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Policy approaches for decoupling freight transportfrom economic growth

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POSSUM

Policy Scenarios for Sustainable Mobility

Policy approaches for decoupling transport from economic growth

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Contents

Abstract

This paper discusses one aspect of sustainable mobility: the connection between the development of freight transport volumes and prosperity. Historically freight transport growth has been strongly linked to GDP growth. This trend cannot continue if society shall develop in the direction of sustainable development. However there are different signs that the historical pattern must not necessarily continue.

Key factors for developing decoupling strategies are: the material intensity of the economy, the spatial structure of production and consumption, the handling requirements of goods, the organisation of transport. Two basic strategies “dematerialisation of the economy” and “reducing the spatial range of material flows” can be identified on this basis. Policy options are being discussed and systemised in this paper.

Despite the fact that research until today has produced little knowledge on the relationship between economic development and transport, it seems possible to conclude that there is considerable scope of action. Slowing down transport growth is feasible without endangering economic development. Appropriate policies which strengthen existing trends and enhance a corresponding structural change may also lead to increased competitivity.

1 The necessity of decoupling freight transport from economic growth

Freight transport in Europe has been increasing considerably in past years, and all trends and forecasts say that it will continue to do so. Even assuming that the upward curve might be flattening, nearly a doubling of ton-kilometres until 2020 seems rather probable according to most current projections. A cautious reference scenario might calculate with an 80% increase between 1995 and 2020 after having experienced a 90% growth in the preceding 25 years. As in the past, freight transport is assumed to follow more or less the development of the gross domestic product. Such an increase in transport volume would generate considerable problems, especially when most of this growth is to be absorbed by road transport. Considering reasonable targets for sustainable mobility scenarios shows that the prolongation of present trends in transport growth and in technology would lead to unacceptable environmental impacts (see Banister et al. 1998).

There are two basic approaches for containing these problems:

- to push technological improvements,
- to slow down transport growth.

An examination of the technological potentials for reducing environmental impact shows that technological approaches are not sufficient for complying with environmental targets, even assuming strong shifts to more environmentally friendly transport modes. Especially a reduction of CO_2 emissions by 25% does not seem achievable with a doubling of transport performance. Slowing down transport growth is therefore necessary.

Usually, slowing down transport growth is still seen as a threat to economic development. However, this is far from being obvious. The interrelationship between economic development and transport is characterised by a series of countervailing trends which may develop in such a way that slowing down transport growth is not only an environmental necessity but also an economical advantage. A differentiated view of the interrelationship between economic development and transport is badly needed. In order to maintain an increase in prosperity, we need to learn how transport growth could be decoupled from economic development. Despite some efforts during the past years, the state of the art in this field is still comparable to the situation in the energy debate some twenty years ago.

The concept of decoupling has emerged in the energy debate of the 70ies. For the purposes of this paper we can simply define transport decoupling as the decrease of the transport intensity of the gross national product GNP over a certain period of time.

2 General approaches for decoupling

2.1 Key factors for decoupling

The three elements that determine transport growth are:

- Transport volume
- Transport distance
- Transport efficiency.

The product of transport volume and transport distance gives the transport performance usually measured in ton-kilometres. The increase of ton-kilometres however is not sufficient for indicating the change in impact of the transport system. For evaluating the economic, environmental and social impact or cost of transport performance the transport efficiency in economic, environmental and social terms is important, it depends on modes, organisation, technology etc. All three elements - transport volume, distance and efficiency - are interrelated, but none is an automatic consequence of economic growth.

Slightly rearranging the factors explaining transport growth identified by McKinnon and Woodborn (1996) we distinguish four factors that link the above transport characteristics to the economic system. They can be considered to be the key factors for developing decoupling strategies:

- the material intensity of the economy
- the spatial structure of production and consumption
- the handling requirements of goods
- the organisation of transport.

The material intensity describes how much material is required for delivering a unit of economic output. A lower material intensity leads mainly to a lower transport volume, it may also have a negative influence on transport efficiency.

The spatial structure of production and consumption mainly influences the transport distances. It may also have consequences for the transport volume, e.g. when production is split up in more steps at different locations requiring additional transport links for the same end user product. Changes in the spatial structure may also have consequences on the efficiency of transport, e.g. spatial concentration of suppliers sometimes allows for bundling and increased efficiency of transport flows.

