

distance carriage of higher value goods, for which rail-based intermodal services might have been suitable, rail carryings have not met expectations. Users, including the existing intermodal integrators, are dissatisfied.

Various aspects of policy are here involved. The first is to continue the liberalisation process, making it also an effective environment for the competitive provision of intra-European rail services. There follows the creation of opportunities for new types of logistic and value-added services to be provided. This has shown limited results even at the early stage during which COST 328 has been in progress. For example, private and public joint venture companies have been formed to integrate freight services, with the entry of new players such as North American railroads and Asiatic container shipping lines into these markets, and with ports and container shipping lines entering land transportation markets. New rail service operators are beginning to emerge. They are, however, apparently encountering typically difficulties in optimising performance using the existing networks, for reasons understandable in the context of the PENTAGON model of Critical Success Factors.

New actors will be actively encouraged by forthcoming aspects of European regulatory policy such as the Rail White Paper of July 1996. One of the most significant policy steps still outstanding is **clarification of the conditions under which access to infrastructure will be charged**. Lack of clarity, with national policies substantially at variance from one another, makes actors' behaviour uncertain, and deters new entrants, especially in the rail operations sector. It also undermines the concept of a Trans-European Network, since provision of infrastructure alone is demonstrably not enough to ensure its use by competing operators when the access conditions are not apparent or equitable. The evaluation of infrastructure investments will increasingly require that the **market conditions for remuneration of infrastructure use**, the influence of possible **European harmonisation of charging principles**, and **social and external costs and benefits**, are taken into account.

A further influence upon the ability of new actors to supply profitable, competitive logistics services, will be the pursuit of the recommendations of the Green Paper of the Commission, on **Fair and Equitable Pricing for Competing Transport Modes**. This envisages a greatly improved identification of the total costs, including external and social costs, incurred by different modes. However, not only the mode, but also the individual operator within a mode, may be responsible for substantially differing external costs, and this will also be a factor influencing actor behaviour.

The Green Paper may also, in the light of the factors already described by Nijkamp and Frybourg as valid for network evaluation, have an important influence upon the added-value of new infrastructure, wherever it becomes possible to differentiate external costs in areas of differing environmental, noise or pollution, or congestion impact. This will also influence behaviour which will vary between congested, main trunk route areas and areas of less dense traffic, or lower demand, or where the threshold of external costs is already lower.

It will therefore already be apparent that inner-European policy measures, which are directly designed to make transportation for end-users more competitive and effective, will considerably modify the competitive behaviour and opportunities of those providing services. However, even if all the steps, and the ultimate extent, of this regulatory and legislative change were already foreseeable, there is as yet no adequate methodology for scientific estimation of the changes in behaviour which will follow. The fall in trucking and rail costs which have occurred in the US environment following deregulation in 1980, and the evolution in service quality, corporate and company structures, and user demand, are certainly of interest, as a demonstration of possible developments. How far they can serve as indicators is not clear since there is still substantial divergence between the regulatory environments involved. European actors have also still to overcome, in rail more than in road traffic, the legacy of national diversity.

4.5 Telecommunications and information networks

Networks for transportation are not restricted to fixed and visible transportation infrastructure of roads, rails, ports and terminals. The existence of telecommunications networks and their use for increasingly high-performance information technology, has a dramatic effect upon users and value-added service providers. Users have, as a consequence of their increasing information skills and opportunities, started to change their approach to customer service, to ordering and supply systems, to stockholding and to other logistic management features. This has been more a feature of some industries than others; automobile manufacturers exploited these opportunities early, and some retail chains and retail supply businesses have also done so. Others are moving into this area. The effect is a change in demand for services, which logistics providers have to respond to. Equally, however, logistic service providers can compete through their exploitation of these means, and some displacement may take place, for example, by those who see information management as a higher-rated part of their business than more traditional operators, forwarders etc.

Information management is also a prerequisite for managing a multimodal operation and optimising economic efficiency. It is apparent that **lack of knowledge of multimodal opportunities, and the inability to manage flexible use of the networks** to serve user demand, are at present **obstacles to realisation** of intermodal service offers. These obstacles might prevail even if the providers of modal services were better able to respond and co-operate than is at present the case.

Use of infrastructure networks is therefore today, for the transportation service provider, increasingly, and probably inevitably, linked to use of an information network which is contributing to operational management, for quality and cost effectiveness, and to customer service. This will be an increasingly important competitive feature. Selling a service at a given and monitored level of performance is a natural corollary of meeting the demand of a market segment or user, whose clear logistic specification must be complied with by transport operators. There is a **necessity for networks of information relating to each modal service being used, but interconnected**, through the operator's own systems, to parts of the service

performed on different modes. Systems such as automatic load or equipment identification will give the capability, through interconnectivity, to permit localisation of merchandise accurately within the network. Since this gives a competitive advantage, it is a value-adding function.

In telecommunications, the notion of a **Value-Added Network, VAN**, is already established. In this context, the 'operators' are also those who mobilise the means required and are not tied to a particular mode or hardware. The 'nodes' are the gateways to the modal networks, which can only be used by operators prepared to use each mode within an optimal market and demand led service.

5. Internationalisation of trade: European Networks in a Global Environment

For the purpose of this report this section concentrates on two aspects which have become increasingly interconnected.

The first is the demand of **users of transport services**, who are able, because of improved means of transport and communications, to exploit a wide diversity of sourcing, assembly and distribution opportunities. The economic effect of dispersed operations within Europe is more a matter of local skills, regional economic policies and access to markets, and is linked closely to use of available networks. This aspect will be referred to in various parts of the report, since it is a recurrent element in the association of actor behaviour with network use and the creation of added value.

The second is the placing of these inner-European activities within a **global dispersion of activities**, which then reflects, uses and stimulates extra-European networks such as air freight and liner shipping. Around these a particular pattern of infrastructure and nodal centres has evolved, and will continue to do so. It will require integration into the networks being established within Europe but, as for liner shipping or civil aviation, obeying economic logic driven by circumstances, as well as trading conditions, largely outside Europe.

The nodal points such as airports and ocean container ports are substantial investment and industrial installations, and, when successful, sustain a high regional economic activity. They are in an extremely competitive global and European environment, and also require substantial inland infrastructure to support them. These installations are no longer of purely national interest, but of European importance. While their local importance as engines of local economic growth is clear, they are also nodal points within European networks.

5.1 The influence of liner shipping on use of inland infrastructure networks

The example of the use made of inner-European networks in connection with liner shipping and trade between Europe and other overseas regions is described here in some detail. The reasons are that :

- it illustrates that European networks cannot be treated as isolated from the behaviour of global actors
- a significant part of European economic activity, including the bulk of its trade with other continents, especially Asia and North America, is involved;
- the cost effectiveness of services over European networks is seen by global operators in the context of global transportation, in which factors are at work which are outside European political and economic influence. It is also an activity which has shown higher than average growth during recent years.

The following considerations refer to the leading integrated door-to-door liner shipping service operators, principally engaged in the high-volume East-West global trades. For others, serving local and regional trades, and regional ports, under local conditions, these trends may not apply.

The factors include:

- Technological development of ships and their operating characteristics
- The effects of changing competition between shipping lines
- Demand for and provision of throughout intermodal services
- Costs, profitability and ownership of container shipping
- Port requirements and facilities
- Trends in global trade and in service provision

These factors have resulted in high quality intermodal services at steadily falling cost to users. Cargo flows are concentrated on a few routes of dense traffics, accompanied by the emergence of hub-and-spoke service patterns. Port, and vessel ownership concentration, accompany the creation of world-wide joint services in partnerships of several global shipping lines. There is a shift of control of liner services in European ports to non-European or global multinational shipowners and managers, (slightly over 50% of global container capacity is provided in 1997 by East Asian managed shipping lines, and these display world-wide the highest growth). Control of inland transport by the global container shipping lines is increasingly part of a through service.

Individual factors have worked as follows:

Size of vessels: In 1984 the first container ships of over 4 000 TEU capacity were built. They were an economic failure. In 1997, however, more than 100 ships of over 4 500 TEU are in service or under construction for the three main trade routes USA - East Asia, East Asia - Europe, and Europe - USA. Vessels of over 6 000 TEU are now in service, and a short term perspective of 8 000 TEU is realistic. Capital and operating costs of these vessels reduce per-slot costs by about 30% compared to their predecessors. However, only some 15 - 25% of door-to-door intercontinental transport costs for container cargo are incurred on the sea. Large ships therefore permit a 5 - 7% reduction of throughout logistic costs, a benefit which, compared to the intense price competition of all the main trades, is considered to justify the investments required. Their dimensions, and the need to concentrate substantial cargo volumes (6 000 TEU) per voyage, while maintaining a competitive service frequency of at least weekly, lead to concentration of these services on a small number of high performance and deep-water container ports with adequate capacity (in Europe,

typically Rotterdam, Hamburg and one other within a weekly service Europe - East Asia). This leads to a new form of port competition, and local distribution, under the control of the shipping lines, predominantly by feeder ship (Hub and Spoke), and secondarily by land.

The operating economics of such vessels are likely to lead to a priority of maximum utilisation and minimum port time, with disincentive to make diversions from the optimum course to serve secondary ports. (Sutcliffe, MDS, Transmed 1996).

The impact of this trend is to impose upon inland network use a series of choices by the lines and their customers depending upon :

- target markets: location and potential
- line of route, Europe - USA or Europe - East Asia, or others
- selected hub-centre ports and feeder ports, and local network efficiency
- line-haul economics and operating criteria of the line or group of lines

It is a fundamental of this process that Europe will be seen, by a line or a group of lines, as a single trading region, within which are several potential markets, and with access primarily over a small number of hub-centre ports of world-class. The use of network links to connect these is determined by global considerations of trading and sea transport, depending also on the line of route (Asia or North America), and by detailed local adequacy and cost effectiveness. The information network which accompanies the process of providing value-added services is part of each shipping line's global system.

An example of new competitive behaviour between shipping lines, and between ports, has arisen since 1992 in the Mediterranean. causes were economic pressure, supported by technological innovation, especially with larger container ships. New Hub Centres without immediate economic hinterland have been created. These serve southern European cargo being carried on large vessels on their through route from Asia to the substantially larger northern European target markets. They do so by providing transshipment to a feeder network (the 'Spokes') to a number of regional ports, each of which would not justify a call by the big ships. The effects upon inland transport networks are:

- to increase dispersion, in Mediterranean destination ports served by feeder ships
- to reduce the likelihood that individual mainland ports may take on a strategic role of inland distribution beyond their own immediate hinterland
- to reduce the likelihood of southern European cargo to and from Asia being routed by northern ports and land networks

The falling cost of sea transport also reduces any residual opportunity of cross-European land transport to compete with the large container ship around the European coast. Distribution into northern Europe from a single Hub port in the Mediterranean becomes therefore illusory. Also, apart from costs, the volume of cargo on a single ship (around 100 container train loads per ship) makes it unlikely that transalpine rail and road capacity can be provided to serve northern regions in competition to direct sea services to northern hub ports. In these, cargo distribution

takes place by a competitive system of feeder ships to secondary ports, by road, by inland waterway and by rail.

However, more efficient services through Mediterranean Hub centres for southern European regions will also increase competition and economic opportunity in those regions.

Competitive behaviour by shipping lines has resulted in steadily falling rates, falling in real terms in the main trades by half in 10 years. The nature of investments and operating costs has led to competition for market shares at falling rates. Cost pressure has led to withdrawals by financially weaker operators, global and regional mergers, and the creation of joint service alliances to offer intensive schedules with shared equipment. This has also reduced the ability of individual lines to compete with sea services, intensifying the interest in on-land service to shippers. This and downward rate pressure have driven lines increasingly to control inland transport and to create a further operator demand upon network providers to reduce costs within Europe.

Increased use of **intermodal sea/land container services** is a normal competitive practice of the larger liner service providers, and responds to an established user requirement. However, the costs of such operations, up to half of door-to-door rates, are disproportionate to the sea sector, which is controlled by the line completely, and benefiting from the biggest investments. The largest liner shipping companies have therefore been prominent in responding to opportunities offered by inner-European liberalisation, to form inland transport companies, obtain rail cars, etc. This follows US experience of deregulation in 1980, after which inland transport demand by container shipping lines led to new operating methods, new technology, substantial rate reductions, service quality improvements, traffic growth and, ultimately, better rail profitability on a modified network with on-going cost-reduction and merger pressure upon railroads.

The network issues for Europe are that,

Firstly, the adequacy of the infrastructure network must facilitate the conduct of overseas trade at conditions which :

- meet trader and user requirements
- stimulate creativity
- permit operators of services to justify their provision of services
- enable competition between operators to be sustained.

Secondly, the decisions on use of the European networks, and indeed of ports and inland transport, although influenced by competitive behaviour, are not primarily decisions of the regional or national network operators themselves such as railways or local integrators. They are, rather, part of a decision-making process rooted in the provision and management of intercontinental liner services, responding to user demand in global trading markets.

Thirdly, decision-making for these operations in future will predominantly be located outside Europe; part of the economic advantage to be achieved is to compete for

resources, to ensure that non-European operators and integrators find justified the on-going provision of adequate services, in competition with other economic regions and trade routes outside Europe.

This example introduces considerations beyond the scope of purely inner-European modelling. The example of liner shipping, although fundamental for overseas trade, will not concern all parts of the network in the same way. It is however a significant feature of European integration and of network use, not only in the hinterland links of ports, but in some areas of critical importance such as the transalpine routes and on trunk routes between European regions and countries and their most appropriate Hub centre ports. Above all it illustrates that the construction of infrastructure purely on a modal basis and according to local or national criteria will probably be a serious cause of inefficiency.

6. Methods of Evaluation

First, a cross reference to the APAS study '**Methodologies for Transport Impact Assessment**' (COST328/328/2/96) is appropriate.

