Jérôme VERNY

INRETS
National Institute of Research on Transports and Safety

20 rue Elisée Reclus, BP 317,
59666 VILLENEUVE D'ASCQ cedex
FRANCE
jerome.verny@inrets.fr

THE PROBLEM OF UNCOUPLING BETWEEN FREIGHT TRANSPORT AND ECONOMIC GROWTH

Introduction

Since 1980, carriers and supply chain managers have been compelled to integrate an emergence concept, applicable to all economic sectors and known as "sustainable development" into their growth strategies. This concept appeared to a large public after the diffusion of the World Commission of Environment and Development's report (WCED, 1987). In this report, we find the standard definition for sustainable development : "development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

When applied to transport, durability involves modifying the present development policies. In this paper, we analyze the emergence of the decoupling concept in European transport policy. Afterwards, we go deeper in our thoughts on sustainable transport system through an approach on distances travelled. How spatial organization of industrial activities ought to evolve so as to move towards a supply chain which will lead to more economical transport services ? Distance is the heart of the problem. Stakes consist of preserving the quality of transport services and maintain the economic growth. The aim is to carry shorter distances or to carry differently. So, our hypothesis supposes a link between productive logics, spatial organization and supply chain.

1. The birth of uncoupling concept

<u>From sustainable development to sustainable freight transport</u>

More than one century later, in 1991, the European Conference of Ministers of Transport (ECMT) published a report on the theme of sustainable transport. This international organization proposed a definition which was to become the standard definition (ECMT, 1991). A sustainable transport system must contribute to economic and social welfare without depleting natural resources, destroying the environment or harming human health. The present transport system has contributed to developing international trade and regional development. Nevertheless, the accentuation of unlimited freight transport demand could harm the economy through involuntarily generated external costs (Whitelegg, 1997). External costs are economic costs which are not included in the formation of product prices. For example, we mention different external costs. Noise caused by transport presents a health

concern or serious nuisance effects. The concentration of greenhouse gases goes up especially because of carbon dioxide and to a lesser extend so do Nitrous Oxydes (NOx), Volatil Organic Compounds (VOC) and particulates. Other external costs are road accidents, infrastructure congestion, etc.

In 2003, a French White Paper on energy consumption considered the present transport system to be unsustainable among other economic sectors. In fact, transport does not respond to the objectives of sustainable development (MDI, 2003). The figure 1 confirms this observation which is similar in the European Union. The figure 1 compares different economic sectors by means of a common indicator, Carbon Dioxide. We notice the pre-eminent position of road transport, exceeding public and freight transport, for emissions of greenhouse gas into the atmosphere. A French inter-ministerial committee on sustainable development noted in 2003 that it is necessary to develop a sustainable, efficient and rational transport system (CIDD, 2003).

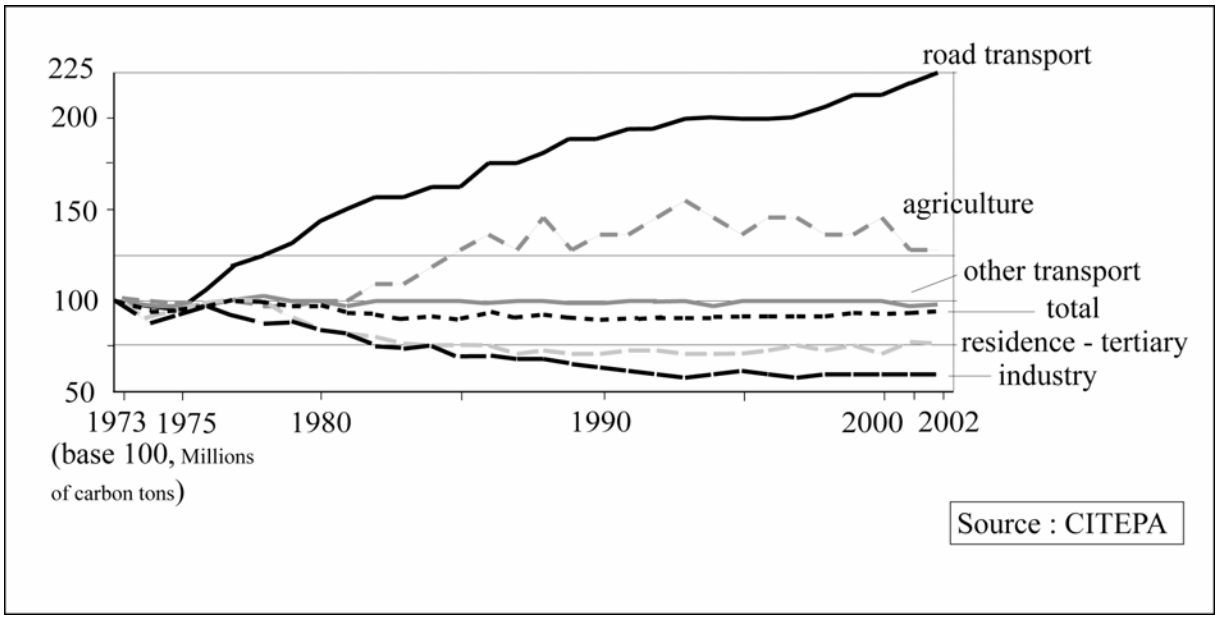

Figure 1. Evolution of CO2 emissions by activity sectors in France between 1970 and 2003

Freight transport demand in the European Union (15)

In the European Union, the growth of external transport costs can be explained through the analysis of the evolution of freight transport demand. The figure 2 represents the evolution from 1970 of all modes of transport, excluding pipelines and air transport, within the first fifteen member countries of the European Union. The indicator is ton-kilometers, used with absolute and relative values. Freight transport demand increased by 4% per year between 1970 and 2000. The figure shows this rise fluctuated between the four modes of transport.

