TOPIC 28
GLOBALISATION
ISSUES

THE NEED FOR AN ASSESSMENT METHODOLOGY IN THE EMERGING EUROPEAN NETWORK ECONOMY

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Abstract

The single market in Europe and the North American Free Trade Association (NAFTA) will promote trans-boarder traffic. GATT will boost international trade and transport infrastructure has to be upgraded to meet globalisation issues, but the possibilities of financing the infrastructures remain limited and public funds are scarce. A new frame of reference seems necessary for the assessment of infrastructure networks on a continental scale.

THE EUROPEAN SCENE

Transportation fulfils a key role in modern societies. It does not only offer services to road users, but also to many other actors: public authorities, network operators, industry and society at large. In the same vein, transport is assuming a central role in the new European force field. The context and nature of European trade and transport is entering a new era. In recent years, Europe offers a scene with profound changes: integration of the EU market, disintegration of various nation states, and more openness between all countries and regions in Europe (including Central and East-Europe). From a global perspective, traditional patterns of competition—within national borders—are increasingly being replaced by vigorous competition on a multi-national and even worldwide scale. "Intra-country" competition is being replaced by "inter-trade-block" competition, since traditional boundaries disappear. This phenomenon takes already clearly place in Europe and will take place in other parts of the world as well. Countries within such trade-blocks are becoming part of an economic *network* with often *European* or even *global* dimensions. To maximize the competitiveness of such a network, and thereby to maximize its socio-economic potential and performance, the quality of European infrastructure is of critical importance, as transport has become an important component of modern production processes, among others because of changes in division of tasks in and between firms (often in different countries) and the logistic integration of business processes (eg horizontal and vertical integration, outsourcing). At the same time, large metropolitan areas appear to become poles of competition in an international context, so that also the quality of a metropolitan network plays a pivotal role.

As a result of globalization and the rapid rise in international interaction and communication, transportation in Europe (both passengers and freight) has grown enormously, especially in recent years. As the supply of infrastructure—for various reasons—followed this trend only in part, existing *infrastructure bottlenecks* have been accentuated. This is a very serious problem, since economic development and infrastructural development have always been strongly interlinked, as is shown by hundreds of years of European history. The full benefits of the foreseen Internal European Market will only be reaped in case of effective (physical and non-physical) infrastructural adjustments in Europe. What is needed in this context, is European—and *not* national—thinking and action in infrastructural policy, based on knowledge of past successes and failures in infrastructural planning and of the future needs of the economy, the people living in Europe and their (increasingly threatened) (natural) environment. Not only in the field of passenger transport, but notably in the field of freight transport, networks in Europe are not performing at a competitive scale. This holds for all *six basic networks*: rail, combined transport, road, inland waterways, airports and seaports.

The above observations demonstrate clearly that the future of a unified Europe will be critically dependent on the functioning of strategic infrastructure networks which are *interconnected* in terms of (1) *integration* between different layers of a network (eg coordination of high speed/long distance networks such as TGV or airplane and lower speed local networks such as light rail or roads), and (2) *intermodality* between different competing or complementary network modalities. In this respect also the quality of *nodal centres* (terminals, stations, urban centres) plays an important role, as well as the frequencies of different types of transport (or carriers) in Europe. These observations clarify the need for research on network cohesiveness in Europe.

In recent years, various European research programmes have been launched which focus on European transport networks and integrated freight transport chains. By way of illustration, we will mention a few of these efforts.

An interesting example is the so-called SCIPIO project which focuses attention on integrated transport on the North-South and East-West axis of the Trans-European network. It adopts a systems approach which aims at evaluating opportunities and limitations of a European intermodal transport strategy, with a particular view on socio-economic, organisational and technological aspects of integrated transport generating synergy.

Another recent EU programme addresses integrated freight transport chains (IFTC) and is part of the new Fourth Framework Programme. It comprises three modules, viz. strategic aspects, information services aspects and technological aspects. It investigates in particular cost-effective strategies in terms of freight delivery, terminal transfer, line haul, distribution and logistics.

Finally, there is the new EU Fourth Framework project on Strategic Research for a Transeuropean Multimodal Network (STRES), which concentrates on socio-economic integrated aspects and impacts of pan-European transport systems and on environmental and technology assessment of transport innovations in these networks. Particular attention is given here to the driving motives of the demand side in terms of mobility, based inter alia on information systems and scenario developments.