This study noted not only that the most commonly used approaches to the assessment of transport policies in Europe are indeed modal and national, but that they were also of the form:

- Financial / commercial analysis
- Cost-benefit analysis
- Multi-criteria Analysis
- Framework Analysis
- Assessment against complex objectives

The APAS work also recognises that the network consists of two main elements, **the physical infrastructure of links and nodes, and the services and their management**. Despite the clear need of an comprehensive, consistent and far-reaching approach to assess impact of transport and investment policies on the European scale of policies now being developed, the **techniques used today** for measuring the impact of strategic transport initiatives **vary by country, by mode and by type of policy**.

In the face of the changing environment described up to now, COST 328 demonstrates that these methods are no longer defensible for strategic, integrated European networks.

Actor behaviour is the key

The earlier section on European Networks in a global trading environment, and particularly the example of international liner shipping, illustrates how evaluation is certainly a function of the factors influencing use of networks, and of the ability to combine modes for efficiency. There will therefore need to be segmentation for different kinds of expected usership. This leads to consideration of differentiated

market-based models as a significant aspect of evaluation of network effectiveness. Market-based differentiation requires that competitive actor behaviour be better understood. This is certainly not yet the case, and indeed should, in a creative, deregulated, competitive environment, remain a volatile, unpredictable and dynamic element. Actor behaviour is nevertheless the key to value-added justification of network use, and this has become a central theme of COST 328.

An example of this is the behaviour of ports. We have treated ports above, either as master gateways, involved in a series of large scale strategic decisions by key players, pursuing economies of scale by concentration, becoming a very few global Hub Centres in Europe, or as a range of outposts to be served as feeders from the Hub Centres. This is however unlikely to be the whole story.

If ports are apparently, in the foregoing section, at the mercy of decisions taken far outside their immediate sphere of action, and are reduced to the role of voiceless interface between shipping lines and inland markets, they will develop new forms of competitive activity of their own. This will take the form of identifying value-adding opportunities of their own, and seeking new partnerships. This is characteristic behaviour for niche and 'second league' players, who may be able to filter off certain activities which the biggest liner consortia and Alliances, the global hub centres and largest concentrators cannot consider.

Certain ports will find no vocation, and their role as gateways to the networks may therefore be eliminated or transferred elsewhere.

For others, the example may usefully be indicative of market dynamics, since demand is very varied and will not always reflect a 'big is beautiful' situation. Those ports which can establish a local value-added advantage, and can join forces with a particular type of trading, cargo flow or shipping service, may see themselves developing outside the dominant pattern of the massive lowest cost, highest volume operations. Their development requires a clear decision not to try to imitate their mainstream competitors, but to concentrate upon differentiation.

The example is illustrative, because it also highlights a mechanism which will be encountered as concentration, mergers and economies of scale apparently continue to dominate service provision thinking. Fundamental is the notion that **use of value-added networks is driven by diversity**. The Local Area Network LAN is the point where economic activity is engendered, through cultural identity, through particular skills and backgrounds. The European network puts LANs into contact together, enables them to find wider markets, and enables them to compete with one another. The types of use which are encountered support two opposing trends, both of which we find in our examples and case studies. One is the inevitable consequence of competition, rationalisation and mergers, the concept of economy of resources, of consumer benefits, and of falling margins and prices. The other is the offsetting concept of demand variations and of choice. New products, new services and innovation arise at a local level, out of a fertile innovative culture. Products of strong identity, and a demand for differentiation in products ultimately consumed, are the means of making reasonable margins.

Within the use made of networks we will find all these things going on. We may expect a few general purpose low cost modal operators, and perhaps integrators, to develop into competing European carriers with high volumes, low margins and low rates. We will expect to find specialists, serving particular regions, industries or sources of cargo, or with particular logistics skills, maintaining by their added-value interest more costly services or higher levels of user-provider integration, and we will also expect these sectors to be in constant dynamic evolution as users develop new and varying demands.

7. COST 328: Organisation of the Studies

Four **Working Groups** were established, composed of contributors from the various countries which were signatory to the Memorandum of Understanding (see Annexe). These Working Groups have examined the following subject areas relevant to the objectives of the study:

- Working Group 1: Peripherality: Cohesiveness
- Working Group 2: Trans-Alpine Freight Transport: Critical Success Factors
- Working Group 3: Rail-Road Competition/Complementarity: Benchmark Analysis
- Working Group 4: Role of Actors: Integration of services

It was apparent that the research process would encounter significant bottlenecks, some of which were characteristic of fundamental inadequacies in European resources for planning purposes, while others would require new sources of input representing the new actors and their behaviour.

Inadequate flow and traffic data sources for this task were, as expected, a serious problem. As a consequence, input to the study has been drawn from :

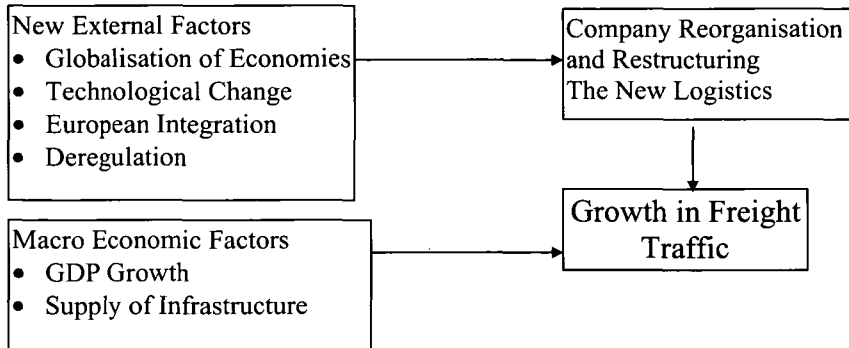
- existing data mostly at national level,
- surveys conducted for the purposes of this study by the Working Groups,
- some secondary sources,
- national data collections (in themselves occasionally impressive),
- very limited European data currently available

The study illustrates again that a serious weakness exists in the area of quantitative transportation use, performance and cost information. The available data is incomplete, sometimes inaccurate, different, mostly national, sources are incompatible in structure, content and periods, and information is seldom up-to-date. Validation and evaluation, without reliable, recent data relating to the decision issues to be considered, are not yet generally possible. In view of the amounts of capital investment involved, and the importance of transportation for the European economy and for political decisions, this inadequacy is remarkable.

However, if we must recognise as a reality, that reliable pan-European data will also in future not become available, then future evaluation will require to resort to methods, indicators and sources which can act as a proxy for direct measured

performances. The work of WG3, in which have been developed and tested modelling approaches suitable for the kind of fuzzy and incomplete data which might be available, is, although not yet conclusive, considered to be a significant step in this process.

Figure 1: *A Model of the Dynamics of the Freight Sector.*



Transport Implications and Comments

- In response to these new strategies from the actors in the freight sector, the structure of the transport system has become more disparate, as consignment size decreases, frequency of movement increases, destinations become more diverse and lead times become shorter.
- Two important responses are required. Greater emphasis must be placed on interchanges as this provides flexibility in the supply chain - interconnectivity. Secondly, there needs to be greater flexibility for transfer between modes (and within a single mode) so that the most efficient use of the whole network is maintained - intermodality.
- New logistics platforms should form the next stage in the restructuring process. These are locations where the key interchange points are set up at the meeting points between road-rail-air (and sea) networks.
 - * It is here that the transport network is complemented by the new communications and information networks.
 - * It is here that the new integrators will locate.
 - * It is likely that these new accessible locations will not be in the city centres but in out of centre hub locations.
 - * The efficiency of the network and the supply chain is dependent upon its weakest link.
- In the past this has been seen as the transport infrastructure; now it is more likely to be seen as the nodal points (or interchanges) in the network.

- * As logistics is a key element in European competitiveness, there may be an important role for the EU (and national governments) in encouraging a European (and national) network of logistics platforms which would provide interconnectivity, interoperability and intermodal interchanges.

In this argument the dynamics of the actors' strategies as reflected by the freight sector are not dependent primarily on the quality of the infrastructure in the traditional sense, but upon the new infrastructure - the logistics and interchanges.

- The freight sector is undergoing a fundamental change and restructuring. This is partly dependent on the move from the industrial economy to the post industrial economy, partly upon globalisation, and partly because of policy changes with the Single Internal Market and deregulation.
- These external factors are much more important than the transport factors and the European network. The new technology allows the globalisation process to take place and for shorter product life cycles, with increased product variety and customer control.
- The new management processes for the complex supply chains now takes a much wider brief than just transport. The value added is not from transport as this forms a declining part of the total costs. The real value added is in the new flexible production processes with out-sourcing and decentralisation, together with new management structures.

This is the justification for the emergence of 'integrators' as new actors in the markets.

- In the initial stage this has led to market opportunities for the integrators to establish dominance in a growing market.
- In the second phase, alliances have been sought to give manufacturers a complete package for supply and distribution/marketing. This may lead to mergers and the development of global integrators.
- The unresolved third phase is whether the market for these new actors is sufficiently large or diverse for it to be contestable. The length and complexity of the supply chains means that there may be opportunities for specialist inputs, where complementarity between supply chains exist or where specialist skills are required to avoid bottlenecks. So the global operators may need local specialist inputs to ensure continuity in the supply chain. However, too many inputs may reduce the effectiveness of the whole process, and in turn lead to higher costs and fragmentation. It is here that the logistics platforms have a crucial role to play in ensuring the weakest points in the chain (the interchanges) operate efficiently.

If we assume that there will be no significant increase in the capacity of the transport network in the central areas of heavy traffics,

- Demand will continue to increase at a greater rate than capacity, and any new investment will have short term benefits, but not solve problems of saturation. Even if sufficient new infrastructure could be built to meet demand, it would not be desirable because of the financial and environmental costs.
- Firms will maintain their competitive advantage through innovation and through the development of logistics systems that make the best use of the existing infrastructure.

There is some value added from the reorganisation of companies with new forms of distribution, facilitated by new technology.

But the real value and unexplored value comes from new forms of operation, from the development of new markets, and from mergers and alliances between management - logistics - distribution. Promotion of a personalised customer-driven service characterised by innovation, multimodality, flexibility and price is the truly dynamic response of the actors in the freight sector.

Summary: The dynamics of the freight sector are **not dependent primarily on the quality of the infrastructure** in the traditional sense, but upon the new infrastructure - the logistics and interchanges. The freight sector is undergoing a fundamental change and restructuring. This is partly dependent on the move from the industrial economy to the post industrial economy, partly upon the globalisation of the economy, and partly because of policy changes with the Single Internal Market and deregulation. These external factors are much more important than the transport factors. The new technology allows the globalisation process to take place and for shorter product life cycles, with increased product variety and customer control. The new management processes for the complex supply chains now take a much wider brief than just transport. The value added is not from transport as this forms a declining part of the total costs. The real value added is in the new flexible production processes with out-sourcing and decentralisation, together with new management structures.

In the initial stage this has led to **market opportunities for the integrators** to establish dominance in a growing market. In the second phase, alliances have been sought to give manufacturers a complete package for supply and distribution/marketing. This may lead to mergers and the development of global integrators. The unresolved third phase is whether the market for these new actors is sufficiently large or diverse for it to be contestable. The length and complexity of the supply chains means that there may be opportunities for specialist inputs, where complementarity between supply chains exist or where specialist skills are required to avoid bottlenecks. So the **global operators may need local specialist inputs** to ensure continuity in the supply chain. However, too many inputs may reduce the effectiveness of the whole process, and in turn lead to higher costs and fragmentation. It is here that the **logistics platforms have a crucial role** to play in ensuring the weakest points in the chain (the interchanges) operate efficiently.

It is generally recognised that there will be no significant increase in the capacity of the transport network. Demand will continue to increase at a greater rate than capacity, and any new investment will have short term benefits, but not solve the problem. Even if it is possible to construct sufficient new infrastructure to meet demand, it would not be desirable because of the financial and environmental costs. Firms will maintain their competitive advantage through innovation and through the development of logistics systems that make the best use of the existing infrastructure. There is some value added from the reorganisation of companies with new forms of distribution, facilitated by the new technology. But **the real value and unexplored value comes from new forms of operation, from the development of new markets,**

and from mergers and alliances between management - logistics - distribution. In the promotion of a personalised customer driven service characterised by innovation, multimodality, flexibility and price is the truly dynamic response of the actors in the freight sector.

The assessment of integrated European transport network operations is a key concern of the whole COST 328 action. This assessment needs to extend wider than the traditional evaluation based on financial appraisal and cost benefit analysis. New requirements have arisen to include the contribution of investment towards social cohesion and environmental improvement. The EU is also concerned about regional development within the EU as well as improved links with third party countries. In addition to these community wide interests, there are also major changes brought about by market forces (e.g. through deregulation), by the single internal market, by technology and by new organisational practices. **A key element is now seen to be the changing role of the actors** in the process at all levels of decision making.

Traditionally, the freight sector has been interested only in the physical movement of goods, with regulation, and with the network. New issues, such as those mentioned above have meant that interest has switched to:

- The ways in which markets are organised and structured;
- The means by which operators can gain added value through the use of the network, and maintain and increase their market share;
- New forms of competition from market principles and globalisation of markets;
- Highly specific manufacturing processes tailored to the client;
- Integration of production and warehousing with minimum levels of stock holding;
- Transport and telecommunications, and innovations to allow new "niche" entrants to the market.

The following trends are characteristic of present behaviour:

- Intensification of transport with commodity transport in tonne-kilometres growing faster than the rate of economic growth (e.g. GDP);
- Increase in competition in freight transport with the opening of the European market. This has led to intense competition, and reductions in rates charged and profit levels in the transport sector;
- The main competitive factor is the quality-price ratio, which in turn means that transport has to be efficiently organised, with support from advanced logistics;
- The quality of the logistics services (both internal and external) is an essential and logical consequence. These services have in turn become more spatially concentrated so that economies of scale and scope can be achieved (e.g. in terms of punctuality, reliability, flexibility, customer orientation, information provision and packaging of services);
- The trend towards logistic ports (or mainports) seems inevitable. Regions which offer favourable opportunities for such logistic services can become the dominant locations, but they also need to invest heavily in the necessary infrastructure - both transport and telecommunications;

- Intermodal competition and complementarity will increase. The result will be that the control functions of freight transport will gain importance, especially in trans-shipment points, so that a new landscape of hierarchically organised and functionally specialised logistic centres may arise.