The handling requirements of goods which include aspects of safety, packaging, consignment size, speed and punctuality, may strongly influence transport efficiency. They have considerably changed over the past years and are linked to the reorganisation of production which also includes the spatial structure.

The way in which transport is organised eminently influences the transport efficiency. That is the field of logistics which in turn is influenced by the organisation of transport markets. The aim of logistics, however, is not simply transport efficiency - in fact, new logistical concepts which have minimised overall expenditure including warehouses sometimes have led to decreasing efficiency of the actual transport operations.

2.2 Basic strategies for decoupling

The trends that these four factors have shown in the last decades are contradictory, manifold and interwoven. Our guiding question in analysing them is the search for realistic political strategies for decoupling. We can distinguish three basic strategies:

- Dematerialisation of the economy,
- Reduction of the spatial range of material flows,
- Optimisation of transport organisation.

In transport research most efforts have been concentrated on the third strategy. This paper concentrates on the two previous ones.

2.3 Basic policy orientations

In order to put these basic strategies into operation a wide range of policy packages is conceivable. Politicians coming from very different backgrounds may agree on these basic strategies but nevertheless prefer different kinds of policy instruments. In order to show the large scope of options which favour decoupling a distinction between different basic policy orientations may be useful. Under policy orientations we understand the generic rationale which usually can be found behind different policy packages. Whereas policy packages are a set of individual measures - the approach of policy orientation is more aggregated. An effective policy package for decoupling will certainly have to combine elements of different approaches. However, different coherent policy packages can be conceived, which primarily rely on one of the three following basic orientations.

- **the policies of lifestyles**: policy intervention is only a secondary help for the ongoing growth of ”postmaterial” lifestyles. A basic element of such lifestyles is a changed attitude towards mobility and material consumption. Quality of life aspects play a central role. Public policy intervention is first of all an anti-discrimination policy in favour of such postmaterial lifestyles. The dynamics might be basically bottom-up. Information policies are an important element of this approach. Knowing the transport effort contained in a product or the transport consequences of a policy decision, helps to reorient behaviour.
- **the policies of market-incentives**: This approach assumes, that people are willing to change their lifestyles, if others do the same and if they have no material disadvantages. Such a system of market incentives, i.e. by fiscal reform or changed property rights, will change the incentive structure. This approach will have some top-down elements, but it will also have to rely on the acceptance of the general public.
- **the policies of regulation**: this approach relies upon technical standards and norms (for instance speed limits, maximum weight of vehicles), on innovative planning methodology (especially: spatial planning; transport impact assessment) and government reform. The general approach is rationalistic, target and criteria led and top-down.

3 Dematerialisation of the economy

Dematerialisation can be defined as the reduction of material resources needed per unit of GDP. Some researchers (see: Schmidt-Bleeck 1994; Hinterberger et al. 1996) think, that a factor 10 would be in the range of what is realistic and necessary within the coming 50 years.

3.1 Past trends

Dematerialisation in the past has been the net result of different market trends with opposite impacts. Some trends, such as the decrease of average household size, have actually increased the need for more products and decreased the use-intensity of many products. Also shorter lifecycles of products, built-in obsolescence, the computerisation of the service sector or the decline of the repair-sector have increased material intensity. Most trends however have led to a decrease of material intensity (Herman et al. 1989). Main factors have been:

- the structural change of the economy towards the service sector,
- the change of work-materials towards lighter materials,
- the miniaturisation of products,
- increasing relevance of design and quality aspects.

However, even if the material-intensity of the economy has decreased, total material consumption has increased due to overall economic growth.

A number of international comparative studies have shown, that dematerialisation is closely linked to economic modernisation. Jänicke et al. (1992) found in their comparative study, that most OECD countries had a increase of per capita income, without an increase in and some cases even a slight decrease of total tonnage transported. The trend was most pronounced in countries with a far reaching structural change of the economy, such as Sweden, UK or Japan. Kageson (1997) conducted a differentiated analysis of the link between different materials and GDP. He found that, the intensity for heavy metals and cement decreased, but that the intensity for light metals increased and that of chemicals and paper remained roughly constant over the last 20 years. In total however the consumption of most of those substances slightly increased.