This variety in approaches towards the study of European transport networks shows convincingly that—despite the glamour embodied in the three appealing missionary statements for European transport policy, viz. interconnectivity, intermodality and interoperability—it has to be recognized that there is still a long way to go. Although the needs and potentials of a coherent transportation system for both passengers and freight are widely acknowledged, the current practice offers at best examples of project-oriented modal solutions and hardly any successful implementation of an integrated blend of synergetic transport solutions. There is thus a need for a *systems-based assessment and evaluation* approach that regards the European space as a comprehensive window of transportation opportunities which may generate a substantial value added in a competitive global economy.

NEW OPPORTUNITIES FOR ACTORS IN THE TRANSPORT MARKET

The European transport market is not only moving towards a more integrated network, but it is also becoming increasingly liberalized. Unnecessary regulations (eg regarding cabotage or protection of national industries) are more and more removed, while an increase in efficiency is strived for through more competition (eg in the aviation sector). The presence of more competitive—or at least contestable—markets should make transport operators more alert and induce a new situation with a higher service level at lower costs. This means that various new transport operators will play a critical role in the development of a European integrated infrastructure network for freight transport, as they govern the strategies to make networks really integrated.

The role (change) of key actors in all transport networks—connecting localities with a global market—can be represented by way of illustration in the "inter-transport" matrix below. This matrix allows to clarify the integrating potential of networks as carried out by the actors/operators (see Table 1).

Table 1 The Inter-Transport matrix

	Functions of "Inter-actors"		
"Integr-actors"	**Interoperability**	**Interconnectivity**	**Intermodality**
Territorial authorities/ policy makers	• safety norms • environmental standards	• local/regional • national/European	• nodal design • tariff system
Private or (semi-public) operators or organisations	• pre-competitive research	• electronic data interchange (EDI) • integrated terminal or transfer services	• logistic suppliers • value added networks • regulators
Industrialists or technical research community	• (pre-)standardisation • infrastructure technology • vehicle dimensions	• information technology • electronic customs	• just-in-time (JIT) design • transshipment technology

In this matrix *interoperability* refers mainly to operational and technical uniformity which allows actors and operators to use and link various layers or components of a transport network. *Interconnectivity* is in particular concerned with horizontal coordination of and access to networks of a different geographical coverage. Finally, *intermodality* addresses the issue of a sequential use of different transport modes in the chain of transport. The Inter-Transport matrix depicts essentially the integrating capabilities of different competing actors in the context of various ways of generating an added value in combined/coordinated network infrastructures.

The Inter-Transport matrix is a useful vehicle for creating an operational typology of actors, their roles and their limitations in the emerging European network economy. Such a classification would concern both passengers and goods, while also information—as a complement or substitute for physical transport—may be included. For example, for passengers a distinction may be made into high speed business trips, short-range regional or local commuting and social trips, and long-range tourist trips. Similarly, for freight transport we might distinguish between express delivery service, containers, swop bodies, bulk goods (short-range) and bulk goods (long-range) (cf. Hines, 1993).

It should be added that the transport function is increasingly shifting away from a purely physical shipment of goods and persons to a *value added process* through which in each step of the chain new services and economic values are added (for instance, assembly in nodal points, service delivery to train passengers in railway stations). This often implies also a transformation into goods or services of a higher market value. An illustrative example is the modern component assembly industry, where components are produced in low wage or cheap resource countries (primary production) and where the final product is assembled—after many transport activities—as close as possible to the final market (secondary production). It is foreseen that value added logistics will increasingly become a major feature of a modern post-Fordist industrial nation. Consequently, in particular *central nodes* of a transport system tend to become places of strategic importance. As a result, the *quality* of the organization of transport as a material and immaterial process chain through links and nodes is becoming the new competitive feature of modes in a transport system.

For most shippers and passengers *travel costs* and *travel time* are the most important decision criteria for the choice of transport modality from any origin A to any origin B. It is important to note that travel costs depend—apart from distance—mainly on volume as a result of scale advantages in the transport sector. This means that large nodes which attract sufficiently high volumes tend to be more competitive as a result of economies of scale. Besides, travel time depends on distance, speed and frequency (Bayliss 1992; Boneschansker and Van Voort 1995).

The above observations suggest in any case five major driving forces for nodal centres (including mainports) in transport systems:

- the micro-economic interest of the *carrier* (in terms of *profits*)
- the micro-economic interest of the *shipper* (in terms of *transport costs*)
- the meso-economic interest of the broader *region containing the nodal centre* (in terms of *indirect spinoffs* due to new value added activities)
- the environmental-economic interest of the *region at large* (in terms of *external or social costs* of transport activities)
- the *meso/macro-economic* interest of the *supplier of public infrastructure networks* (in terms of efficiency and equity).