We might envisage a move away from dispersed forms of production which are reliant upon energy consumptive transport towards centres of production with a high added value. These new centres (mainports and logistic platforms) would also be associated with clean technology so that they become the most attractive places in which to locate. The effects would be self-reinforcing. This development process has been termed the inverse pyramid of interest (Frybourg and Nijkamp, 1995), and it involves a set of actors with different but complementary interests:

- The micro-economic interest of the carrier in terms of profits;
- The micro-economic interests of the shipper in terms of transport costs;
- The meso-economic interest of the broader region containing the nodal centre in terms of indirect spin-offs due to new value added activities;
- The environmental economic interests of the region as a whole in terms of the external and social costs of transport;
- The macro-economic interests of the supplier of public infrastructure networks in terms of efficiency and equity.

If the ideal types of new centres of production can be identified, and if this coincides with the interests of the individual firms, then both the sectoral and spatial aspects of the new European policy become apparent. And this policy should be sustainable.

8. Conclusions of the Study COST 328

The COST 328 action has first of all confirmed that this area of study is highly complex, and that the issues involved are a real and definite challenge to future infrastructure planners. The evidence is, despite an obvious need to carry on with research into the various courses of action which have been opened up, that there are many factors at work now which are the consequence primarily of Users' Strategies of Choice. There is already a marked response to the opportunities given in a Single Europe and a free competition for provision of goods and services. Transport users are first engaged in a competitive fight to create and market products at reasonable margins. Purchasers of goods and services are exercising their strengths in markets which are increasingly serviced at once locally, regionally, from Europe and globally.

The methods and instruments include management of the cost and quality of the flow of goods, and this is placing increasing pressure upon transport service providers to respond. A higher level of logistic performance is a start. The recent measures to deregulate or liberalise the transport markets are therefore offering a welcome opportunity to users and service suppliers to become more flexible and more demanding.

The added-value nature of transport operations is also apparent in a consideration of the use which transporters can make of different transport modes. Options and combinations imply strategies of choice, which are just beginning to emerge from the essentially modal provision of transport which has been traditional. Use of various modes means knowledge and control, and these are skills which are not generally available. They can develop, at first among large organisations with special incentives; the study has seen the case of intermodal liner shipping companies. There are also some intermodal operators who, although relatively successful, encounter at once the inhibitions of a very imperfect freedom of access and interconnectivity between and within modes.

The modal networks do not give the freedom of interchange and optimisation which this type of demand is seeking. The rail network is the most problematical in this, partly because of its history of national networks, and partly because it is still, together with its operating and service provision elements, able or trying to act as a national monopolist or to seek to dominate use of its system in a number of areas. Moreover, the necessary harmonisation of rules of access and interoperability do not yet satisfactorily exist. Organisational issues, and then finance and technical matters, have been identified with slightly varying importance as Critical Success Factors demanding serious attention to improve prospects of increased network efficiency.

Railways are not however alone, and the general question of infrastructure provision is not satisfactorily resolved. The TENs which aim at a cohesive, integrating European network are clearly desirable, and call for both financial and planning methods which replace conventional national thinking on infrastructure provision. But there are still many major infrastructure projects which are national in inspiration and in conception.

The original purpose of COST 328 has been to find ways of evaluating infrastructure investments, and the combination of the factors described here shows that improved results from network synergies are indeed a key to European strategic infrastructure justification. However, almost all aspects of a process of evaluation are at present imperfect, or scarcely measurable. If the achievement of network synergies and improved efficiency by users and service providers is held back by failing Critical Success Factors, then this justification for new infrastructure will not be forthcoming.

If the ability of users to respond flexibly, in the sense of a competitive and deregulated market, to the network's potential is hindered, through any inadequacy including those of the users themselves, then the optimisation of performance which modelling and evaluation instruments may demonstrate as justification will also not be realised. The modelling techniques which have been explored during COST328 are potentially promising. They now need substantial further research to become generally applicable, and the harmonisation of available data, without which there can be no quantitative appraisal, will need to be addressed.

The issues of peripherality and accessibility, which are at the basis of the requirement that European infrastructure should help achieve cohesion and economic integration throughout the European Union, have been shown through the Case Studies to require careful and differentiated attention. Transport infrastructure is clearly desirable, but

regional needs and opportunities for network synergies may not coincide. The TEN approach is one of a Value-added network which connects and feeds Local Area Networks, LANs, where creative economic activity is focused.

COST 328 has shown how European networks are necessarily a part of a virtual global network which today involves global liner container shipping operations and civil aviation, and for which the impact upon European inland distribution has to be seen in terms of European network synergies, related to demand and operating pattern entirely controlled by the users, the international and global integrators.

Most of all, COST 328 has shown that to be economically effective in Europe, **the construction of new strategic European infrastructure cannot be done, as in the past, as a series of disconnected modal projects, or as a series of national or local issues.** The network is only economically relevant when it is used for added value operations by users. These exercise economic and service quality choices and will increasingly be called upon to make discriminating use of various modes to optimise network efficiency. This is at present not adequately possible, and therefore efficiency is not being achieved. It would be presumably a mistake to consider that the lacking efficiency can be won back by further increases in large scale modal infrastructure projects, when we see that some actors are already moving towards a more critical and selective view of their opportunities, and are expressing dissatisfaction with their limited ability to use their new freedoms of choice.

COST 328 is not complete. This has several reasons, but one must be that the deregulatory process in transportation is itself not yet clear or fully effective. Associated with this is the incomplete learning and development process among users. The opportunities already opening up to optimise their operations by free use of the networks are only partly being exploited. There are also still important national regulatory, policy and user variations. The study has identified significant barriers, with hinder inconnectivity, interoperability and intermodality, and are therefore holding back network integration and the extensive realisation of network synergies. Adequate systems, including Information Technology, to test, use and manage a wide range of alternatives, and to manage operations at interchanges, are not yet generally developed.

New entrants into the transportation world, and especially potential new European multi-modal integrators, have not yet made an impact. The parallel process of improvement or elimination of traditional transport service operators has not yet advanced significantly. New patterns of actors' behaviour, like new actors and new competitive situations, need time to evolve. They may, as competitive pressures change, rapidly move into areas today unsuspected. Finally, we expect to see emerge, through change and innovative action, a number of large competing service providers, who can act as effective European integrators, using new technologies and information systems, and who are able to bring to network use the multi-modal operations which will add value and justify the provision of facilities.

These new, or new-style, operators may evolve out of existing operating companies, in forwarding, distribution, road haulage or existing rail or intermodal sectors, or as part of global transport companies such as shipping lines. Alongside them we may

expect to see a variety of specialists, using their skills in one or more modes to meet particular types of demand. This is a dynamic process which has scarcely started. The indications from COST 328 are that it will be a very necessary step for European prosperity and for the raising of transportation efficiency. The task of estimating and quantifying this process is clearly likely to occupy us for a long time. It is the way in which added-value network synergies will come about, if Europe is not to remain at the present, clearly less than optimal, use, justification and evaluation of infrastructure resources.

9. Appendix:

Papers, Reports and Case Studies

COST 328 ISINE General:

- COST/315/94 Memorandum of Understanding for the Implementation of a European Research Action in the field of the integrated strategic infrastructure networks in Europe, COST Action 328.
- COST328/1/94 Extract of White Paper 'Growth, Competitiveness and Employment' Chapter 3: Transeuropean Networks (COM(93) 700 final)
- COST328/9/95 Frybourg/Nijkamp; Towards an evaluation framework for integrated European transport network operations: and COST328/8/95 Frybourg/Nijkamp ISINE: *Sidney Conference paper, 8/95*
- COST/328/2/96 Methodologies for Transport Impact Assessment *Extract from APAS study prepared by COST Secretariat, 1/96*
- EC-DGVII, VII/169/96-EN: ISINE Proceedings of the International Colloquium held at 'Ecole Polytechnique Fédérale, Lausanne, 2-3 March 1995

WG1 Peripherality

- COST328/4/96: Vickerman: Transport Provision and regional development in Europe: towards a framework for appraisal, *draft working paper for WG1, 1/96*
- Vickerman, Accessibility, Peripherality and Spatial development: The question of choice: *Draft 12/96 based on project 'Transport and Regional Development in Europe', and NECTAR Mons 9/96.*
- Crowley, Case Study, Ireland: *Case Study produced for WG1, 1996*
- Zaragoza-Ramirez: Peripheral regions and their access to networks: Spain *Case study for WG1, 1996*
- COST328/3/96 Pasi/Himanen, Transport of Goods between the Nordic Countries and Central Europe : *Case Study, VTT Communities and Infrastructure, 1/96 and Transport of Passengers 1/97*
- COST328: Portugal: Accessibility to the Centre of Europe, The Impact of Investment in Transport Infrastructures from 1985 to 1996, *Case Study for WG1, Junta Autonoma de Estradas Lisbon 12/96*

WG2 Trans-Alpine Freight Transport

- COST328/10/96 Müller/Maggi: **Interim Report and Preliminary results: 4/96**
- Maggi/Müller, **Critical Success Factors for the Integration of Trans-Alpine Freight Transport Markets**, *Draft Final report, Zürich, 1/97*

This final report refers to the following papers

- COST328/13/96 Russo/Fischer: **Road-Rail interconnectivity in the Alpine Freight Transport Bottlenecks and Policies from an Austrian-Italian perspective: Case Study for WG2 6/96**
- Reynaud, Gautier, Marie, Wynter **Etude du transport de Marchandises Transalpin - Projection de la Demande Potentielle de Transport Combiné: Paper for COST 328 TAFT seminar Lugano, 12-13/1/97**
- Demille, Dupuis, Jourquin, Beuthe: **On the crossing of the Alpine Chain and the Swiss Regulation of Trucking**, *paper for Nicosia Convention, 19-23.3.97*
- Bolis, Simona : **Trasporto Merci Transalpino: Analisi e Prospettive di Sviluppo**, *Thesis, University of Bergamo, 1996*
- Caruso Frezzo, Maurizio: **The role of the Italian Railways in International Freight Transport**, *Paper for TAFT Seminar Lugano, 12-13/1/97*
- Reggiani, Bolis and Nicoletti, **Methods and Models analysing Transalpine Freight Transport: an overview**. *Bologna, 1995*
- Rossera, Fabio: **Freight Traffic through the Alps: Peculiarities and Impacts of Abnormal Routing: IRE Bellinzona 1994**
- Rossera: **Modelling Transalpine Freight Transport: Discussion Paper, IRE Bellinzona, 1995**
- Rossera: **A Fixed-Demand Model with transit restrictions for evaluating the modal and route choice in transalpine freight: Discussion paper, Nectar 2 Workshop, Mons 2/96**
- Banister and Müller **Infrastructure Networks and Transport Priorities of two Islands, Switzerland and Great Britain: Working Paper 16, UCL London 1996**
- Maggi and Müller **Price Effects of Regulation**, *Paper for 5. Regional Science Ass. Intl. Conference, Tokyo 1996*
- Müller Karin, **Price-Quality Strategies of Freight Carriers in response to network integration: Paper for Euroconference on Eur. Transport and Telecommunications Networks, Espinho P, 4/1995**
- COST/328/2/97 Markus Maibach **Infras, Transalpine Combined Transport – Actors, Strategies and Interlinkages An Overview paper, 1997.**

WG3 Road-Rail-Waterways Competition/Complementarity

- COST328/17/96 Nijkamp, Kostas, Bithas: **Towards an effective and efficient Multi-modal freight transport network in Europe: Results of study and survey on perceived barriers to multimodal effectiveness, 11/96, also presentation to Nicosia Conference, 19-23/3/97**
- Nijkamp, **From missing networks to interoperable networks: The need for European co-operation in the railway sector**, *Paper for Transport Policy, Elsevier 1995*

- Button and Nijkamp, **Networks, Stability and Spatial Economic Integration: Paper presented at NECTAR meeting, FUCAM Mons 24-28/9/96**
- Reggiani, Nijkamp, Wai Fai Tsang, **European Freight Transport Analysis using Neural Networks and Logit Models: COST328 draft12/1996, NECTAR Conference, FUCAM Mons, 9/96, also TI97-032/3, Tinbergen Institute, 1997**
- Martellato and Nijkamp: **The Concept of Accessibility Revisited, TI96-100/5 Tinbergen Institute, 1996**
- Demilie, Jourquin, Beuthe: **A sensitivity analysis of transportation modes: Market shares on a multimodal network : A Case study of dry bulk transport, Benelux / Germany and Spain : FUCAM Mons, 1996**
- Reggiani, Nijkamp and Bolis, **The Role of Transalpine Freight Transport: Case study with Logit and neural models, Draft for COST328, 1997**

WG4 Actors' Strategies

- David Banister, Ken Button, and Marina Van Geenhuizen **Strategic Changes between the Actors: A Position Paper on the Freight Sector, presented at the COST 328 Colloquium Integrated Strategic Infrastructure Networks in Europe - Lausanne 2-3 March 1995**
- David Banister **Draft - Criteria for Selection of "New" Actors, presented at the COST 328 WG4 Actors Strategies meeting in Paris, 21 March 1996**
- David Banister **The Dynamic Response of the Actors in the Freight Sector Paper prepared for COST 328 WG4 Actors' Strategies - December 1996**
- David Banister and Karin Müller **Infrastructure Networks and Transport Priorities of Two Islands: Switzerland and Great Britain, Planning and Development Research Centre, Bartlett School of Planning, University College London, Working Paper 16, February 1996**
- Marina van Geenhuizen, Rob van der Heijden and Gert-Jan Muilerman **Transport using the River Rhine: New Bottlenecks in Old Networks, Report prepared for COST 328, December 1996**
- Christian Hey and Ruggero Schleicher-Tappeser (eds) **Case Studies on the Policies of the Integration of the Environmental Dimension into Infrastructure Planning, Chapters from Final Report on Incorporation of the Environmental Dimension into Freight Transport Policies - 1996, prepared for COST 328 WG4 Actors Strategies, March 1996.**
- Michel Houée **Eléments pour une Typologie des Acteurs de l'Economie des Réseaux, Contribution to COST 328 WG4 Actors Strategies, May 1995.**
- Michel Houée **Relations entre Opérateurs et Régulateurs, et Intégration des Réseaux, presented at the COST 328 Colloquium on Integrated Strategic Infrastructure Networks in Europe - Lausanne 2-3 March 1995.**
- Michel Houée **Proposal for Typology of Actors, presented at the COST 328 WG4 Actors Strategies meeting in Paris, 21 March 1996**
- Michel Houée **Survey about Actors Concerned with the Integration of Networks, Paper for the Actors Strategies Questionnaire, September 1996.**
- Miroslav Jelaska **An Initiative for Better Definition of the Transport Network Integration, A Draft Text for COST 328 WG4- July 1995**

- Miroslav Jelaska **Electronics and Telecommunications as the Integration Actors**, *Paper for COST 328 WG4, Actors Strategies*, January 1997
- Karin Müller **Competitive Strategies of Freight Carriers in Response to network Integration**, *Dissertation Design Paper for COST 328 WG1 and 4*, March 1996.
- M. Jelaska. **Electronic and Telecommunications as the Integration Actors**, Draft, January 1997

In preparation:

- Mette Skramris and David Banister **Cost and Traffic Projections of Large Transport Infrastructure Investments: UK and Danish Case Studies**, *Planning and Development Research Centre, Bartlett School of Planning, University College London, Working Paper 19, February 1997*
- Michel Houée, **Results of Actors strategies questionnaire**, *draft report 4/97*.