Only road transport and short sea shipping justify the dynamics of European freight transport system. However, the characteristics of these two modes are different. Nevertheless, road and maritime transport have managed to satisfy the continuous and regular growth of freight transport demand since 1970 in the European Union. In 1970, inter-European road freight transport reached 31% of the market share, compared with 35% for short sea shipping. Thirty years later, in 2000, the reverse situation arose. Road transport accounted for 43% of market share and maritime transport 41%. In the interval 1970 – 2000, the positive rate of maritime transport growth appeared inferior to that of road transport which rose to 225%.

However, mostly road transport generates high pressure on the environment. In order to integrate the objectives of sustainable development into transport system, the nuisance effects of road transport have to decrease without modifying the quality of the supply. If this is not so, the reduction of the environmental effects of road transport will disturb economic development.

When we observe the evolution of rail transport and inland waterways (figure 2), we notice performance and service of these modes of transport do not respond to demand. The confirmation of missing suitability between supply and demand justifies the weakness of rail and inland waterways market shares. Between 1970 and 2000, these market shares fell from 30% to less than 15%. This decrease is explained by the atony of rail and inland waterways ton-kilometers achieved in the European Union and also by the rise in road freight transport.

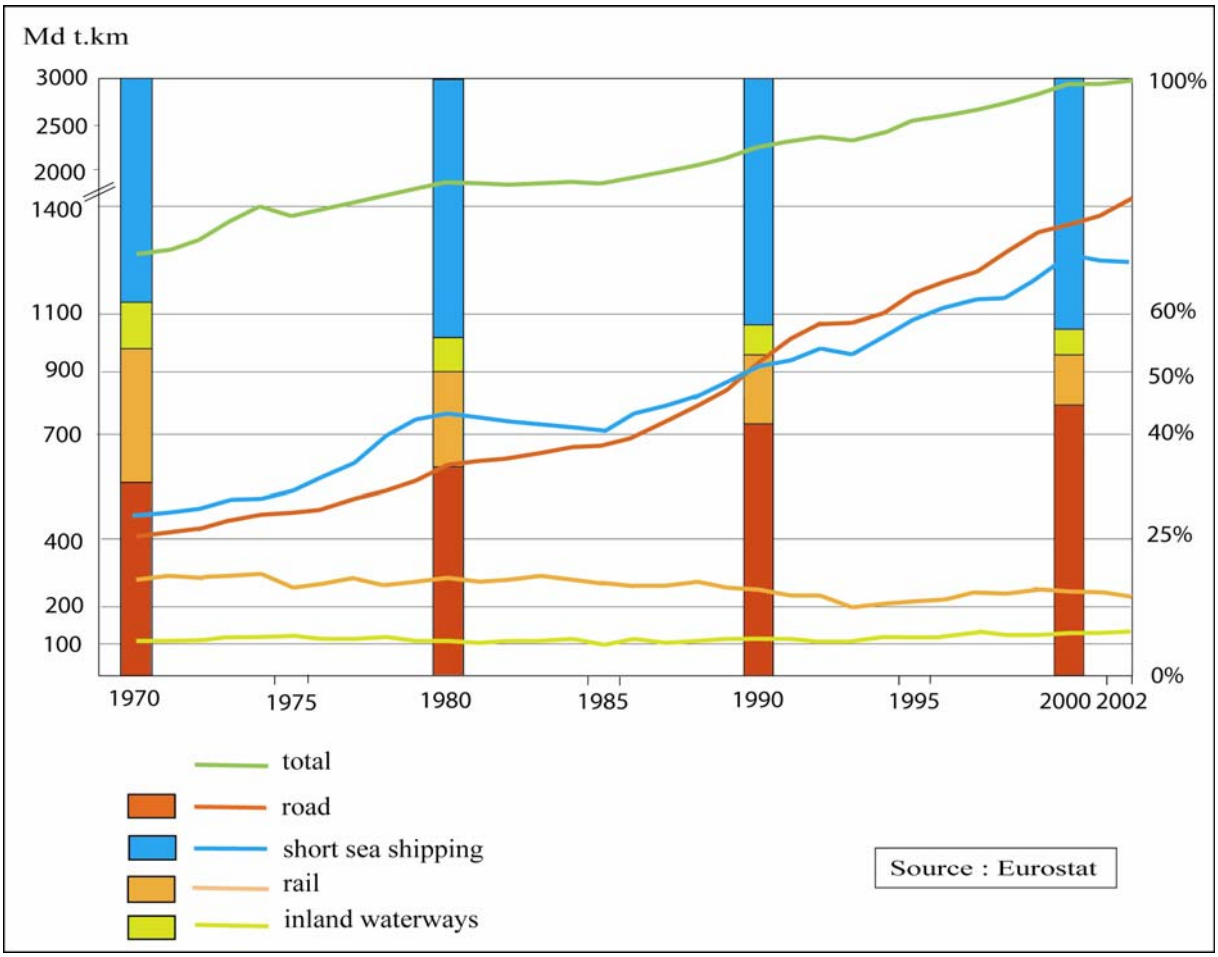

Figure 2. Evolution of modal split of intra-EU (15) flows in t.km, between1970 and 2002

In order to optimize the quantitative approach of freight modal split in Europe, we think it is better to use more than one variable, in the circumstances ton-kilometers. In fact, ton-kilometers is a controversial unit. Tons and value of freight transported offer another viewpoint of the dynamics of European freight transport system. Ton-kilometers show a two-headed transport system, with road transport and short sea shipping. The figure 3 demonstrates the present system is dominated only by road transport when we use value units. Roads are the main modes of transport for carrying light and high value products. Road transport accounts for 45% of ton market share and 70% of value market share. The difference between the figure 2 and the figure 3 is the maritime market share which does not exceed 40% of tons and 23% of value.

The weakness of rail transport and inland waterways is surprising in particular with ton unit. The capacity of a trailer is clearly inferior to that of a goods van, an inland barge or a coaster vessel. Nevertheless, the set-off of road payload is explained by more frequent shipments. We notice alternative modes of transport hold more important ton market shares than value market shares because they can carry low value heavy goods.