3.2 Key strategies for Dematerialisation

One can assume that prevailing market trends in the near future will be along a similar path than those of the past. So material intensity will continue to decrease slightly. But a factor 10 will not be achieved by market trends alone. A more active policy approach will be required.

Three basic strategies for dematerialisation can be identified:

- replacement of material products by services
- miniaturisation
- increased durability of products

A series of authors (e.g. Schmidt-Bleek 1994; Stahel 1993) has suggested a new service oriented philosophy. Instead of buying products consumers should first look at the service they need. Such services often can be satisfied in less material intensive ways. For example, it would be less material and energy intensive to keep food cold (the service) by having well insulated places built into houses, instead of using separate refrigerators. Accessibility (the service) can be reached by buying a car or by moving near to places, which offer essential facilities. It can be achieved by other means of transport or by car-sharing or rental. Instead of material-intensive status symbols such as cars, more sophisticated ones such as electronics, clothes or art objects

could fulfil the same function. Shared use of expensive consumer goods (washing machines, cars, other household equipment) would reduce the number of products sold per unit of service (Haake 1996). This could be realised on a voluntary basis through self-organization of different households or on a commercial basis by rental or leasing.

Another approach is to increase the life-span of products (Haake 1996, Stahel 1993). Durability can be increased by redesigning consumer goods (using durable materials, repair-friendly construction etc.) or by increasing the life-span of components. Such a strategy is especially relevant for products, where the ratio between the resource use for production to the resource needs during the use of the products is high. Where it is low, a balance must be found between the efficiency gains by higher durability and the efficiency losses by a slower innovation rate. Haake (1996) argues, that from a microeconomic point of view higher durability may be associated with a lower profit rate. So, incentives must be found, which make durability more profitable.

Finally, material intensity can be further reduced by new materials, which may allow the production of lighter or smaller products. The miniaturisation of computer electronics is a good example for this trend (see: Herman et al. 1989; van Veen-Groot/ Nijkamp 1997). Also lighter vehicles are technically available, but still not marketed due to their safety problems (see below).

3.3 Policies for Dematerialisation

3.3.1 Lifestyle-oriented policies

Policy intervention would essentially be a secondary help for the ongoing growth of "postmaterial" life styles. It can be understood as an "anti-discrimination policy" in favour of such emerging lifestyles, modifying elements of the fiscal and institutional framework traditionally favouring material consumption and equipment ownership. Raising awareness and providing pertinent information would be an essential element of such a policy.

Information plays a crucial role in consumer decisions. The material intensity of alternative choices is generally not known. This might change, if the material intensity of production and use of products and services is part of the product information. Concepts for aggregated information systems have been developed by different institutions (e.g. different kinds of life-cycle-analysis, the MIPS concept, ecological foot-prints etc., an overview is given in Hinterberger et al. 1996).

Also manufacturers often lack the necessary information on material use and environmental impacts. Eco-audit and life-cycle assessment may contribute considerably to integrate such aspects into business decisions.

Political communication on the impacts of certain materialist life-styles on the environment and health, as well as a public discourse on images for a “good life” might help to reorientate individual behaviour (see: Hinterberger et al. 1996: 273). Policy-makers often have considerable public authority to communicate new orientations.

3.3.2 Market-oriented policies

Over the last decades the fiscal system of most European countries has increased the relative burden on labour and decreased the burden on capital, energy and resources. Recent initiatives for an ecological tax reform intend to reverse this trend. The general objective of an ecological tax reform is to increase resource-productivity and to reduce the pressure on the rationalisation of labour (OECD 1995; 1996). This will have a positive impact on dematerialisation (Haake

1996; Schmidt-Bleek 1994). Most strategies for ecological tax reform imply a gradual but in the long run substantial increase of resource taxes. Many proposals suggest an annual increase of 5 - 7% (Hohmeyer 1995). In Denmark the share of "green taxes" of total government income will rise from 10 to 15% between 1993 and 1998 (Bach 1995). The effects on energy consumption are estimated to be between 20 - 30% reduction by such measures (ibid.). Fiscal reform also implies a systematic review of existing hidden subsidies such as tax exemptions, which distort relative prices.