Other relevant papers

- Frybourg, **Une Stratégie: Pourquoi? Comment la générer, comment l'évaluer, comment la réaliser?:** *presented at NECTAR conference, FUCAM Mons 9/96*
- Euro-CASE papers: Frybourg, **Transportation Study**, 7/96 and **Mobility, Transport and Traffic**, *Report of meeting at Royal Academy of Engineering, London, 13/11/96*

Recommendations and Lessons

by
Dr.-Ing. Milan Janić

Contents

1. Introduction	69
2. Background	70
3. Identification of an operational assessment/evaluation framework on the integrated networks	72
3.1. The requirements.....	73
3.2. The methods for assessing/evaluation the network performances.....	73
4. Application of the findings of COST 328 Action development	76
4.1. Proposal of the ‘policy guidelines.....	76
4.2. Proposal for a ‘Good Policy Practice’ in assessing/evaluating European network	80
5. Conclusions	82
6. References	83

1. Introduction

Transport plays a key role in integrating the newly expanded and unified Europe. The integration is expected to be carried out through the development of new infrastructure links, nodes and services, based on complementarity and competition which is expected to alleviate (or replace) national, local and institutional barriers. Against this background, Europe is faced with major decisions on the future transport infrastructure investments. Many actors are expected to take part and influence these integrative processes. These are: the customers (the users) of transport services (the passengers and shippers of goods), the network actors (modal transport carriers and multi-modal integrators of transport and interchange services), public, semi-public and private investors, local communities, national governments, the European Union and various public authorities.

Title XII of the Treaty on the European Union (EU), the White Paper for a Common Transport Policy (CTP) and the conclusions of the Edinburgh and Copenhagen European Council have stressed the importance and significance of the development of Trans-European transport networks in the EU. The main policy objectives (i.e., the focal points of the European infrastructure network policy) for these networks have been formulated to be as much as possible intermodal, interconnected and interoperable. These concepts are expected to enhance the socio-economic benefits of the European networks through an efficient operation of the internal (regional and national) markets and support for the European integration and globalisation of trade.

Development of such network(s) has required the definition (design) of a completely new framework for an assessment/evaluation of the networks. This activity should identify meaningful and practical indicators of the network performance, for both operators and investors, and allow the development of an appropriate analytical framework for assessment and evaluation.

A new innovative framework should be applied to allow for a better assessment/evaluation of transport infrastructure on a local, national (regional) and European scale. In particular, it should take into account further development of supporting telecommunication networks, harmonisation of transport system(s) operations, provision of convenient access to the transport infrastructure as well as redefinition of the current roles of the actors represented by the public authorities at a local (regional), national, and/or European level on the one side, and public, semi-public and private network actors on the other side. If these preconditions were fulfilled, a higher added value representing the synergy benefits for the network operators themselves, the users of transport services and community as a whole would be obtained.

The problems and dilemmas in developing the 'Integrated Strategic Infrastructure Networks' methodology under new conditions and requirements have initiated the launching of the COST 328 Action whose main objectives have been the following (COST 328/1/94):

- To contribute to a strategic definition of the integration of a Trans-European networks.
- To stimulate thought on development of the methodology for the assessment and evaluation of performances of transport networks and strategies for their development and/or integration.

The Action has fulfilled these objectives through two steps. The first one has been the development of the framework for assessment/evaluation of the integrated Trans-European networks based on a set of the indicators of the network performance and critical factors of success or failure of the network integration. Carrying out relevant European case studies in order to check the operational feasibility of proposed approach has represented the second one. Four Working Groups have carried them out on the following subject areas (EC, 1998 *a*). Working Group 1 (WG 1) has dealt with the 'Accessibility' and 'Peripherality' of the networks in order to find out the solutions of the feasible connections of the European peripheral and central ('core') areas (regions). WG 2 has dealt with the case study related to the various aspects (the problems) of the 'Trans-Alpine Freight Transport'. WG 3 has carried out the study on the 'Rail-Road competition/complementarity'. It has developed the convenient modelling techniques and methods and investigated the significance and impacts of the various factors on the present rail/road inter-modal operations (Benchmark Analysis). WG 4 has investigated the dynamic development of the European freight transport sector in dependence on the quality of existing and new modal-transport, logistics and interchange infrastructure, market development and the role of 'actors', the modal transport operators and integrators of the network services.

The present concluding 'policy' report addresses a summary on the following key issues of the COST 328 Action:

- Identification of an assessment/evaluation framework which would be suitable for European transport policy.
- Formulation of policy guidelines that are the results of previous findings.
- Proposal for 'Good Policy Practice' in assessing/evaluating European network developments.

2. Background

Development of the European transport infrastructure networks has been conditioned by many factors for a long time. Regarding the COST 328 Action all they have been identified and considered as the constraints (i.e., the 'barriers' or 'Critical Success Factors') which have hindered the development of these networks independently on the national borders (institutionally) and individual transport modes (technically/technologically). Such independent (non co-ordinated) development has created a lot of problems and inconsistencies at the European (international) level. It has caused the present networks to be unable to successfully support the development of the 'Common Market' and 'unification' of Europe. The ways of evaluation of the particular investment programmes have represented the main problems. First, the most of them have taken into account only the ways how the network can be designed and developed. Second, the highest priorities have been assigned to the national

infrastructure investments without considering the other (either similar and/or complementary) ones which have often been parallel carried out at the nearby locations in the neighbouring countries. This has, under conditions of falling (virtual removal) of the national borders, risen a risk of imbalance of the infrastructure capacities of different transport modes at both national and European level. Due to simultaneous development of the competition within the same and between different transport modes the over-capacity of the transport infrastructure at one mode and the under-capacity at the others has emerged as common phenomenon. Thus, on the one side the inherent positive impacts of transport on the socio-economic development have been reduced. On the other side its negative impacts on the environment through increased air pollution, noise, congestion and safety, at regional, national and European level have enhanced. Essentially, all these have indicated that the overall planning, evaluation and development of the transport infrastructure has been modal and to a great extent intra-national activity.

However, for the last decade the pattern of transport demand in Europe has been starting to change. The changes have been caused by the changes of both overall socio-economic background and the transport sector itself. This has enhanced the requirements for the operation of more efficient networks which would be able to link the modal infrastructure and related services on the one side, and the nodes of the European network economy on the other side. In such context they have been required to become a value-added configurations which would be able to provide the efficient use of essentially passive infrastructure.

In order to fulfil such request the strategies for the integration of the networks have been identified. The horizontal and vertical integration of the networks can be carried out. The main strategies for the horizontal integration of the networks have been identified to be the intermodality, interconnectivity and interoperability. Generally, these are primarily the 'technology-driven' strategies which could be achieved in the real-life transport networks through carrying out the following activities (EC, 1995):

- Increasing of efficiency of the inter-modal networks through a better alignment of single-mode operations, a better integration of high and low transport flows, and improving of traffic and transport management systems.
- Improving of efficiency of transit/transfer points (the uni-modal and multi-modal seaports and inland terminals) through optimisation and rationalisation of their design and transfer (transshipment) technologies.
- Involving of the information technologies for transport management to improve the quality of service to the users through tracing, tracking and overall and specific integration of modal information

The main strategy for the vertical integration of the networks has been identified to be the development of the 'demand-led' logistics chains in which the high-quality and a relatively cheap logistics services will be provided to the end users. The logistic suppliers as the new actors have been expected to operate these chains in which the transport services play one of the most important roles (EC, 1998).

The behaviour of the logistics suppliers as well as the other network actors has been expected to create synergy in an interconnected transport infrastructure and thus significantly impact the further development of the relationships between demand and supply. Generally, the network actors have been classified as the 'old' and 'new' ones. The 'old' actors have already operated in the markets. They have been titled as the 'network operators'. The 'modal operators' have represented them. They have provided the modal transport capacities, facilities and equipment. The 'new' network operators have been the 'integrators of services' like the 'freight forwarders' and 'logistic suppliers'. They have used the various transport modes and related interchanges (uni-modal and inter-modal terminals) in order to co-ordinate, manage and operate the freight and passenger flows in the networks. Their operations have mostly been adapted to the characteristics of demand (i.e., to the customers'-users' service preferences). The customers have preferred the services with a high speed, flexibility and reliability, and low cost. In other words the supply of services (i.e., the capacity and quality) has been linked to the features of O/D freight flows and passengers (i.e., the market segments) rather than to the inherent operation of the individual transport modes. The requests for higher quality of service on the one side and close linkage of the actors' operations to the pattern of demand on the other side have enhanced (increased) the importance of integration of transport networks operated by different transport modes. This integration itself has enhanced the importance of uni- and/or multi-modal transfer/transit operations which have to be carried out within particular logistics chains. The multi-modal services have been expected to improve the overall utilisation of the transport infrastructure and thus convert it from an 'extremely passive' to a high 'value added' entity.

Both the horizontal and vertical strategies of the integration of the networks have been interrelated. In some sense the horizontal integration of the networks has been one of the most important preconditions for their successful vertical integration.

The procedures and principles for the implementation of the particular strategies for the horizontal and vertical integration of the real networks have been proposed by the COST 328 Action.

3. Identification of an operational assessment/ evaluation framework on the integrated networks

An operational (practical) analytical assessment/evaluation framework for the 'Integrated Strategic Infrastructure Networks in Europe' should fulfil the two objectives:

- To identify the meaningful and practical indicators of the network performances,
- To take into account the behaviour of the various actors like the network carriers-operators, the integrators of network services including the logistics suppliers, the public, semi-public and private investors, the local communities, the national governments and the European Union.

The requirements and the methods of assessment/evaluation of the network performances compose such framework.

3.1. The requirements

An assessment/evaluation framework for the European transport policy has to fulfil the following requirements (Frybourg and Nijkamp, 1995):

- To provide sufficient (but countable) number of the policy evaluation criteria which have to be operational, testable and measurable.
- To enable the applicability of selected criteria to the various geographical scales and transport modes.
- To focus on the actors' behaviour.
- To be able to incapsulate the impacts of transport systems' changes.
- To provide the framework for linking these criteria to the major policy assessment angles.

(Four policy assessment angles might be taken into account. These are: a) the technical/ technological and institutional harmonisation of the multi-modal networks; b) the growth of efficiency of both public and private actors using these networks; c) distributional equity for all interest groups and regions involved; d) sustainable development in terms of environmental impacts and resource consumption (Frybourg and Nijkamp, 1995).

3.2. The method for assessing/evaluation the network performances

In order to design the methods for assessing/evaluation the network performances it has been necessary to introduce the concept of integrated networks.

Generally, the integrated networks consist of the physical infrastructure represented by the network links and nodes, the services, and their organisation and management. With respect to the number of transport modes taking part in the provision of the transport services they can be classified into uni-modal and multi-modal (or inter-modal) networks. Uni-modal networks are operated by 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., the freight and passenger interchanges) have to be provided in the multi-modal networks. At the freight transport these are the inland uni-modal and multi-modal terminal and seaports.

At both classes of the networks the conditions for the complementarity and competition should be fulfilled. Complementarity should provide the added value through the networks synergy. Competition should be developed in order to provide the operations under the most cost-efficient conditions at the European scale.

The performances of the integrated networks are dependent on the set of *quantitative* and *qualitative* factors. The 'demand/capacity' ratio has been identified as the most important (representative) quantitative factor. The 'network cohesiveness' has been identified as the most important qualitative factor. The main indicators of the network cohesiveness have been considered to be the 'intermodality', 'interconnectivity' and 'interoperability' (Frybourg and Nijkamp, 1995).