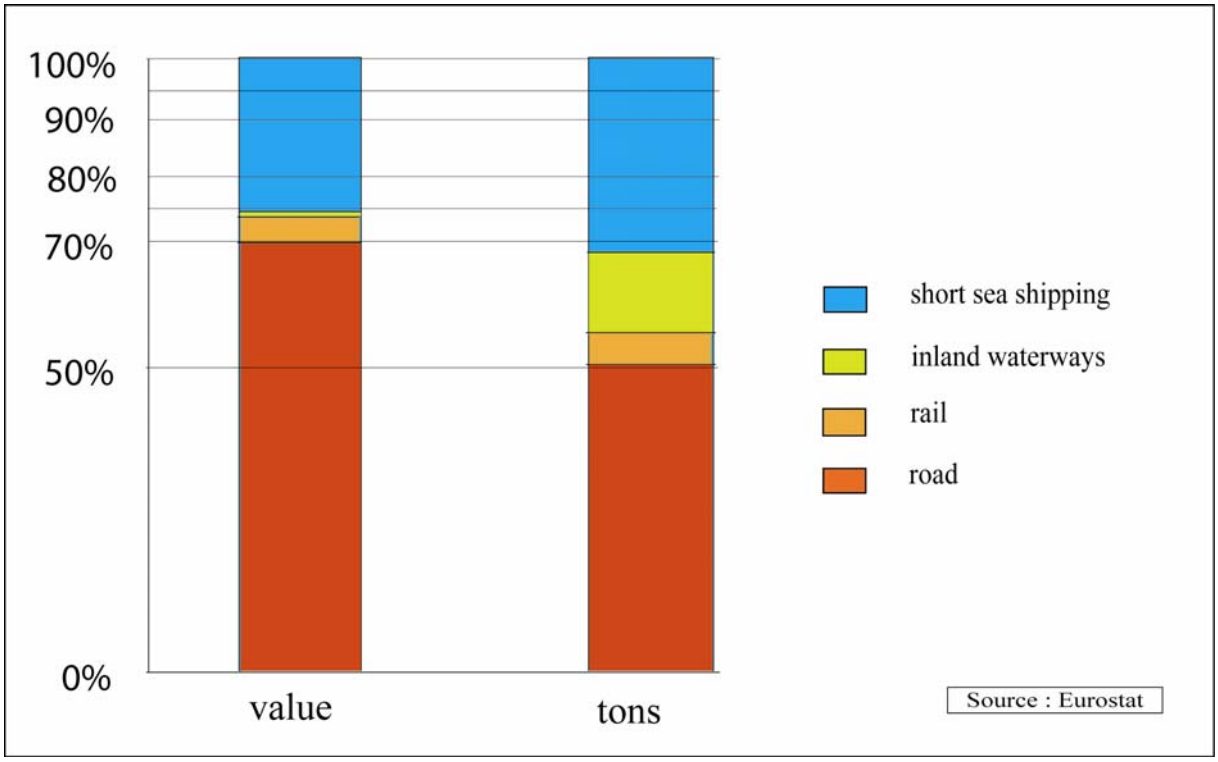

Figure 3. Modal split in EU (15) freight transport : 2000 in value and tons

Stakes for competitive and sustainable mobility

Numerous researchers have taken an interest in the study of environmental problems due to freight transport system. P. Nijkamp and H. Priemus explain that a transport system inflicts too many costs which are difficult to bear on the environment (ECMT, 1993). Hence, the ecological sustainability recommended by the famous Brundtland report (Our common future) is threatened (WCED, 1987). External transport costs have repercussions on social progress as well and these amplify unsustainable land-use planning as the table 1 shows.

Table 1. The variability of transport external effects for different spatial scales

STAKES	Externalities	Local	Regional	National (France)	EU	World -wide
Economy	Economic Development	+	++	++	++	+
Territory	Spatial equity	+	++	++	+	/
	Amenities	--	-	/	/	/
Social	Congestion	--	(-)	/	/	/
	Accidents	-	-	CNSR	-	-
	Use conflicts	--	--	-	-	/

Environment	Atmospheric pollutions	--	-	-	/	/
	Greenhouse effect	/	/	PNLCC	Kyoto	Kyoto
	Noise	--	-	/	/	/
	Division	--	-	-	/	/
	Consumption of a non-renewable resource	/	/	-	--	--
	Sites and ground pollution	--	-	-	/	/
	Waste Production	--	-	/	/	/

CNSR : National Council for Road Safety
PNLCC : National Program against Climate Change

Stakes, targets, decision-making power for sustainable mobility change according to the choice of spatial scale. For example, a traffic jam is one of the social stakes. Additionally, it is one of the numerous nuisance effects of sustainable mobility. Thus, congestion is a negative aspect only on local and regional scales. On a large scale, we find other positive or negative externalities such as the greenhouse effect which benefits from projects like Kyoto protocol or in France the National Program against Climate Change (PNLCC). When taking this report into account, contemporary societies need sustainable mobility. It is necessary to improve knowledge so as to conciliate the decrease of external transport costs and the basic function of transport system in economic growth. Otherwise, all activities which depend on transport will be paralyzed in the medium term.

A real contradiction characterizes freight transport system : society desires much more mobility and fewer nuisance effects simultaneously. The first, corresponds to a “market” logic and the latter to a “citizen” logic. Sustainable mobility sets its heart on conciliating economic growth with land-use planning, social welfare and environmental respect.

2. The decoupling between freight transport demand and economic growth

In Europe, transport geography reflects an intense concentration of population and activities in “Banane Bleue” which stretches from London to Milan via Rotterdam. Sustainable mobility interests high policy instances. In September 2001, the decoupling notion left the narrow world of transport economists to which it had belonged for a few years. The publication of the European Commission’s White Paper « European transport policy for 2010 : time to decide » introduced it to a wider public (CEC, 2001). This perception enables the analysis of underlying freight transport logics and the suggestion of new ideas for reducing nuisance effects.