This implies that a sustainable development presupposes a balance between these five conflicting considerations of actors at various levels, seen from a long term perspective. The various forces at work can also be represented in a reverse *pyramid of interests* depicting the various force fields from the actors involved (see Figure 1). *Spatial sustainability* presupposes a balanced evolution of the successive layers of these force fields for all actors and users involved, now and in the future. A condition sine qua non for spatial sustainability is the existence of an efficiently operating transport market, in which sustainable transport chains—respecting economic efficiency, social equity and environmental quality—serve to fulfil the customers' wishes. Clearly, there are different network development options in Europe. This also means that various scenarios can be

developed which depict possible futures, based on hypothetical assumptions on anyone of the successive layers and on combinations thereof.

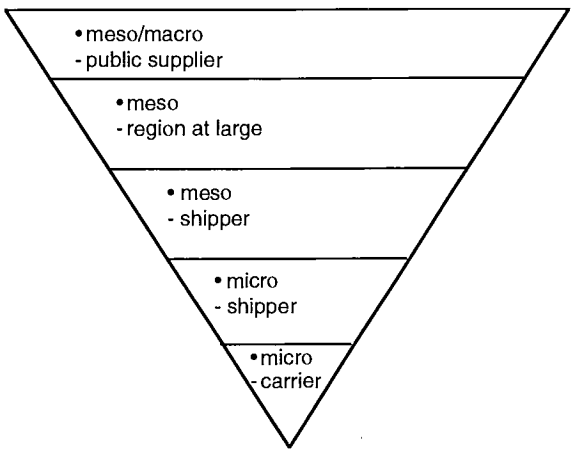

Figure 1 The reverse pyramid of interests in the transport sector

Consequently, a new element to be considered in the current European transport policy scene is the changing role of actors in this field, in both the public domain (eg infrastructure owners or transport authorities) and the private domain (eg freight forwarders or logistics suppliers). A major issue is whether and how transport regulatory policy can be used to create conditions for fair competition, based on a creative division of tasks between public authorities and private actors with the aim to generate added value on using intermodal networks in Europe. This issue is once more important in the light of profound changes in decision processes of freight forwarders, new acquisitions and mergers in the freight industry, and company diversification into non-core business.

TRANSPORTATION AS A SERVICE INDUSTRY

Transport is often regarded as a derived demand. Clearly, this is true in as far as the shipment of goods is necessary to serve the needs of the markets. But at the same time it should be realized that transport is a major industrial sector with its own indigenous target to make money out of physical movement. Thus, transport contributes significantly to GDP as a normal industry creating value added. The main challenge of the transport sector will be the creation of competitive locational conditions for regions, cities and industries to such an extent that they are able to operate at a competitive edge. That is also the main reason why in the commercial sector people are willing to pay for transport and for the use of high quality transport networks.

In light of the strategic importance of networks, it is also clear that the evaluation of investment programmes related to a network should not be based on individual projects, but on the *synergy* created by network operators in an interconnected infrastructure. This means that an infrastructure network is a cohesive set of links (edges) between concentrations of population or economic activity centres (the so-called nodes), which serve to provide all services (transportation, communication) that are necessary for an efficient transport of persons, goods or information between nodes. The assessment and the evaluation of a network should therefore not only take account of the way such a network can be designed and developed but also *operated* (see also EC 1994).

Internationalisation, reflected inter alia in global sourcing, has created interwoven networks of international trading and industrial relations, in which firms in several countries produce different goods and service components of the same final product. In the last two decades, the globalisation and intensified competition in world trade has not only emerged from the liberalisation of trade policies in many countries, but also from major advances in communication, transport and storage technologies. The 'extended' firm—or the network firm—including formal and informal links (merging or partnership) is mainly economic oriented and follows prevailing market forces, but falls short in including and considering environmental effects and socio-cultural impacts. Therefore, it is also necessary to introduce sustainable development criteria.