- Intermodality addresses the sequential use of different transport modes in the logistic chain(s). The actors like the territorial authorities/decision makers may

- concern the nodal design and tariff system as the integrative elements of the networks. In the same context the public, semi-public and private operators and the organisations can act either as the 'logistic suppliers', the operators of complete value added networks, and/or the regulators of the network operations. The industrialists and the technical research community may concern the transshipment technology and just-in-time (JIT) design as the main intermodal elements of the networks.
- *Interconnectivity* is particularly concerned with the horizontal co-ordination of the networks which have different geographical coverage and access. The actors like the territorial authorities and policy decision makers may consider the connectivity of the networks at a local (regional), national and international (European) level as a potential for obtaining the infrastructure added value. The operators and organisations may consider the application of 'Electronic Data Interchange' (EDI), and the integrated terminal and/or transfer services as the ways to establish the interconnectivity of the network(s). The industrialists and the technical research community can consider the development and implementation of the information technology and electronic customs as the way to establish the interconnectivity of these networks.
- *Interoperability* mainly refers to the technical and operational (procedural) uniformity which may be convenient for the actors (the modal carriers and the integrators of the network services) to link the various layers or components of the transport networks. Different actors may consider this attribute in different ways. For example, the territorial authorities/policy makers are mostly interested in the safety and the environmental norms and standards. The operators may consider the interoperability as a matter of the pre-competitive research. The industrialists and technical research community may consider the (pre-)standardisation, compatibility of the infrastructure technology, facilities and equipment, and the specific characteristics of the vehicles (dimensions) as the most suitable way for interoperable integration of the networks.

Since the quantitative measurement of the most of these 'cohesive' features has been recognised as a difficult research task and since the most real-life data on them have been missing, the 'proxy' indicators of the network performances have been introduced for practical (operational) purposes. They have been presented in a form of the Pentagon model (EC, 1998b). The model has identified five types of factors for measuring the network performances with respect to the 'cohesive' network features. These are: 'hardware', 'software', 'orgware', 'finware', and 'ecoware'. As it is shown in Figure 1, dealing with the Pentagon model in an operational way requests the establishment of the correspondence between its factors and a) the components of actual (real) network, and b) the network cohesiveness features represented by the intermodality, interoperability and interconnectivity.

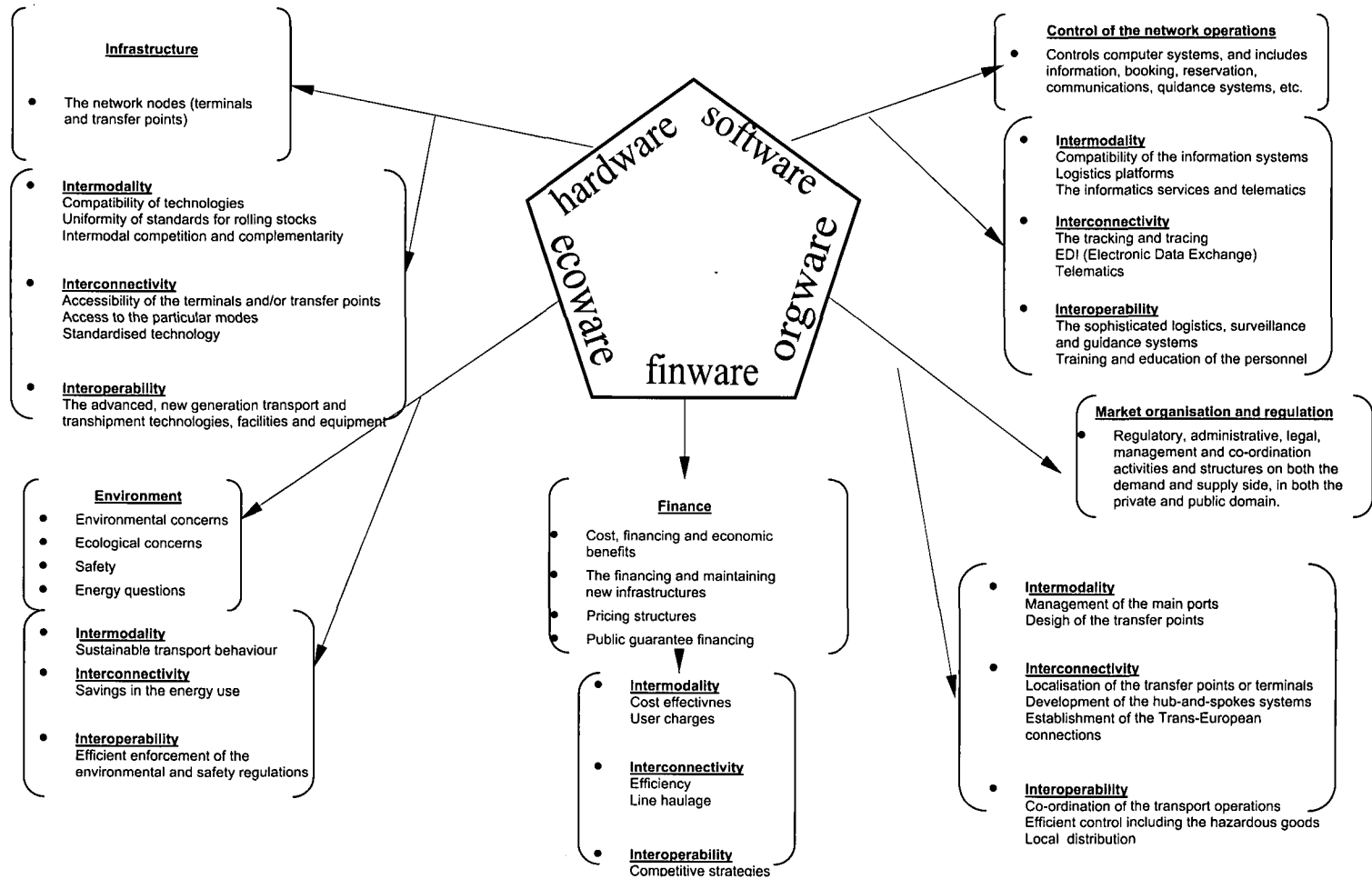


Figure 1: The factors and cohesive features of the networks according to the Pentagon model

They may have different relative importance in different situations for the various types of actors. In particular, they have been highlighted as possible barriers up to the point of identification as the 'Critical Success Factors' (CSF) for the network performance. In order to be of the practical value the factors and characteristics shown in Figure 1 should be converted into the measurable indicators which will be dependent on the individual transport modes considered, the actors at hand, the region under investigation, the policies pursued, etc..

4. The application of the findings of the COST 328 Action

The framework based on the Pentagon model and the findings of the case studies examined by four Working Groups of the COST 328 Action have been applied to define the policy recommendations on the assessing/evaluation of the future developments of the 'Integrated Strategic Infrastructure Networks in Europe'. Broadly, the recommendations can be classified into the 'policy guidelines' and the proposals on a 'Good Policy Practice'. The former set of recommendations mostly relates to the development of different policy issues. As they would be implemented, they were able to further increase the efficiency of the operations of integrated networks mostly through alleviating and/or removing of the existing and future potential barriers (i.e., the 'Success Factors') on the factors of network developments.

4.1. Proposal of the 'policy guidelines'

The main principles for the formulation of the 'policy guidelines' based on the findings of the COST 328 Action should be directed to remove different kinds of barriers (hardware, software, orgware, finware, ecoware) to the horizontal integration of the network like intermodality, interoperability and interconnectivity. They address the tasks of all actors and particularly the national governments (regional level) and the European Union (global level). They may be summarised as follows:

4.1.1. The institutional and organisational framework for an efficient operation of the 'ISINE' should be established through the following policy measures:

- The transport markets should be further liberalised or deregulated. This is expected to increase the efficiency of intermodal transport operations through creation of an effective institutional environment for both competitive and complementary intra-European multi-modal services. Specifically, the liberalisation or deregulation will increase the capacity of the network through the integration of the infrastructure, modal and inter-modal services, removing of the suppliers' local monopolies and re-orientation of the market structure from the national to European dimension. Thus the access to market will be alleviated.

- *The rules for infrastructure use, market access, property rights for basic service providers and an international harmonisation of the norms should be defined*
They are expected to considerably contribute to integration of the networks. After liberalisation or deregulation the conditions for the the Trans-European networks. In particular, the charging principles and conditions for entrance the market should be clarified. This may provide the increasing of certainty of behaviour of the existing and new entrants. Particularly, at the railways the separation of the tracks and operations reflects the need for free access to the infrastructure. This has been recognised as the only way for instigating the competition there.
- *The principles on the 'Fair and Equitable Pricing for Competing Transport Modes' should be strictly appreciated* ('Green Paper' of the European Commission, EC, 1996). Designing the apparent policy directives should encourage the development and operations of more 'environmentally-friendly' transport modes. This should include designing of the proper measures for improvement the identification of social cost (internal/private and external) (per mode, across the modes and per individual modal operator). In addition, this should include the development of the principles for differentiating the external costs with respect to operational environment defined by the areas of different noise, air pollution, and congestion impacts. According to a fair principle the user and polluter should pay the full social costs. In principle, due to a low public acceptability and difficulties in reaching of an international agreement the implementation of these measures should be fiscally neutral.
- *The new principles and procedures for evaluation the investments of the transport and inter-modal infrastructure should be introduced.* A multi-method strategy is essential to understanding of the key components of evaluation along two dimensions of the Pentagon model (factors perspective) and evaluation/decision level (actor perspective). Apart from the national and cohesiveness like the intermodality, interoperability and interconnectivity. The later set of the recommendations relates to the examination of the activities on the assessing/evaluating of the modally based principles and procedures which have mostly been applied to evaluation of the TENs, a new form of economic modelling should be taken into account. Apart from the infrastructure investment costs themselves, also the actors' behaviour, market conditions for remuneration, influence of eventual (possible) harmonisation of the charging principles of the European infrastructure, and social cost (internal/private costs and external cost) and benefits should be taken into account. A differentiated approach in evaluation of the infrastructure proposals in the form of projects, programmes and policy evaluation at a local, national and European level of interest should be applied. Since the necessary investments for developing the Trans-European networks will be large, it will be necessary to look for a proper and the most efficient forms of the partnership between different private, semi-public and public investors at the national and European level. They may be private funding agencies, national governments and providers of the European capital (EIB, EBRD).

4.1.2. The procedures and rules for improving the performance of the railways should be defined

- *The various barriers to successful operations of the railways over Europe should be alleviated, reduced and even completely removed.* The 'lack of interoperability of railways at the European level'(hardware) and the 'lack and high cost of railway infrastructure and user costs' (finware) have been identified as the main barriers hindering the successful inclusion of the railways into the efficient intermodal operations at both national and international (European) level. The collusive agreements between operators, predatory practice, monopolies and incumbent advantages have been identified as the main barriers at the local level. They should considerably be reduced and even completely eliminated. Reduction of barriers at three levels (local, national, international) could be carried out by introduction of the common technical standards for the railway operations and new financial schemes for realising the investments in the railway infrastructure, intermodal rolling stocks and intermodal terminals. This will require the development of a new legislation and appropriate social adjustments related to the market structure, the railways management (which is bureaucratic) and ownership of the enterprises and infrastructure.
- *The new logistics systems should be developed.* They should be based on the multi-modal transport which will require dedicated policy on both the intermodal transport and terminals in a broader sense. This will involve development of the new types of railway services (i.e., direct/block/shuttle trains), new types of the logistics services at the ports and inland inter-modal terminals as the value-added services and their co-ordination at the inter-modal interfaces (the terminals). As well, the design of 'ideal' types of a European (and national) logistics platforms and main-ports which should be able to provide intermodality, interconnectivity and interoperability of the inter-modal networks will be necessary.

4.1.3. The information systems and technology should be further developed

Since the information management has been identified as a prerequisite for managing a multi-modal operations and optimising the economic efficiency it will be necessary to initiate research and development of the information systems which will be able to fulfil the following requirements:

- To provide *free and open exchange of operational data* between the modes and interchanges, as well as the information of better quality for strategic choice.
- To provide *the potential users of multi-modal services to have access to the information networks* which will allow modal choice and managing the operations during their movements through particular modes and nodal points.

4.1.4. The research should be continued

- The internalisation and globalisation of the economic activities affecting the development of transport in Europe should be particularly investigated. In particular their acting as a 'cause' and 'effect' will require further investigation.
- The relationship between global networks and European networks should be further studied. The studies should involve the operations of liner container shipping and civil aviation, and synergy which arise at the seaport and airport interfaces and is related to demand and operation of the global integrators
- The research on designing of more appropriate (unique) measures of the network 'accessibility' and 'peripherality' should be continued. They should be included in the evaluation procedures on the inter-connectivity of the peripheral regions though 'core' area and 'directly'. Apart from the characteristics of the traffic flow these measures should be taken into account in evaluation of the particular projects as a more objective and unambiguous measures of the accessibility. Instead of single measure, a set of measures based on the specific geographic and economics characteristics of the region(s) has shown to be appropriate.
- The methodology for scientific estimation and monitoring the changes of the actors' behaviour should be developed. The actors have been the modal carriers, integrators of inter-modal services and customers (the users of these services). It will be particularly important to monitor the changes of the actors' behaviour by ongoing observations since there has not been a stable pattern of behaviour. The continuous research task should be studying and estimating of the processes of evolving new or new-style operators (the actors). This should include all aspects of their behaviour and particularly the movements towards the effective European multi-modal integrators (actors) which will use the new modal, terminal and information technologies in order to add value and justify the provision of the infrastructure.
- The behaviour of the shippers should be investigated too. They have been shown to have an instrumental role in providing effectively the 'door-to-door' inter-modal services which is a major growth area with the use of logistics and the emergence of new integrators.
- The ways of resorting the methods, indicators and sources which can be used as proxy for direct measurement of the performances should be investigated. It is necessary since the incomplete and discrepant statistical data will result from deregulated or liberalised markets. The investigations should particularly include the collection and harmonisation of necessary data. In order to successfully use these data, the development and improvement of the fuzzy modelling techniques like the Neural Networks and Logit models will be necessary.