The coupling between freight transport demand and economic development

The link between the growth of transport and economy is usually handled in literature through a relation of positive transport forces on economy and vice versa. This is the basis of all the works in favour of infrastructure policies (Joignaux, 1997). Recently, another way of considering this relation between transport and the economy has been developed. The representation is focussed on negative incidences resulting from the growth in transport demand. The quantitative approach of the link between transport and the economy is illustrated in figures 4 for the European Union and 5 for France. The data were brought back to their respective values of 1962 and 1970, affected by the index 100. On the whole, the high growth rates of macro-economic indicators reflect the dynamics of the transport sector and economy. However, industrial production seems to have moderate growth.

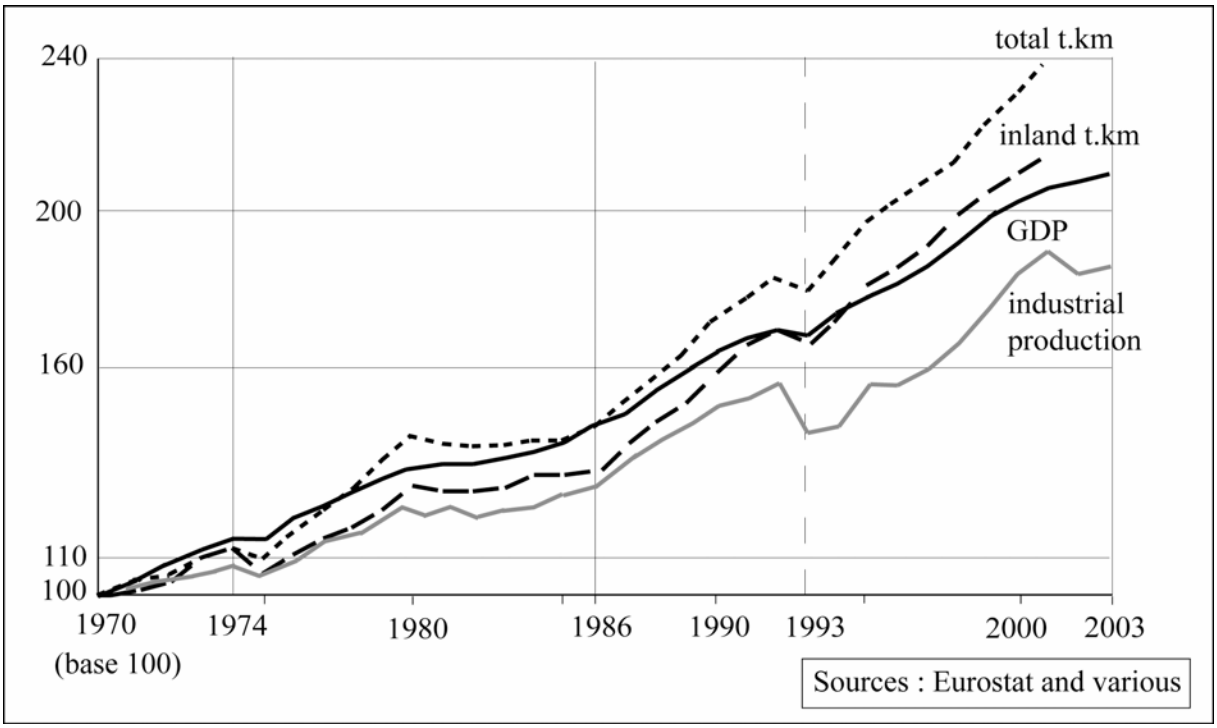

Figure 4. Evolution of transport (t.km) and economy (GDP, industrial production) in EU (15) from 1970 to 2003

For the European Union, we notice the growth of short sea shipping is more important than that of inland modes of transport. Consequently, the total ton-kilometers curve is above that of inland ton-kilometers. For this territory and France, the coefficient of determination R^2 between inland ton-kilometers and GDP is almost 1 (0,99) between 1970 and 2002 or 2003 (France). The relation between freight transport demand and economic activity is intensive and positive in the long term. This observation corroborates the existence of coupling between two indicators, inland ton-kilometers and GDP, in the European Union and France. However, France has an atypical evolution because this country experienced an uncoupling between transport and the economy from 1974 to 1986.