It is further noteworthy that infrastructure activities which create the most significant and durable benefits in terms of both production and consumption provide a degree of reliability and quality that is desired by *paying users*. Users' charges should be based on economic prices reflecting both costs of supply and demand considerations (willingness to pay) as well as externalities. This means that new policies on network operations should be based on customer's preferences (and not modal interests), user charges and a third party access. This approach is called *unbundling* by the World Bank in its 'World Development Report 1994'. In this context much emphasis is placed on three principles: customer driven, user charges and third party access. Public services are provided through a combination of capital and management. Infrastructure is not only a matter of *investment* (or capital stock), but also a matter of *operation and management*. The weaknesses and deficiencies in the infrastructure sector are inherent in incentives produced by the current institutional and organisational arrangements. Production inefficiency is consequently built into organisations where outputs and inputs are not carefully measured, monitored and managed. Lack of maintenance is intertwined with political and institutional bias toward new investments. Traditionally, the interest in networks was instigated by supply side motives, but it is increasingly recognised that new competitive behaviour of firms in Europe requires to focus much more directly on those actors who coordinate, manage and operate flows in this network. Consequently, much more attention is needed for demand driven activities in the transport sector. But the way towards real value added networks based on *interoperability, interconnectivity* and *integrated chains* is still very long and full of obstacles, as it also requires a focus on competitive actors in the transport market.

Infrastructure has often been managed by means of a *bureaucracy*, not as a *service industry*. This model is characterised by poor accounting for costs, little relationship between revenues and costs or between revenue and service performance, and thus lack of accountability to the ultimate users as the 'customers'. Apart from the poor service quality which has often resulted from this approach, bureaucratic systems of infrastructure provision have given little regard to good management of assets (eg maintenance of roads, bridges, pipelines) which has often undermined their performance. Market instruments should contribute to a greater extent to the provision of infrastructure. Market instruments are here interpreted in the sense of competition and pricing. A commercial orientation (eg awareness of costs) and financial discipline are basic preconditions for the use of these market instruments. In many infrastructure activities, the potential for applying competition and pricing has been enhanced by technological change, which has altered the nature of production and the services themselves.

For infrastructure activities which do not lend themselves to market instruments, other approaches are needed to ensure a satisfactory performance. A corollary of this is that governments must focus on, and perform more effectively, the functions which should remain their responsibility, in particular certain well defined tasks of planning and regulation. The planning and financing of national highways, for example, remains a public responsibility in virtually all countries; on the other hand, many countries have adopted the goal of at least partially privatising national railroads (eg by privatising railway operations).

As a result of various new market forces, the role of *public* (or semi-public) actors is declining and the importance of *private* operators is rising (cf. Widlert 1995). Besides, in a long transport chain, the importance of transport and logistic costs may be rather significant, so that *cost improvement* in the transport sector is a necessary condition for reaping the fruits of an integrated European infrastructure network. This means that there is a need for a fresh look at European transport, in particular since transport chains tend to exhibit complex webs of ramifications and interactions.

This is, for instance, reflected in the dual phenomenon of a simultaneous rise in standard packaging units (containers, pallets etc.) and in specialized handling services (eg fast delivery services). Hub-and-spokes systems, new types of warehousing, just-in-time deliveries and many other phenomena illustrate the rich variety of modalities and configurations that are possible in modern transport activities. It is increasingly realized that the transport chain is increasingly governed by the wishes of the *customer*, so that ultimately the most important driving force in transport operations is executed by those integrators/actors who fulfil to a maximum degree the customers' wishes (in terms of costs, speed, reliability etc) (cf. OECD 1992).

TOWARDS AN ASSESSMENT METHODOLOGY OF SYNERGY IN EUROPEAN NETWORKS

The previous sections have emphasized the potential of properly functioning multi-faceted networks for European integration. Transport is clearly a sector of strategic importance. In view of a pro-active European infrastructure policy that aims at maximizing the performance, and thus the benefits, of interconnected networks for European countries, it is necessary to develop an appropriate analytical framework for assessment and evaluation, based also on a set of meaningful and practical indicators (cf. Nijkamp and Blaas 1994). It makes sense to measure the added value and synergy of a (European) network configuration by means of a benefit criterion which we will indicate here by the general term (network) performance. Here we will assume that the performance of a network is determined by both *quantitative use* indicators related to actual demand (function, fulfilment or use) in relation to capacity and *qualitative structure* characteristics which depict the cohesiveness (or synergy) of a network in terms of modes, regions, interconnectivity etc. From an economic perspective it would be desirable to have a full insight into all costs and benefits (including the distributional implications) of extensions or improvements in network infrastructure. There is a wealth of studies on time savings and monetary evaluations of transportation, but their empirical validity is often questioned, their policy use is usually limited and their transferability to other situations is often very problematic. Therefore, we will in our analysis sketch a rather simple and practical method which might be helpful in a European context to trace the impacts of transportation network changes.