4.2. *Proposal for a 'Good Policy Practice' in assessing/evaluating the European network development*

Each WG has applied the new 'Evaluation Framework' to the specific case studies. It has contained a broad set of aspects of the evaluation of the transport infrastructure. Thus, this framework can be considered as a part of a 'Good Policy Practice' that could be applied to the assessment and evaluation of future transport projects.

A 'Good Policy Practice' in assessing/evaluating the European network developments should involve two phases:

- Identification and quantification of the barriers (i.e., the 'Critical Success Factors') to the multi-modal networks cohesiveness (intermodality, interoperability, interconnectivity) by using of the Pentagon model.
- Allocation of the available (very often a scarce) investment sources (funds) to different transport projects by using of the evaluation framework.

4.2.1. *The barriers (i.e., the 'Critical Success Factors') to the multi-modal networks cohesiveness (intermodality, interoperability, interconnectivity) by using of the Pentagon model should be identified*

The main characteristics of the Pentagon mode have been explained above.

4.2.2. *The 'optimal' or 'sufficiently good' allocation of the available (very often scarce) investment sources (funds) to different transport projects by using of the evaluation framework*

The COST 328 Action has proposed one among the most promising methodologies (frameworks) for assessing/evaluating of the European network developments. This methodology assumes that the new individual links and nodes should be assessed as the parts of the network. That means that their direct and indirect effects on the transport network should be taken into account. The evaluation has been proposed to be carried out at three separate levels: the level of to the individual project where the methods and procedures are well known, the 'programme' level and 'policy' level (EC, 1998 *a,b*).

The evaluation framework to allocate the investments to different projects, programmes and policies consists of two parts:

- i) The 'Evaluation Processes'
- ii) The 'Decision Making Processes'.

i) The Evaluation Processes

According to the current practice the projects, programmes and policies coincide with the specific local, regional (or national) and European (wide) area networks and interests.

Apart from the different 'Evaluation levels', the 'Evaluation processes' incorporate the 'Evaluation methods' and 'Other Components' that could be applied to evaluation. The latter two components are summarised as follows:

- The Financial Appraisal and Cost Benefit Analysis. As methods they could be applied for evaluation of the *specific projects*. As well, they may include the 'Environmental assessment' and 'Social Impact Analysis' as the additional components in evaluation.
- The Multi-Criteria Analysis and Framework. These methods could be applied to assessment and evaluation of *the programmes*. The additional components in evaluation would ensure that the individual costs and benefits of the projects conform to a wider programme objectives, particularly on regional development and environment.
- The Strategic Environmental Assessment and Complex Objective Analysis, Including Meta Analysis. These methods could be applied to evaluation of *the transport policies*. The additional components in evaluation would fit the particular programmes into the national and international policy context, so that broad economic, social and environmental objectives have been met.

ii) The Decision Making Processes

The 'Decision Making Processes' take into accounts the 'Levels of Decision', 'Key Issues' and 'Critical Success Factors'.

- At the '*local-project level*' the individual links, terminals, and interchanges for each transport mode represent the key issues. The 'Critical Success Factors' have been identified to be the 'Restrictions', 'Competition between Modes', 'Finance and Subsidy', 'Individuals' and 'Levels of Integration'. Reducing of these barriers may add the value to links and nodes.
- At the '*national'-programme level*', the Logistics and Network Effects, including the questions of Intermodality, Interoperability and Interconnectivity, and the crowding of investment represent the key issues. The 'Critical Success Factors' have shown to be the 'Regulation', 'Competition', 'Finance' (private semi-public and public), 'Companies', 'Integrators', 'New Actors', 'Mergers and Alliances'. Reducing of these barriers may provide 'adding value' to the network and communications.
- At the '*national and EU-Policy level*', the 'Competitiveness', 'Cohesiveness' and 'Environment', but also the 'Price Competition', 'Liberalisation and Open Access Policies' are considered as the key issues. The 'Critical Success Factors' have been identified to be the 'Regulations', 'Competitive Frameworks', 'Financial Institutions', 'Governments', 'International Agencies', and 'Multinational Companies'. They are expected to add the value to the competitive position of countries and the EU (EC, 1998a, b).

5. Conclusions

The Trans European Transport Networks have been considered as Value Added Networks. The Cost 328 Action has indicated that there have been considerable barriers distorting optimal response to the value-added potential of these networks.

This concluding 'policy report' has summarised the following key issues on the COST 328 Action:

- Identification of an assessment/evaluation framework expected to be suitable for European transport policy.
- Formulation of policy guidelines resulted from the findings of the case studies carried out by four WG (Working Groups).
- Proposals for a 'Good Policy Practice' in assessing/evaluation of the European network development.

The *assessment/evaluation framework* has been developed in a form of the Pentagon model which has been able to identify the performances of the networks and the barriers to their horizontal and vertical integration. Horizontal integration, recognised as a precondition for vertical integration, has been able to be carried out through the network intermodality, interconnectivity and interoperability. Vertical integration has been able to be achieved by establishment of the demand-led sub-networks containing the logistics chains whose main component has been the 'door-to-door' transport service.

The '*policy guidelines*' have been defined on the basis of findings of the case studies. They have been related to alleviating (or removing) of the barriers to successful horizontal and vertical integration of the networks at European scale. A set of recommendations on the establishment of the institutional and operational framework for efficient operations of the integrated networks, the rules and procedures for improving the performances of railways, developments of the information technologies and future research have formed these guidelines.

A '*Good Policy Practice*' in assessing/evaluation of the development of European networks has involved the identification of the barriers (i.e., 'Critical Success Factors') to the network integration by use of the Pentagon model and the evaluation framework for investing into the network developments. This framework has comprised the 'evaluation processes' and 'decision making processes'.

Apart from important achievements, both this report and COST 328 Action have emphasised the necessity of continuation of the various investigative, planing and operational activities in order to achieve the objectives of the integration of the European transport networks as Value Added Networks.

6. References

COST/1/94, *Memorandum of Understanding for the Implementation of a European Research Action in the Field of the Integrated Strategic Infrastructure Networks in Europe*, Cost 328 Action.

EC, (1995), *Transport Intermodality*, Task Force, European Commission, DG-VII, Brussels, Belgium.

EC, (1996), *Towards Fair and Efficient Pricing in Transport: Policy Options for Internalising the External Costs of Transport in European Union*, (Green Paper), Bulletin of the European Union, Supplement 2/96, European Commission, Brussels, Belgium.

EC, (1998a), *Actors and Factors*, COST 328–Integrated Strategic Infrastructure Networks in Europe-ISINE, Final Report, European Commission, Cost Secretariat, DG VII, Brussels, Belgium.

EC, (1998b), *Final Report*, COST 328–Integrated Strategic Infrastructure Networks in Europe-ISINE, European Commission, Cost Secretariat, DG VII, Brussels, Belgium.

Frybourg M., Nijkamp P., (1995), 'An Assessment Methodology for Integrated European Transport Network Operations', *COST 328–Integrated Strategic Infrastructure Networks in Europe-ISINE*, Synthesis of the International Colloquium held at 'Ecole Polytechnique Federale de Lausanne' 2/3 March 1995, pp. 29-59.

EUROPEAN CO-OPERATION
IN THE FIELD OF
SCIENTIFIC AND TECHNICAL RESEARCH

Brussels. 20 September 94

COST 315/94

COST

NOTE

Subject: Memorandum of Understanding for the implementation of a European research Action in the field of the integrated strategic infrastructure networks in Europe (COST Action 328)

Delegations will find attached hereto the text of the abovementioned Memorandum, signed in Brussels on 14 September 1994.

COST/315/94

**MEMORANDUM OF UNDERSTANDING
FOR THE IMPLEMENTATION OF
A EUROPEAN RESEARCH ACTION IN THE FIELD
OF THE INTEGRATED STRATEGIC INFRASTRUCTURE
NETWORKS IN EUROPE (COST ACTION 328)**

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in a European research Action in the field of the integrated strategic infrastructure networks in Europe, have reached the following understanding:

SECTION 1

1. The Signatories intend to co-operate in an Action to promote research in the field of the integrated strategic infrastructure networks in Europe (hereinafter referred to as the *Action').
2. The main objective of the project is to contribute to a strategic definition of the integration of the Trans-European networks and to stimulate thought on the development of methodologies for the assessment of performances of transport networks and for strategies for their development and/or integration.
3. The Signatories hereby declare their intention of carrying out the Action jointly, in accordance with the general description given in Annex 11, adhering as far as possible to a timetable to be decided by the Management Committee referred to in Annex
4. The Action will be carried out through concerted action in accordance with the provisions of Annex I.
5. The overall value of the activities of the Signatories under the Action is estimated at ECU 500 000 at 1994 prices.
6. The Signatories will make every effort to ensure that the necessary funds are made available under their internal financing procedures.

SECTION 2

The Signatories intend to take part in the Action in one or several of the following ways:

- (a) by carrying out studies and research in their technical services or public research establishments (hereinafter referred to as "public research establishments");
- (b) by concluding contracts for studies and research with other organisations (hereinafter referred to as "research contractors*");
- (c) by contributing to the provision of a Secretariat and/or other co-ordinatory services or activities necessary for the aims of the Action to be achieved;
- (d) by making information on existing relevant research, including all necessary basic data, available to other Signatories;
- (e) by arranging for inter-laboratory visits and by co-operating in a small-scale exchange of staff in the later stages.

SECTION 3

1. This Memorandum of Understanding will take effect for three years upon signature by at least five Signatories. This Memorandum of Understanding may expire on the entry into force of an agreement between the European Communities and the non-Community COST member countries having the same aim as that of the present Memorandum of Understanding. This change in the rules governing the project is subject to the prior agreement of the Management Committee referred to in Annex 1.
2. This Memorandum of Understanding may be amended in writing at any time by arrangement between the Signatories.

3. A Signatory which intends, for any reason whatsoever, to terminate its participation in the Action will notify the secretary-general of the Council of the European Union of its intention as soon as possible, preferably not later than three months beforehand.
4. If at any time the number of Signatories falls below five, the Management Committee referred to in Annex 1 will examine the situation which has arisen and consider whether or not this Memorandum of Understanding should be terminated by decision of the Signatories.

SECTION 4

1. This Memorandum of Understanding will, for a period of six months from the date of the first signing, remain open for signing, by the Governments of the countries which are members of the COST framework and also by the European Communities.

The Governments referred to in the first subparagraph and the European Communities may take part in the Action on a provisional basis during the abovementioned period even though they may not have signed this Memorandum of Understanding.

2. After this period of six months has elapsed, application to sign this Memorandum of Understanding from the Governments referred to in paragraph 1 or from the European Communities will be decided upon by the Management Committee referred to in Annex 1, which may attach special conditions thereto.
3. Any Signatory may designate one or more competent public authorities or bodies to act on its behalf, in respect of the implementation of the Action.

SECTION 5

This Memorandum of Understanding is of an exclusively recommendatory nature. It will not create any binding legal effect in public international law.

SECTION 6

1. The secretary-general of the Council of the European Union will inform all Signatories of the signing dates and the date of entry into effect of this Memorandum of Understanding, and will forward to them all notices which he has received under this Memorandum of Understanding.
2. This Memorandum of Understanding will be deposited with the General Secretariat of the Council of the European Union. The secretary-general will transmit a certified copy to each of the Signatories.

Geschehen zu Brüssel am vierzehnten September neunzehnhundertvierundneunzig.

Done at Brussels on the fourteenth day of September in the year one thousand nine hundred and ninety-four.

Fait à Bruxelles, le quatorze septembre mil neuf cent quatre-vingt-quatorze.

For regeringen for Kongeriget Danmark

A handwritten signature in black ink, appearing to read 'Poul Schlüter', with a long horizontal stroke extending to the right.

Für die Regierung der Bundesrepublik Deutschland

A handwritten signature in black ink, appearing to read 'Genscher', with a long horizontal stroke extending to the right.

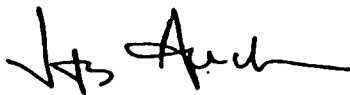
Per il Governo della Repubblica italiana

A handwritten signature in black ink, appearing to read 'Amintore Fanfani', with a long horizontal stroke extending to the right.

Voor de Regering van het Koninkrijk der Nederlanden

A handwritten signature in black ink, appearing to read 'B. R. Sm.', with a long horizontal stroke extending to the right.

For the Government of the Kingdom of Sweden

A handwritten signature in black ink, appearing to read 'Ingvar Carlsson', with a long horizontal stroke extending to the right.

CO-ORDINATION OF THE ACTION

CHAPTER 1

1. A Management Committee (hereinafter referred to as "the Committee") will be set up, composed of not more than two representatives of each Signatory. Each representative may be accompanied by such experts or advisers as he or she may need.

The Governments of the countries which are members of the COST framework and the European Communities may, in accordance with the second subparagraph of Section 40) of the Memorandum of Understanding, participate in the work of the Committee before becoming Signatories to the Memorandum without however, having the right to vote.

When the European Communities are not a Signatory to the Memorandum of Understanding, a representative of the Commission of the European Communities may attend Committee meetings as an observer.

2. The Committee will be responsible for co-ordinating the Action and, in particular, for making the necessary arrangements for:
 - (a) the choice of research topics on the basis of those provided for in Annex 11 including any modifications submitted to Signatories by the competent public authorities or bodies; any proposed changes to the Action framework will be referred for an opinion to the COST Technical Committee on Transport;
 - (b) advising on the direction which work should take;
 - (c) drawing up detailed plans and defining methods for the different phases of execution of the Action;
 - (d) co-ordinating the contributions referred to in subparagraph (c) of Section 2 of the Memorandum of Understanding;

- (e) keeping abreast of the research being done in the territory of the Signatories and in other countries;
 - (f) liaising with appropriate international bodies;
 - (g) exchanging research results amongst the Signatories to the extent compatible with adequate safeguards for the interests of Signatories, their competent public authorities or bodies and research contractors in respect of industrial property rights and commercially confidential material;
 - (h) drawing up the annual interim reports and the final report to be submitted to the Signatories and circulated as appropriate;
 - (i) dealing with any problem which may arise out of the execution of the Action, including those relating to possible special conditions to be attached to accession to the Memorandum of Understanding in the case of applications submitted more than six months after the date of the first signing.
- 3. The Committee will establish its rules of procedure.
 - 4. The Secretariat of the Committee will be provided at the invitation of the Signatories by either the Commission of the European Communities or one of the Signatory States.