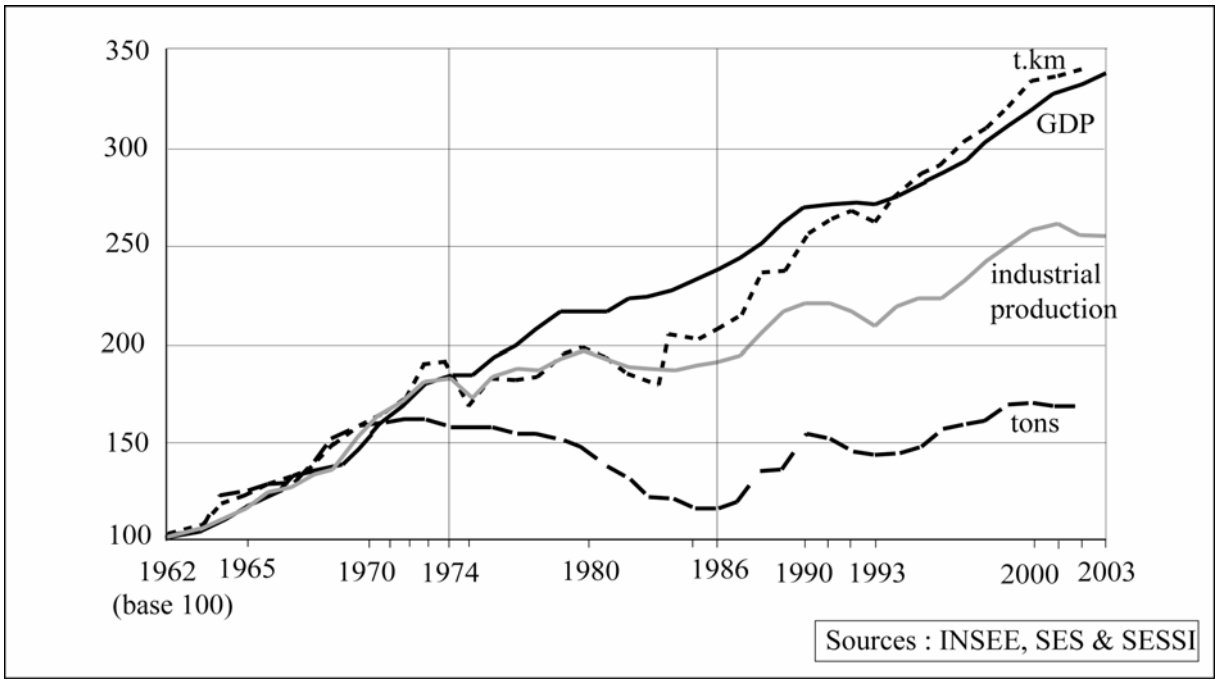

Figure 5. Evolution in France of inland transport demand (t, t.km) and economy (GDP, industrial production) between1962 and 2003

Since 1970, the instability of the international monetary system has been accompanied by a deep impoverishment of indicators such as profitability and productivity of capital (Savy, 1996). The evolution of tonnages, announced in 1970, the crisis which was to occur four years later. 1974 marked a key turning point with the first oil crisis . This event meant the end of the thirty glorious years (1945-1975). The economy of the European members was still industrial. Thus depending especially on the importations of petroleum and refined petroleum products. Faced with these difficulties, we can observe an individual dynamic of each indicator since 1974. The economic system, and more precisely the international industrial system, has changed. This perturbation transformed the transported freight volumes which went down.

The second oil crisis in 1979 did not have a higher impact than the first. However, a new industrial era appeared, generating consistent repercussions on distributive logics. The irregular and unpronounced growth of ton-kilometers between 1974 and 1986 was a result of an increase in distances travelled which offset the decrease in tonnages.

The good economic climate since 1986 has contributed to promoting a rise in transported freight volumes, particularly because of the integration in the European Union of the Iberian peninsula. Yet, the dynamic of GDP is more moderate than that of transport demand. Since 1993, the year of the creation of the single market, the four curves have shown a reinforcement of the link between freight transport demand and economic activity. In figures 4 and 5, the disappearance of borders appears because this destabilized the growth rate of the four variables. But free freight circulation has confirmed the sustained growth of transport demand. At the same time, new production organizations have developed. These have been contributing to promoting the evolution of freight flow structures because of the elaboration of even lighter materials used for products. Moreover, supply and market areas have been widening. Therefore, the link between inland ton-kilometers and GDP has been intensifying since 1986 and even more so since 1993.

Since 2000, the present economic model has become one where less transport is consumed. This supposes an evolution in production and distribution modes which have favoured the rise in transported freight volumes and distances travelled for several decades.

But we do not benefit from a medium-term viewpoint which would enable the validation of this orientation towards a natural uncoupling.

Carrying shorter distances, carrying differently : two approaches of uncoupling

For several decades, the mobility of physical and information goods in public transport has progressed at the same rate or even slightly higher than the rate of economic growth. The metaphor of "coupling" means mobility and economic growth are similar. In 1997, the first studies on this new approach to the link between transport and economy appeared. The European Conference of Ministers of Transport, further to its Twelfth International Symposium on Theory and Practice in Transport Economics, started to improve this concept of coupling. During this symposium, E. Van de Voorde and H. Meersman thought it would be necessary to examine possibilities for going against the future growth of freight transport demand (ECMT, 1997). This communication explicitly questioned the relation between transport demand and the economy. At the same time, the concept of "uncoupling" emerged in literature. The latter was used to qualify the breaking of the link : « *By decoupling we mean a decrease in transport intensity of GDP that will allow the volume of transport to increase at a lower rate than the economy at large* » (Banister & al., 2000). The feasibility of uncoupling is an approach which aims towards sustainable mobility.