The following assumptions are made on the performance of places on a network as a result of network cohesiveness in the above mentioned qualitative sense:

- the cohesiveness or synergy of a place on a network is higher the larger the number of other places that can be reached from that place (interconnectivity)
- the cohesiveness of a city is higher the more transport modes can be used to reach that place (intermodal flexibility)
- the cohesiveness of a city is lower the higher the average cost to reach all other places (spatial-economic (in)efficiency)
- the cohesiveness of a city is lower the more time it takes on average to reach all other places (geographical (in)accessibility).

A few observations are to be made on the measurement of each of these concepts (see also Bruinsma 1994).

Interconnectivity

This concept may not only measure the number of destinations in reach from city i, but more in particular the number of places that can be reached within a given travel distance (eg 6 hours). Furthermore, rather than taking absolute numbers of destinations one might take the population size or economic activity level of these destinations corrected for distance (following the usual gravity approach).

Intermodal flexibility

This variable refers to the number of modes actually in use for inter-urban freight transport, such as road, rail, air, inland waterways, short and deep sea shipping. If necessary, also capacity indicators like the number of lanes or trucks may be added as adjustment factors for the intermodal flexibility index.

Spatial-economic (in)efficiency

This indicator concerns the average costs (eg tonkm) to reach other destinations with the given intermodal composition. Such costs include all variable and fixed costs charged to the user (including environmental charges). Time costs are separately included in the next item in order to have a distinct indicator for transport time in view of congestion.

Geographical (in)accessibility

This final indicator measures average transport time including congestion. Also a correction for the frequency of the service may be included.

Finally, it should be noted that for the sake of convenience the last two indicators are transformed into benefit indicators (the higher the better), ie for the cost indicators we take the reverse.

It is evident that in general the network performance—as a quantitative use indicator observed at some node of a network—is higher the more the network is used for economic purposes of all actors involved. Clearly, performance can, in principle, be measured in financial-economic terms, but there are also other relevant measures which may be more practical:

- *revealed preference indicators:*
  - number of successful firms
  - new firm formation
  - growth of the city
  - number of visitors
  - (foreign) investments
- *stated preference indicators:*
  - perceived attractiveness
  - willingness to stay
  - expert opinion

In general, it should thus be possible to assess a quantitative indicator P_i for the performance of a city i on a network, relative to all other cities on the network. P_i will thus be higher the higher the actual use D_i of the entire network by actors in city i. This actual use is—given an effective market potential of goods—co-determined by the four above mentioned network cohesiveness (C) factors: interconnectivity (IC), intermodal flexibility (IM), spatial-economic efficiency (SE) and geographical access (GA). These factors can now be depicted in a comprehensive network cohesiveness diagram (see Figure 2). It is evident that a place i has a maximum cohesiveness or network synergy if all four indicators are at their maximum (see dashed lines). A less than maximum cohesiveness will lead to a position somewhere more in the centre of Figure 2 (see dotted line), so that the ratio can be used as a proxy for the actual level of cohesiveness of a city on a network. The position of each node in a transport network can be depicted in this way.

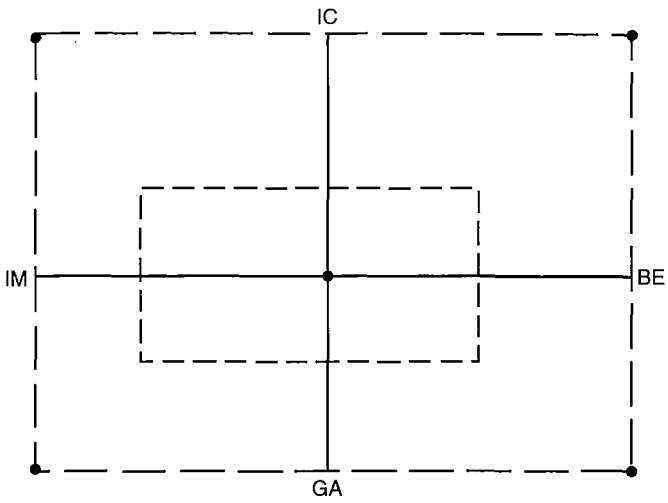

Figure 2 A network cohesiveness diagram

Consequently, we may now imagine a production function for the performance of cities on a network:

$$P_i = f(D_i, C_i) \tag{1}$$

which may lead to the following isoquant (see Figure 3). The backward bending part of the isoquant is a typical inefficiency range of network operations where too high use densities of a network (ie congestion) create diseconomies of scale.