CHAPTER II

- 1. Signatories will invite public research establishments or research contractors in their territories to submit proposals for research work to their respective competent public authorities or bodies. Proposals accepted under this procedure will be submitted to the Committee.
- 2. Signatories will request public research establishments or research contractors, before the Committee takes any decision on a proposal, to submit to the public authorities or bodies referred to in paragraph 1 notification of previous

commitments and industrial property rights which they consider might preclude or hinder the execution of the Actions of the Signatories.

CHAPTER III

1. Signatories will request their public research establishments or research contractors to submit periodical progress reports and a final report.
2. The progress reports will be distributed to the Signatories only through their representatives on the Committee. The Signatories will treat these progress reports as confidential and will not use them for purposes other than research work. In order to assess better the final data on the Action, the Signatory States are invited, for the preparation of the final report, to state the approximate level of spending at national level arising from their involvement in the said Action. The final report on the results obtained will have much wider circulation, covering at least the Signatories' public research establishments or research contractors concerned.

CHAPTER IV

1. In order to facilitate the exchange of results referred to in Chapter 1, paragraph 2(g), and subject to national law, Signatories intend to ensure, through the inclusion of appropriate terms in research contracts, that the owners of industrial property rights and technical information resulting from work carried out in implementation of that part of the Action assigned to them under Annex 11 (hereinafter referred to as *the research results') will be under an obligation, if so requested by another Signatory (hereinafter referred to as the "Applicant Signatory") to supply the research results and to grant to the applicant

Signatory or to a third party nominated by the applicant Signatory a licence to use the research results and such technical know-how incorporated therein as is

necessary for such use if the applicant Signatory requires the granting of a licence for the execution of work in respect of the Action.

Such licences will be granted on fair and reasonable terms having regard to commercial usage.

2. Signatories will, by including appropriate clauses in contracts placed with research contractors, provide for the licence referred to in paragraph 1 to be extended on fair and reasonable terms, having regard to commercial usage, to previous industrial property rights and to prior technical know-how acquired by the research contractor insofar as the research results could not otherwise be used for the purpose referred to in paragraph 1.

Where a research contractor is unable or unwilling to agree to such extension, the Signatory will submit the case to the Committee, before the contract is concluded; thereafter the Committee will state its position on the case, if possible after having consulted the interested parties.

3. Signatories will take any steps necessary to ensure that the fulfilment of the condition laid down in this Chapter will not be affected by any subsequent transfer of rights to ownership of the research results. Any such transfer will be notified to the Committee.
4. If a Signatory terminates its participation in the Action, any rights of use which it has granted, or is obliged to grant, to, or has obtained from, other Signatories in application of the Memorandum of Understanding and concerning work carried out up to the date on which the said Signatory terminates its participation will continue thereafter.
5. The provisions of paragraphs 1 to 4 will continue to apply after the period of operation of the Memorandum of Understanding has expired and will apply to industrial property rights as long as these remain valid, and to unprotected inventions and technical know-how until such time as they pass into the public domain other than through disclosure by the licensee.

GENERAL DESCRIPTION OF THE ACTION

1. Context

It is increasingly recognised that the performance of an economy and the economic and social cohesion of a territory depend heavily on the quality of its transport infrastructure networks.

With regard to goods, the increased splitting up of activities between companies and the logistic integration of the industrial and commercial processes are clearly determined by the transport function in the activity pattern of the companies.

With regard to travellers, changing social patterns generate greater demand for mobility amongst European citizens.

The effective running of the internal market, European integration and the globalisation of trade therefore require a new frame of reference in order to assess the infrastructure networks on both a national and European scale.

However, the European transport infrastructure network is composed of several national networks for each mode of transport. The frameworks of analysis of these

networks are quite often contained within national borders, while those used for the trans-national networks within the framework of the European Commission's work remain modal.

National or European investment priorities are thus established for each mode with the risk of overcapacity because of the competition between transport modes. Moreover the scope for financing the infrastructures remain limited and it has been widely accepted that transport and its infrastructures have a positive socio-economic external impact if account is taken of regional planning but

these may often be deemed negative because of harmful effects on the environment and safety problems.

In parallel, while the definition of infrastructure supply remains modal and to a great extent intra-national, the pattern of demand is changing with the emergence of operators linked to market segments rather than to modes.

The utility of the infrastructures, which are themselves passive, is now increased by a wide variety of "value added" services, by analogy with the telecommunications sector, which co-ordinate and manage an increasingly large proportion of the traffic flow. The operation of these actors referred to as "network operators" (including "freight forwarders" and "logistic suppliers"), are demand driven and no longer exclusively determined by the transport mode.

These considerations suggest the need for integrated transport network strategies based on demand within segments and involving interoperability, interconnection and intermodality.

2. Objectives

Title XI of the Treaty on the European Union, the White Paper for a common transport policy, and the conclusions of the Edinburgh and Copenhagen European Council stress the importance to the European Union of developing a Trans-European transport network that is interconnected, interoperable and intermodal.

To contribute to the achievement of the aims of economic and social European cohesion and of closer ties with the Eastern European countries, the development of integrated transport networks would require the simultaneous development of the telecommunications networks and a redefinition of roles between public authorities (local, national or European) and private actors to encourage great added value from the operation of transport networks for the benefit of both transport operators and the community.

The harmonisation of technical aspects of transport systems and access of third parties to the infrastructure may also be a precondition of such an integration.

The objective of the COST Action 328 are to contribute to a strategic definition of the integration of the Trans-European networks and to stimulate thought on the development of methodologies for the assessment of performance of transport networks and for strategies for their development and/or integration.

The work so far undertaken in this area by the national research bodies and/or commissioned by the international organisations tend naturally to focus on their own author's and country. It is therefore necessary to co-ordinate the research so as to take into account all the strategic integration factors in which each of the countries has a specific interest.

3. Expected advantages

The transport studies and the current assessment methods for the infrastructure networks are primarily based on flow forecasts, drawn up under single-mode supply and per project.

COST Action 328 intends to adopt a new approach by examining, for each major segment of demand, the strategies of the transport actors to make best use of the potential of infrastructure networks. In addition to identifying the major sectors of demand, and classifying the actors and their behaviour, the research project will provide a new practical method of evaluation for the integration of Trans-European transport networks.

This method will use a set of performance indicators and of critical factors of success or failure of the integration of Trans-European networks. It should serve as a basis for identifying the ways in which private and public actors will benefit from the single market in view of the problems posed by competition, complementarity, bottlenecks and pollution of transport.

4. Work programme

The aim of the research is to produce a practical socio-economic methodology of assessing the integration of the Trans-European networks in order to draw operational lessons for the implementation by decision makers of the Integrated Strategic Infrastructure Networks in Europe.

The Action would therefore consist of two partly overlapping and inseparable steps.

1) The design of the evaluation methodology

The first stage will be to identify a set of performance indicators that take account of productivity, spatial cohesion, harmonisation, externalities and yield management. A second stage will be to link these indicators with critical factors of success or failure such as financing problems, institutional matters and the extent of technological compatibility. Particular emphasis will be placed on network operators who drive demand and on their capacity to generate value added. This step will last 12 months.

2) The validation of the evaluation method

In order to test this method and experimental conditions and to make sure of its applicability, it is necessary to apply it to various case studies. Those case studies must check the feasibility of this method for the most complete network configuration possible and must involve the maximum number of countries taking part in the Action.

For those reasons, at least the two following case studies will be carried out:

- North-South rail-road interconnectivity in the case of transalpine freight Transport
- the diversification and integration strategies of transport companies.

The other case studies envisaged but whose implementation will depend on the contributions by each country taking part, are, in particular:

- Rail-Truck Interconnectivity in freight transport Networks in Europe
- Access and use by small and medium-sized enterprises of nodes in European networks
- changing roles of European "tour-operators"
- the integration of peripheral countries networks (including South-Alpine connectivity)
- Assessment and evaluation of interoperability between different modal networks on specific corridor in Europe (including short sea shipping and inland waterways)

This step should last 15 months.

The research project will be based on close scientific co-operation between the experts of the NECTAR network (Network on European Communication and Transport Activity Research) and members of transport research organisations. The work, undertaken in collaboration with the national and/or of transport experts, will be based mainly on documentary information, consultations with experts, interviews with decision-makers, and for the case studies, data collecting and processing.

The participating countries will have to help for providing documents useful for the works, in particular from their own country, for making easier the achievement of the interviews, and for accessing to data, especially in regards with the case studies.

5. Duration

The envisaged duration of the Action is 3 years, allocated as follows:

- 3 months: Drafting of a preliminary report specifying the goals, the actors' typology, the various networks and changes in technical, economic and political context.
- 12 months: Designing the methodology of assessment, preparation of an interim report
- 15 months: Carrying out case studies
- 6 months: Conclusions and lessons drawing-up the final report.

6. Estimated cost

The overall cost of the Action is estimated at ECU 500 000. However it may be adjusted according to the contribution of the participating countries and of the case studies carried out.

MANAGEMENT COMMITTEE MEMBERS

AUSTRIA

Prof. Dr.-Ing K.W. AXHAUSEN
Institut für Strassenbau und Verkehrsplanung
Leopold-Franzens-Universität
Technikerstrasse, 13
A-6020 INNSBRUCK
Tel : 43 512 507.69.02
Fax : 43 512 507.29.06
E-mail : K.W.Axhausen@uibk.ac.at

Prof. Manfred FISCHER
Chair and Head of Department
Vienna University of Economics and Business
Administration
Department of Economic and Social
Geography
Augasse 2-6
A-1090 WIEN
Tel : 43/1.313.36.48.36
Fax : 43/1.31.33.67.03
E-mail : manfred.fischer@wu-wien.ac.at

Dr. Thomas MACOUN
Institute for Traffic Technique and Traffic
Planning
Technical University of Vienna
Gußhaußstraße 30
A-1040 WIEN
Tel : 43/1.588.01.40.07
Fax : 43/1.505.77.19

BELGIUM

Prof. M. BEUTHE
FUCAM
Département Techniques économiques
Chaussée de Binche, 151
B-7000 MONS
Tel : 32/65.32.32.96
Fax : 32/65.31.56.91
E-mail : beuthe@message.fucam.ac.be

Dr. B. JOURQUIN
FUCAM
Groupe "Transport et Mobilité"
Chaussée de Binche, 151
B-7000 MONS
Tel : 32/65.32.32.93
Fax : 32/65.31.56.91
E-mail : jourquin@message.fucam.ac.be

Prof. J. MARCHAL
Université de Liège
Institut de Génie Civil/ANAST
Quai Banning 6, Bât. C2
B-4000 LIEGE
Tel : 32/43.66.92.27
Fax : 32/43.66.91.33

CZECH REPUBLIC

Mr. M. KUBASEK
CDV BRNO
Vinohrady 10
CZ-65992 BRNO
Tel : 420/5 43.21.50.50
Fax : 420/ 5 43.21.12.15

Mr. VANCURA
Transport Research Centre
CDV
Sokolovska, 82
CZ-18000 PRAHA 8
Tel : 420/ 2 2481 73 83
Fax : 420/ 2 2481 83 91
E-mail : cdvp Praha@vol.cz

Mr. VIT SEDHIDUBSKY
Transport Research Centre
CDV
Sokolovska, 82
CZ-18000 PRAHA 8
Tel : 4202/248.173.83
Fax : 4202/248.183.91
E-mail : cdv.praha@vol.cz

DENMARK

Mr. Kent BENTZEN
Man. Director
NTU - Nordisk Transport Udvikling
Rørdalsvej 201
Postboks 8410
DK-9220 AALBORG
Tel : 45/99.30.00.00
Fax : 45/99.30.00.01
E-mail : Ntu-aalborg@ntu.dk

Prof. FLYVBJERG
Aalborg University
Fibigerstraede, 11
DK-9220 AALBORG OEST

Tel : 45/98.15.85.22
Fax : 45/98.15.65.41
E-mail : flyvbjerg@i4.auc.dk

FRANCE

Mr. Jean Louis DEYRIS
Directeur
Technicatome
CE de Saclay
B.P. 17
F-91192 GIF-SUR-YVETTE CEDEX
Tel : 33/1.69.33.80.73
Fax : 33/1.69.33.80.12

Mr. Michel FRYBOURG
Avenue Félix Faure, 108
F-75015 PARIS
Tel : 33/1.45.62.17.32 ou 45.62.87.60
Fax : 33/1.45.63.55.44
E-mail : Frybourg@club-internet.fr

Mr. Michel HOUÉE
SES/DAEI
La Défense
F-92055 PARIS La Défense
Tel : 33/1.40.81.13.57
Fax : 33/1.40.81.17.71

Mr. Christian REYNAUD
INRETS
BP 34
F-94114 ARCUEIL - CEDEX
Tel : 33/1.47.40.72.62
Fax : 33/1.45.47.56.06

Dr. Laura WYNTER
PRISM
Université de Versailles
Avenue des Etats-Unis 45
F-78035 Versailles-Cedex
Tel : 33 1 39.25.43.38
Fax : 33.1 39.25.40.57
E-mail : laura@prism.uvsq.fr

GERMANY

Mr. Christian HEY
EURES - Institut für regionale Studien in
Europa
Schleicher Tappeser KG
Basler Straße 19
D-79100 FREIBURG
Tel : 49/761.70.44.10
Fax : 49/761.704.41.44