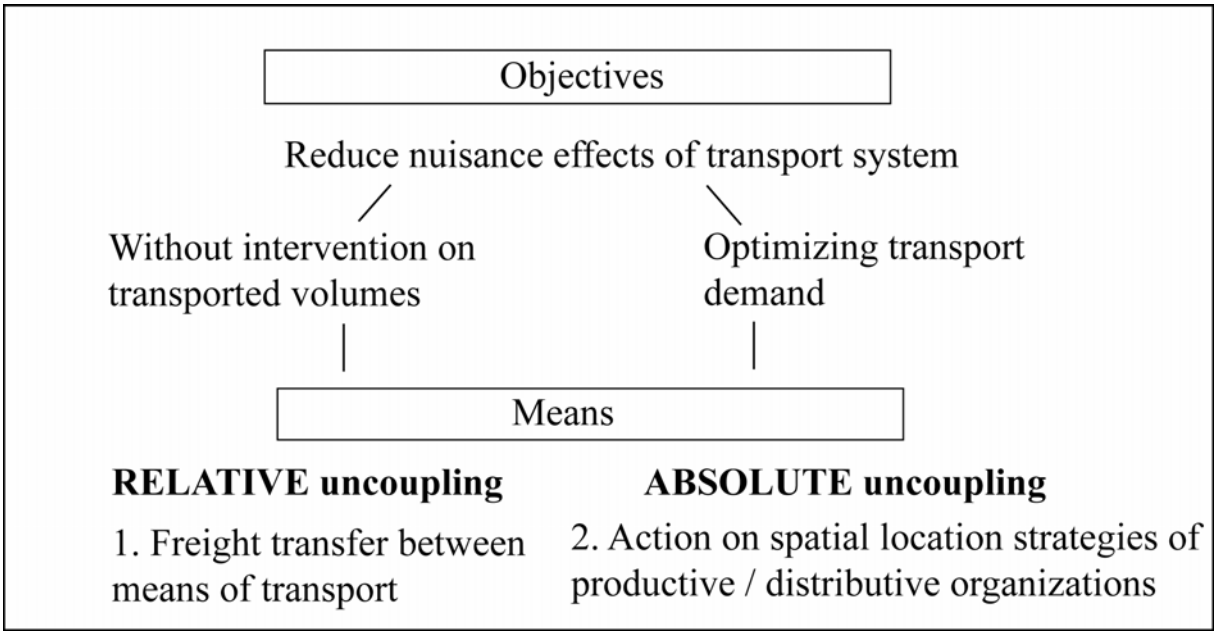

Figure 6. uncoupling economy / freight transport

G. Joignaux and J. Verny have specified the concept of uncoupling (Joignaux and Verny, 2002). They distinguish, in figure 7, two acceptations of uncoupling. The first, referred to as "absolute uncoupling", leads to questioning the spatial organization logics which production and distribution firms obey. These logics determine the location of productive and logistic activities. Hence, they characterize transport demand because of its component of distance in ton-kilometers. In this concept of absolute uncoupling, our attention focuses on the process which generates freight flows. In fact, freight flows are interesting due to spatial dimension because they are defined by lengthening and more frequent shipments. This approach combines information on geographical location and industrial organization. Its aim

is “to carry shorter distances”. This perception of uncoupling was ratified in an official report intended for the French government (DATAR, 2003).

The second meaning is referred to as “relative uncoupling”. This applies to freight transfer between modes of transport (a part of road freight haulage towards alternative modes of transport like rail, inland waterways, short sea shipping). The freight modal split would be obliged to respect the objectives fixed by sustainable development. External costs go down with the same quantity of freight transported. The nuisance effects caused by this new modal split will be reduced due to the decrease in transported freight volumes by road. But in this second approach, distances do not go down. Its goal is “to carry differently”.

3. The determinants of freight transport demand evolution

A geographer can analyze the sustainable mobility concept thanks to hypothetical progress. In this chapter, we have retained an approach by the links between productive and logistic organizations, spatial location of activities and transport system.

Productive and distributive organizations

Internationalization of trade and production is a present trend which is expanding according to the globalization process. Productive organizations are deeply restructured. Their spatial dimension is moving. Former periods have never known such international development. So we use economic globalization in order to evoke this change of production and trade scale.

Since 1970 in the European market and in other world regions, a deep evolution has occurred in the content and structure of freight flows. Industrial processes have become complex due to the transformation of product demand and the incorporation of innovation in products. These new industrial organization forms explain the death of stock economy and the birth of flow economy. The characteristics of the first are gross production, a slightly diversified and with a slow renewal cycle. In the second case, we find personalized products, with a quicker production cycle which enable a more frequent renewal of all products.

Moreover, this evolution participates in the specialization of production units or large regions of production. The aim is to adapt supply to demand with best production costs. So productivity increases, stocks go down. Freight flows must be quick, regular, reactive, respecting delivery times and lower prices. These requirements generate smaller but more frequent freight flows. Tonnage by sending decreases. But we observe the same transported freight volumes. The reduction in the number of production units depends on a new spatial division of labour. Since 1980, productive organization has been participating in transforming the polyvalent production units in modern specialization production sites (figures 7 and 8). We notice the market area of a polyvalent production unit is limited because the same goods are produced by another unit not far away. The consequence is the absence of flows between these two supply chains. The situation varies when a specialization process in the production unit of some products appears. The costumer area widens thanks to a common supply chain between different industrial sites. The new supply chain management needs organizational methods to improve the subcontracting of stock management. These methods transfer stocks and/or management from industrial sites to warehouses, often out of production units, which are more often managed by a provider of logistic services (Joignaux and Kapros, 1996). Logistic subcontracting favours a multiplication of inter-industrial flows. So travelled distances rise further to two geographical movements : dispersion and geographical concentration.

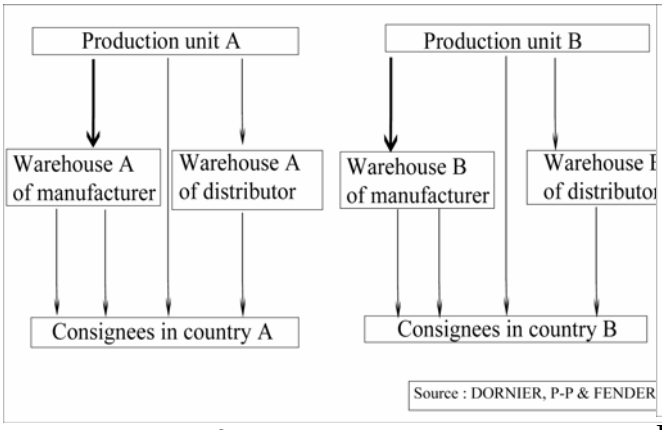

Figure 7. Simplified supply chain (1980's)

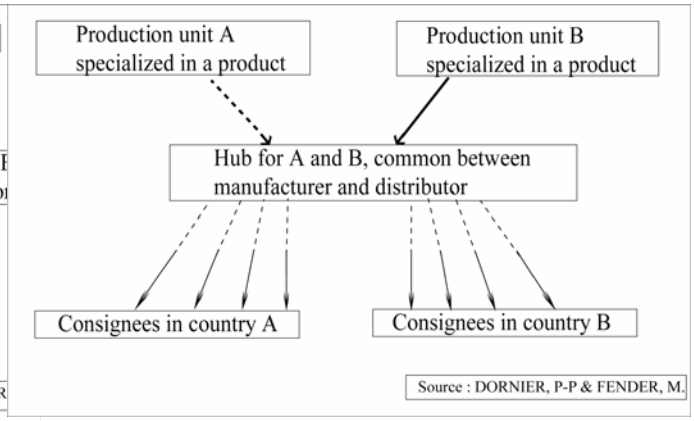

Figure 8. Simplified supply chain (in future)

Spatial organization logics of industrial and distribution activities

The processing of the industrial organization has had an impact on the strategies of location of industrial sites when looking for necessary resources. These transformations have contributed to promoting geographical polarization of industrial and distribution activities. Geographical polarization strengthens the physical proximity between enterprises. Polarization in present modern societies is growing stronger for industrial and distribution activities (Veltz, 1996). This tendency depends on the emergence of organizational proximity which optimizes supply chain effectiveness. Logistic systems are moving towards scope economy (Besson & al., 1988). Agglomeration forces are taking part in a very pronounced single center – periphery structure. So P. Krugman talked about a spatial disparity reinforcement which has an impact on the growth of distances travelled (Krugman and Venables, 1995).