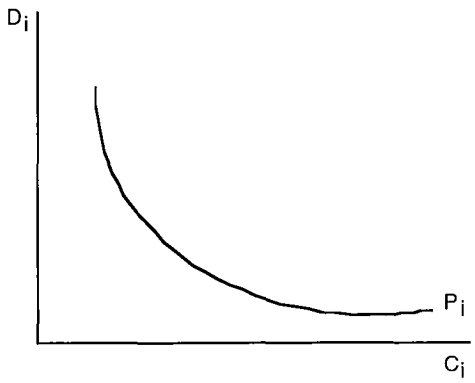

Figure 3 Isoquant for network performance

This approach can also be used to assess the consequences of improvements of a network, not only locally but also internationally (eg in the framework of the European TEN—Trans-European Networks—policy). Improvement and extensions can be introduced as exogenous shocks or as endogenous growth factors in a more general equilibrium setting.

EPILOGUE

Infrastructures serve as the foundation for the durable construction of the "house of Europe", an edifice which sees itself as innovative, dynamic, convivial and fair to all ("growth, competitiveness, employment"), which respects both free enterprise and its citizens' rights, thus protecting the latter and safeguarding the environment but simultaneously encouraging its entrepreneurs who are faced with the globalization of the economy. It is in this respect that infrastructures and public services have a role to play together, because an infrastructure is a passive instrument. It has to be activated by "value added services", the value of which is assessed in the light of objectives which public bodies have set themselves.

The European Union has officially drawn a distinction between the ownership of infrastructures and the activities which use those infrastructures. It is in this respect that Directive 440/91 of the European Commission concerning railways was innovative, because it defined transport activities as the responsibility of operators acting in a competitive field where infrastructures are publicly owned and designed to meet the needs of citizens. While infrastructure policy must usually take account of three geographical levels, viz. the region, the nation and Europe as a whole, by the same token operators must fulfil the needs of their customers and not treat them as undifferentiated and passive users, in particular because a highly diversified demand has to be met in a competitive context.

The European transport and communications network scene is thus showing clear signs of drastic change. To improve the basis for European policy-making in the area of cohesive infrastructure networks which fulfil the EU conditions of interconnectivity, intermodality and interoperability, a research effort has to be made to provide consistent, manageable and applicable guidelines. This paper has made an attempt to provide a more solid contribution to decision-making in European transportation, by focusing on evaluation indicators and methods for improving or expanding European transport networks. By addressing the issue of both efficiency (value added) and cohesiveness of transport operations also a framework for prioritisation has been constructed. It can be used at different scales of policy analysis in Europe. A main feature is that it looks at the transportation scene from the user side (including operators) with a particular view on the strategic importance of nodes that can be reached in a network. Such nodes have been identified here as cities in a European network, but it is clear that in the private sector such nodes may also be terminals and logistic centres. Finally, conditions of spatial-environmental sustainability can also be incorporated in this methodological framework, by conceiving of environmental decay as social costs originating from negative externalities.

Although in the present paper the concepts of added value and (shadow) benefits of geographical accessibility have been placed at the forefront, it ought to be recognized that contextual factors such as logistics development, structure and morphology of the European space-economy and institutional/organisational issues have to be regarded as well. In other words, evaluation methodologies have to be placed in the proper context of practical policy ramifications.

It goes without saying that the above research task is challenging and fraught with many uncertain elements of network policy, and therefore it seems necessary and promising to connect a *scenario analysis* with the above analysis framework in order to bridge the gap between a—sometimes fuzzy—European policy orientation and a too simple technical infrastructure orientation. In the context of a restructuring European economy it seems plausible to distinguish two categories of scenarios, viz. *external* scenarios (eg demography, technology etc.) and *policy* scenarios (eg packages of different policy instruments). Such a scenario experiment would also allow to introduce the different implications of the element of *time* (preparation, construction, implementation and use) in European transport policy. Besides, such scenarios may be helpful to distinguish between various European policy initiatives regarding the TENs (eg technical standardisation, liberalisation of the European transport market). Consequently, this paper contains a difficult research task. It will in particular be the challenge of the COST 328 programme of the EU to fill part of the missing knowledge in the area of integrated European transport network operations.

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