Prof. Jan KOWALSKI
Universität Karlsruhe
Inst. für Wirtschaftspolitik und Wirtschaftsforschung
Kollegium am Schloß, Bau IV
D-76128 KARLSRUHE
Tel : 49/721.608.30.75
Fax : 49/721.60.73.76
E-mail : kowalski@iwwhp01.wiwi.uni-karlsruhe.de

Mrs. VERON
Umweltbundesamt Berlin
Bismarkplatz 1
D-14193 BERLIN
Tel : 49/30.89.03.24.06
Fax : 49/30.89.03.22.85

GREECE

Dr. Kostas BITHAS
Parnithos, 56
GR-11364 ATHENS
Tel : 30 1 86.28.915
Fax : 30 1 92.48.781

Dr. S. PAPADIMITRIOU
University of Piraeus
Department of Maritime Studies
40 Karaoli & Dimitriou Str.
GR-18532 PIRAEUS
Tel : 30/1.412.07.51 Ext. 159
Fax : 30/1.412.58.08 or 417.90.64

Dr. E. THALASSINOS
University of Piraeus
Department of Maritime Studies
80 Karaoli & Dimitriou Str.
GR-18534 PIRAEUS
Tel : 30/1.413.17.93 or 412.00.64
Fax : 30/1.417.90.64

IRELAND

Prof. James A. CROWLEY
University College Dublin
Transport Policy Research
Belfield
IRL- DUBLIN 4
Tel : 353/1.706.88.20
Fax : 353/1.706.89.54
E-mail : jcrowley@ucd.ie

ITALY

Ms. Simona BOLIS
Università di Bologna
Dipartimento di Scienze Economiche
Piazza scaravilli, 2
I-40126 BOLOGNA
Tel : 39 35.79.46.13
Fax : 39 35.79.20.11

Prof. Aura REGGIANI
Università di Bologna
Dipartimento di Scienze Economiche
Piazza Scaravilli, 2
I-40126 BOLOGNA
Tel : 39/2.26.68.00.93
Fax : 39/51.22.19.68 ou 39 2 706.37.081
E-mail : reggiani@economia.unibo.it

Mr. Fabio ROSSERA
IRE
Stabile Torretta
I-6501 BELLINZMA
Tel : 41 805.35.011.05
Fax :
E-mail : frossera@guest.cscs.ch

Ing. Pietro SPIRITO
Ferrovie dello Stato S.P.A.
Area Trasporto
Pzza Croce Rossa 1
I-00161 ROMA
Tel : 39/6.854.32.52
Fax : 39/6.84.90.51.59

NORWAY

Mr. Arild HERVIK
Molde College
P.O. BOx 308
N-6401 MOLDE
Tel : 47/71.21.41.00
Fax : 47/71.21.42.99

PORTUGAL

Mrs. Maria FORTUNATA DOURADO
Junta Autónoma de Estradas
Praça de Portagem
P-2800 ALMADA
Tel : 351/1.294.74.15
Fax : 351/1.294.02.34
E-mail : jae.gpp@mail.telepac.pt

Mrs. Maria Carlota SALES HENRIQUES
Junta Autonoma de Estradas
Gabinete de Planeamento e Programação
Praça de Portagem
P-2800 ALMADA
Tel : 351/1.295.80.40
Fax : 351/1.294.02.34

SLOVENIA

Dr. Ing. Milan JANIC
ALFA SP FORWARDING AGENCY
Gregorjeva 9
SI-1000 LJUBLJANA
Tel : 386/61.125.64.09
Fax : 386/61.140.41.55
E-mail : milan.janic@siol.net

Mr. Miroslav JELASKA
Consultant
Institute for Process Automation
Stegne 21
P.O.B 65
SI-1000 LJUBLJANA
Tel : 386/61.151.13.31
Fax : 386/61.151.14.13
E-mail : miroslav.jelaska@guest.arnes.si

Mr. Vital SEVER
Chief research
Prometni Institut
Institute of Transportation
Kolodvorska 11
SI-61000 LJUBLJANA
Tel : 386/61.32.12.68
Fax : 386/61.31.92.77

SPAIN

Mr. Ramon CONSTANTINO GONZALEZ
Environment, Transport & Planning
General Pardiñas, 112bis -1er-A
E-28006 MADRID
Tel : 34/91.411.23.11
Fax : 34/91.563.27.99

Mr. Carlos GARCIA SUAREZ
Environment, Transport & Planning
General Pardiñas, 112bis -1er-A
E-28006 MADRID
Tel : 34/91.411.23.11
Fax : 34/91.563.27.99

Mrs. Julia PEREZ-CEREZO
Environment, Transport & Planning
General Pardiñas, 112bis -1er-A
E-28006 MADRID
Tel : 34/91.411.23.11
Fax : 34/91.563.27.99
E-mail : environment@servicom.es

Mr. Aniceto ZARAGOZA
Asociación Española de la Carretera
Goya 23, 4º Dcha
E-28001 MADRID
Tel : 34/91.577.99.72
Fax : 34/91.576.65.22

SUOMI FINLAND

Dr. Veli HIMANEN
V. T. T.
P. O. Box 1902
FIN-02044 VTT
Tel : 358/9.456.45.98
Fax : 358/9.46.48.50
E-mail : veli.himanen@vtt.fi

Mr. Heli KOSKI
University of Oulu
P.O. Box 111
FIN-90571 OULU
Tel : 358/815.532.916
Fax : 358/815.532.906
E-mail : hkoski@cc.oulu.fi

Mrs. Rita PIIRAINEN
Ministry of Transport and Communications
P. O. Box 235
FIN-00131 HELSINKI
Tel : 358/9.160.26.39
Fax : 358/9.160.25.93

Mrs. Nina RAITANEN
Ministry of Transport and Communications
P. O. Box 235
FIN-00131 HELSINKI
Tel : 358/9.160.26.39
Fax : 358/9.160.25.93

SWEDEN

Prof. Jan Owen JANSSON
Linköping University
Department of Management and Economics
S-581 83 LINKÖPING
Tel : 46/13.28.15.65
Fax : 46/13.28.18.73

SWITZERLAND

Dr. R. MAGGI
Università della Svizzera italiana
Centrocivico
Via Ospedale, 13
CH-6900 LUGANO
Tel : 41/91 912.46.46
Fax : 41/91 912.46.47
E-mail : Rico.Maggi@eco.usi.ti-edu.ch

Mr. Markus MAIBACH
INFRAS
Consultants for Environmental Economics and
Policies
Rieterstrasse, 18
CH-8002 ZÜRICH
Tel : 41 1 202.93.14
Fax : 41 1 202.33.65
E-mail : zuerich@infras.ch

Mr. Francis PERRET
Professeur
Institute of Transportation
Département Génie Civil
CH-1015 LAUSANNE
Tel : 41/21.693.24.65
Fax : 41/21.693.50.60

Mr. Bryan A. STONE
Intermodal Transportation Consultant
Gempenweg, 20
CH-4107 ETTINGEN
Tel : 41 61 721.38.25
Fax : 41 61 721.38.25
E-mail : stone@eye.ch

THE NETHERLANDS

Prof. Peter NIJKAMP
Free University of Amsterdam
Department of Economics
De Boelelaan 1105
NL-1081 HV AMSTERDAM
Tel : 31/20.444.60.91
Fax : 31/20.444.60.04
E-mail : pnijkamp@econ.vu.nl

UNITED KINGDOM

Prof. David BANISTER
The Bartlett
University College London
22 Gordon Street
GB- LONDON WC1H 0QB
Tel : 44/171.380.74.56
Fax : 44/171.380.75.02
E-mail : d.banister@ucl.ac.uk

Professor Harry T. DIMITRIOU
The Bartlett School of Planning
22 Gordon Street
London
WC1H 0QB
Tel : 44/171-380-7456.
Fax : 44/171-380-7502.
e-mail h.dimitriou@ucl.ac.uk

Prof. R. W. VICKERMAN
University of Kent at Canterbury
Centre for European, Regional and Transport
Economics
Keynes College - The University
GB- CANTERBURY, KENT CT2 7NP
Tel : 44/1227.82.34.95
Fax : 44/1227.82.77.84
E-mail : r.w.vickerman@ukc.ac.uk

Mr. Dan GREENWOOD
DG VII.C.4.
BU33 5/5
Tel : 32/2.296.84.80
Fax : 32/2.296.90.67
E-mail : dan.greenwood@dg7.cec.be

Mr. Keith KEEN
DG VII.E.2.
BU31 5/40
Tel : 32/2.296.34.69
Fax : 32/2.296.83.50
E-mail : keith.keen@dg7.cec.be

EUROPEAN COMMISSION

Mrs. Maria ALFAYATE
DG VII.E.2.
BU31 5/34
Tel : 32/2.296.82.50
Fax : 32/2.296.37.65
E-mail : maria.alfayate@dg7.cec.be

Mr. Fernando ARAGON MORALES
VII.D.4.
BU33 3/56
Tel : 32/2.296.84.83
Fax : 32/2.295.65.04
E-mail : fernando.aragon-morales@dg7.cec.be

Mr. Alfonso GONZALEZ FINAT
DG VII.A.3.
BU33 3/35
Tel : 32/2.296.82.87
Fax : 32/2.295.65.04
E-mail : alfonso.gonzalez-finat@dg7.cec.be

COST TRANSPORT OVERVIEW

COST Transport is one of 17 domains existing in COST at the present time.

It was to be one of the seven areas seen as best suited for this new form of collaboration, which was officially set up by a Ministerial Conference in November 1971.

The Transport area lends itself particularly well to the COST framework, both because it combines aspects from a number of disciplines, and because of the need for harmonisation at European level. Liaison with the Transport Ministries and Administrations in the various countries is a key element of these COST Actions.

The COST Transport Secretariat is located within the Directorate General for Transport of the European Commission. The location with the staff managing the Fourth Framework Transport RTD Programme, as well as the proximity with the Common Transport Policy Directorates, enables close collaboration between Transport Research activities and serves as a basis for further political action.

COST Transport Actions are authorised and supervised by the COST Technical Committee on Transport which, in turn, reports to the COST Committee of Senior Officials. Both of these decision-making bodies comprise representatives of the national governments of the COST countries.

By the end of September 1998, the COST Transport domain comprised 14 ongoing Actions, with a total estimated cost of ECU 30 Million. 26 Actions have been completed, and a further 8 Actions have been selected by the COST Technical Committee on Transport and are under preparation.

Actions Underway

COST 319:	Estimation of pollutant emissions from transport
COST 323:	Weigh in motion of road vehicles
COST 326:	Electronic marine chart display
COST 327:	Motorcycle safety helmets
COST 328:	Integrated Strategic Infrastructure Networks in Europe
COST 329:	Models for traffic and safety development and interventions
COST 331:	Requirements for pavement markings
COST 332:	Transport and Land-Use policies
COST 333:	Development of new bituminous pavement design method
COST 334:	Effects of wide single tyres and dual tyres
COST 335:	Passengers accessibility of heavy rail systems
COST 336:	Falling weight deflectometer
COST 337:	Unbound granular materials for road pavements
COST 339:	Small containers

Actions in preparation

- COST 338: Information overload in the field of traffic signs
- COST 340: Towards an intermodal transport network: Lessons from history
- COST 341: Habitat fragmentation due to transportation infrastructure
- COST 342: Parking policy : Effects on Mobility and the Local Economy
- COST 343: Reduction in Road Closures by Improved Maintenance Procedures
- COST 344: Improvements to Snow and Ice Control on European Roads
- COST 345: Procedures Required for Assessing Highway Structures
- COST 346: Instantaneous Energy Consumption and Emissions of Road Vehicles, especially of Heavy Duty Vehicles

Completed Actions

- COST 30: Electronic aids to traffic on major roads
- COST 30 bis: Same aim as COST 30 but with demonstration action
- COST 33: Forward study of passenger transport requirements between major European conurbations
- COST 301: Shore based marine navigation aid systems
- COST 302: Technical & economic conditions of the utilization of electric road vehicles in Europe
- COST 303: Technical and economic evaluation of dual-mode trolleybus national programmes
- COST 304: Alternative fuels for road vehicles
- COST 305: Data system for the study of demand for interregional passenger transport
- COST 306: Automatic transmission of data relating to transport
- COST 307: Rational use of energy in interregional transport
- COST 308: Maintenance of ships
- COST 309: Road weather conditions
- COST 310: Freight transport logistics
- COST 311: Simulation of maritime traffic
- COST 312: Effects of the Channel Tunnel on traffic flows
- COST 313: Socio-economic cost of road accidents
- COST 314: Express delivery services
- COST 315: Large containers
- COST 317: Socio-economic effects of the Channel Tunnel
- COST 318: Interactions between high speed rail and air passenger transport
- COST 320: Effects of E.D.I. on transport
- COST 321: Urban goods transport
- COST 322: Low Floor Buses
- COST 324: Long term performance of road pavements
- COST 325: New pavement monitoring equipment and methods
- COST 330: Teleinformatics links between ports and their partners

Up to date information on COST Transport can be found on the World Wide Web, at the following address: <http://www.cordis.lu/COST-Transport/home.html>

European Commission

EUR 18165 - COST 328 - Integrated Strategic Infrastructure Networks in Europe

Luxembourg : Office for Official Publications of the European Communities

1998 - 111 p. - 17,5 x 25,0 cm

ISBN 92-828-4573-7

Price (excluding VAT) in Luxembourg: ECU 7

Contributing to a strategic definition of the integration of the Trans-European networks and stimulating the development of methodologies for the assessment of performances of transport networks and for strategies for their development and/or integration.

This very ambitious objective brought together 17 countries: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, The Netherlands, Portugal, Slovenia, Spain, Sweden, Switzerland and the United Kingdom into COST 328.

One part of the COST 328 research has been to concentrate on the necessary components of the evaluation process that includes all aspects of the infrastructure. The second main strand of research has been to examine these processes in more detail through specific case studies in the four COST 328 working groups. In this Final Report the main findings are brought together.