Supply chain

Transport system is a component of supply chain management. For several decades, supply chain management has continued to evolve, becoming more complex. Nature and intensity of freight flows have closely followed this evolution. For example, the growth of transported freight volumes by road depends on the rise of semi-finished or finished products. Some inputs can explain the supply chain modifications : economic globalization, international trade, information and communication technologies, new spatial and organizational structures of industrial sector.

A narrow link exists between productive organization, spatial location and the supply chain (Joignaux and Verny, 2004). The emissions of material flows, from productive or distributive sites, and spatial dynamic of these sites have an impact on logistic organizations. These can disturb transported freight volumes and distances travelled. The understanding of the underlying economic logics could permit a move towards a better supply chain with a reduction in distances travelled. The aim would be to have fewer trucks on the road. The figure 9 is a synthesis of a geographical approach of the determinants of freight transport demand evolution.

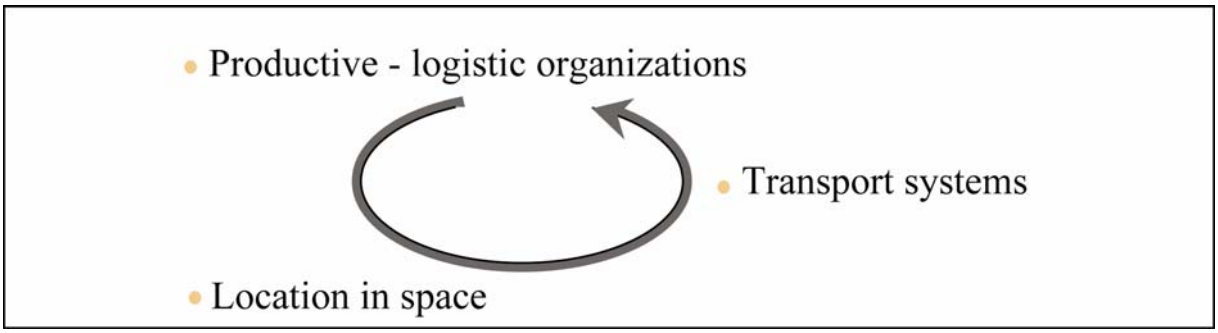

Figure 9. Underlying logics of freight transport demand

4. Distances travelled and location criteria : positive factors towards a sustainable mobility in freight transport ?

Distance is a determinant of transport demand. The evolution of spatial organization logics of industrial and distribution activities generates impact on place (dispersion and geographical concentration) and transported freight volumes (increase). So we can measure a rise in distances travelled (lengthening and increase in sending frequencies). How can we integrate the spatial dimension in the analysis of sustainable mobility ?

The place of transport and logistics in location criteria of industrial and distribution activities

Before the second world war, transport costs were an important determinant in the choice of industrial unit location. But since this period, this function has been subsiding. During the thirty glorious years (1945-1975), the modernization of transport system contributed to a large geographical dispersion of activities location. C. Gachelin talked about a “revolution” (Gachelin, 1977). Several explanations : the greater containerization, the networking infrastructure, the decrease in transport costs, the improvements of quality of services offered by inland, maritime and air transport (high-speed, payload, productivity). The control of technics and the optimization of the supply chain explain the geographical movement of dispersion. In some economic sectors like microcomputing, transport system is becoming a marginal criterion for location of industrial sites. Therefore, we note a collapse of time-space (Tolley and Turton, 1995). Related transport operations like handling charges, storage, insurance, etc., stay important criteria for the location of industrial and distribution sites (Savy, 2000).

Logistics and distances travelled

The integration of space in the sites location strategies results from the evolution of transport system like location criterion. For different scales – local, regional, national, continental or world-wide – the attenuation of transport system in location characteristics has repercussions on the spatial dynamics of industrial structure. Physical distance travelled fades in aid of time-space and cost-space. But the manufacturer and the person in charge of regional development continue to allow a large place for transport system because they know this remains a necessary condition for improving economic activity on a territory. Indeed, the offer of services now is more important than infrastructure or technique of transport. The importance of transport supply, which was before rare, does not participate in land-use

planning. Organizational proximity takes precedence often to the detriment of physical proximity especially due to information and communication technologies.

Now, logistics is becoming more important than transport operation in the choice of industrial and distribution sites location. In fact, manufacturers want to subcontract their related transport operations. So we notice an intensification of the relation between manufacturers and carriers. Carriers become progressively supply chain managers. Now, the competitiveness of firms depends indeed on logistics. Cost, delivery times and quality of service are the three criteria of an efficient supply chain. This one participates in transforming the spatial dynamic of industrial and distribution sites. These thoughts are near those proposed by the fundamental theory of spatial analysis. However, the principal criterion in the firms location strategies is not transport system but logistics.

The works of P. Krugman, M. Fujita and J-F. Thisse (Krugman, 1991a ; Fujita and Thisse, 2002) show the importance of logistics in an economic space which proposes several optimal locations. Physical distance and transport cost become obsolete after the progressive rise of added value on a product. Therefore, each firm wants to enlarge its market area from just one distribution point. The first aim is to minimize transport costs between factory and customer. The second consists of facilitating final production operations like industrial completion, packaging, stock management. The increase in mobility is an opportunity for an industrial site which wants to develop new organizational modes. But this evolution involves new relations with space (Plassard, 2003). Therefore, the result of optimal location, making abstraction of physical distance, contributes to developing a new geographical organization of production in opposition to the objectives of sustainable mobility.

Impacts on territory

Territories are made of places linked by networking (Savy, 1993). The accentuation of logistics in the choice of factory location and the new spatial organization of productive system has repercussions on territory. P. Krugman, one of the initiators of the new economic geography, specifies the evolution of transport and production costs changes the territorial organization scheme as well (Krugman, 1995). These underlying logics partly explain the emergence of the geographical concentration for industrial and distribution activities near the customer market. Spatial concentration of productive system reflects the real attractive power of firms on activities which can be different to theirs. This observation supposes the participation of metropolis in the control of world-wide space thanks to multinational firms which are localized in these metropolis (Wackermann, 1995). However, spatial concentration of industrial and distribution firms moves towards a dispersion of production sites inherent in globalization (Wackermann, 1989). Production sites of multinational firms follow the geographical movement of concentration. But these firms participate in promoting geographical dispersion. Multinational firms take advantage of spatial division of labour and lower transport costs to develop production sites in countries based on their own criteria such as flexible social and environmental legislations or lower salary costs.

The revolution of transport system techniques and the evolution of productive and distributive organizations have promoted organizational proximity. This relativization of physical distance by the new concepts of time-space and cost-space contributes to the emergence of a new industrial and transport geography. Geographical concentration and dispersion involve an increase in distances travelled which justify an intensification of freight transport demand. This transport system is moving away from sustainable development.

5. Conclusions

In the medium or long term, it will be difficult to reverse the process which has permitted the development of geographical concentration and dispersion and increased polyvalence of production unit, harmonization of firms location on territory (spatial equity). Specialization and economy of scales have created irreversibility. We note physical distance and its control is a major component for promoting sustainable mobility in Europe.

But how can we use territory for going further on sustainable freight transport demand ? Is it necessary to consider an optimal management of networks thanks to the control of distribution sites? Do we have room for manoeuvre for reorientating the present logics of optimal location of productive and distributive sites ? In an article with a provocative title « Transport in regional science : « The death of distance » is premature » », P. Rietveld et R. Vickerman show the importance of transport system in the spatial organization in spite of the collapse of time-space and the reduction of cost-space (Rietveld and Vickerman, 2004). Transport system can be used to promote again the optimal location of productive and distributive sites once more without forgetting the reduction in distances travelled.

Bibliography

Banister, D. & al. *European transport policy and sustainable mobility*. Spon press, New York, 2000.

Besson, P. and al. *Gestion de production et transports : vers une nouvelle économie de la circulation*. Paradigme, Caen, 1988.

Commission of the European Communities. *European transport policy for 2010 : time to decide*. White paper, Publications of European Commission, Brussels, 2001.

Comité Interministériel pour le Développement Durable. *Stratégie nationale de développement durable : programmes d'actions*. Publications du Conseil National du Développement Durable, Paris, 2003.

Délégation à l'Aménagement du Territoire et à l'Action Régionale. *La France en Europe : quelle ambition pour la politique des transports*. Publications de la DATAR, Paris, 2003.

European Conference of Ministers of Transport. *Which changes for transport in the next century ?*. 14th international symposium on theory and practice in transport economics, Publications of OCDE, Paris, 1997.

European Conference of Ministers of Transport. *Transport growth in question*. 12th international symposium on theory and practice in transport economics, Publications of OCDE, Publications of OCDE, Paris, 1993.

European Conference of Ministers of Transport. *Freight transport and environment*. Publications of OCDE, Paris, 1991.

Fujita, M., and J. F. Thisse. *Economics of agglomeration : cities, industrial location and regional growth*. Cambridge University Press, Cambridge, 2002.

Gachelin, C. *La localisation des industries*. Presses Universitaires de France, Paris, 1977.

Joignaux, G., and J. Verny. Le découplage entre transport de marchandises et croissance : organisations productives, localisations et demande de transport. *Revue d'économie régionale et urbaine*, RERU, No. 5, 2004,

Joignaux, G., and J. Verny. *Etude du découplage entre croissance économique et mobilité : bilan et perspectives (volet marchandises)*. Rapport pour la DATAR, INRETS, Villeneuve d'Ascq, 2002.

Joignaux, G. L'approche des relations entre infrastructures et territoires : retours sur la théorie et les méthodes. in Burmeister, A., and G. Joignaux. *Infrastructures de transport et territoires : approches de quelques grands projets*. L'Harmattan, Paris, 1997, pp. 17-38.

Joignaux, G., and S. Kapros. Les territoires de la logistique : le cas du Nord – Pas-de-Calais. *Revue d'Economie Régionale et Urbaine*, RERU, No. 1, 1996, pp. 53-70.

Krugman, P., and A. J. Venables. Globalization and the inequality of nations. *Quarterly journal of economics*, No. 110, 1995, pp. 857-880.

Krugman, P. Increasing returns and economic geography. *Journal of political economy*, No. 99, 1991, pp. 483-499.

Ministère délégué à l'industrie. *Livre blanc sur les énergies*. La documentation française, Paris, 2003.

Plassard, F. *Transport et territoire*. La documentation française, Paris, 2003.

Rietveld, P. and R. W. Vickerman. Transport in regional science : The "death of distance" is premature. *Papers in regional science*, No. 83, 2004, pp. 229-248.

Savy, M. Le transport des marchandises. in Chapelon, L (coord). *Transports et énergie*. Atlas de France : volume 11, Reclus – La documentation française, Paris, 2000, pp. 121-130.

Savy, M. Les temps du fret : croissance et fluctuations du transport de marchandises. *Transports*, No. 376, 1996, pp. 89-93.

Savy, M. *Logistique et territoire : le nouvel espace du transport*. GIP Reclus, Montpellier, 1993.

Tolley, R., and B. J. Turton. *Transport Systems, Policy and Planning : A geographical Approach*. Longman, London, 1995.

Veltz, P. *Globalisation, villes et territoires : l'économie d'archipel*. Presses Universitaires de France, Paris, 1996.

Wackermann, G. *De l'espace national à la mondialisation*. Ellipses, Paris, 1995.

Wackermann, G. Les pays ateliers. In *Encyclopaedia Universalis*. Universalia, 1989, pp. 224-228.

World Commission on Environment and Development. *Our common future*. Editions du Fleuve, Montréal, 1987.