A strategy towards dematerialisation may also be promoted by changing property rights. Presently manufacturers have no incentive to reduce obsolescence of their products, since they do not have a responsibility for their products after they were sold. Manufacturers liability over the whole life-cycle of products would radically change the incentive structure. If manufacturers have to pay the cost for waste treatment, they have an incentive to reduce the waste per unit sold (Haake 1996).

3.3.3 Regulation-oriented policies

Standards can often help to overcome prisoners dilemma situations. E.g. the market introduction of lighter vehicles often fails because of safety considerations. A lighter vehicle is disadvantaged compared to heavier vehicles in case of accident (Herman et al. 1989). This is a typical prisoners dilemma situation, where coordination is necessary. If standards for maximum weight are introduced, lighter vehicles are no more disadvantaged. This would reduce specific material demand. Similar cases can be found in other fields.

3.4 Assessing the Potential for Dematerialisation

Taking in account the pace of behavioural changes, of technical development and of market penetration one can assume that the potential of these policies for dematerialisation is at least

- 5 % for substitution of material products by services
- 5 % for increased durability of products
- 5 % for miniaturisation.

Roughly, the overall potential for dematerialisation through targeted policies can be considered to be around 15 to 20% until 2020 beyond forecasted trends.

4 The spatial dimension: countervailing trends

This chapter gives a background on the general trends concerning the spatial structure of production and transport. The corresponding decoupling potentials and policy options will be discussed in chapter 5.

4.1 "Glocalization" trends and the concept of territorialisation

For the period of the last 20 years two apparently contradictory trends can be observed (see: Krätke 1995; 1996; Storper 1995; Julien 1996, Maillat 1995; Dicken 1994):

- globalisation: intensified international trade and foreign direct investment links,
- regionalisation: emergence of regional production clusters with strong intra-regional links and growing importance of regional markets.

Both have a dialectical relationship - the emergence of regional production clusters is a response to the challenges of the competition from cheap labour countries. On the other side, many world-market success-stories can only be explained by prior home-based factors.

For the future of transport demand in 2020 and the assessment of the potential for decoupling transport from economic growth, it is important to know more about the dynamics and the relevance of such different trends. If one follows the typology of Storper (1995) and Julien (1996), one has to distinguish between the market space and the operation space of enterprises. The markets are characterised by the flows of commodities to the consumers. The operation space or the production system is defined by the linkages and resources, which are required to maintain production and to promote innovation. Both, market space and space of the production system, may be strongly territorialised or strongly globalised. This can be illustrated in the matrix below:

		Territorialisation of production system	
		high	low
International Flows	high	• Intra-firm trade w/asset specificities - intermediate outputs of FDI - international markets served from territorial cores • industrial districts • inter-firm + inter-industrial trade **1**	• International division of labour e.g. in routinised manufacturing • International markets e.g. in consumer services • Inter-firm and inter-industry trade without territorial core **2**
	low	**3** • Locally-serving production to specialised tastes with low international competition	**4** • Local commerce in basic services not delivered via big-firm hierarchies

Traditionally economic growth in the open world market oriented economies is associated with the globalisation process. This is characterised by global markets and global sourcing strategies, allocating production factors, where they earn the highest profits. This type of production corresponds to the field 2 in Storpers diagram. This type of globalisation is associated with increased transport demand: Transport distances become longer - the division

of labour and specialisation intensify - and hence transport demand increases (see: Baum et al. 1994; Ihde 1984, Gleich et al. 1993; Nijkamp et al. 1995). Often this process is associated with a concentration and centralisation of production, which itself creates additional transport demand due to the longer distances between producer and consumer (see: Koopman 1992, McKinnon/ Woodburn 1993). Concentration advances especially, where economies of scale exist. This is the typical case of mass-production.

Since the economic crisis of the seventies however a new production paradigm was emerging, the so-called "flexible specialisation" (Piore/ Sabel 1985). This paradigm is characterised by flexible technologies for specialised and segmented markets, small production series and hence flexible adjustment to changing consumer tastes. The economic success of this production model is not determined by economies of scale, but by economies of scope. The success of this type of production strongly influenced the reshaping of the European economic space, with a number of emerging successful regions (such as the "Terza Italia", Southern Germany, Southern France, Northern Denmark) and others declining, because they were still relying on traditional mass-production (see: Krätke 1996, Maillat 1995). When competition by low wage countries became strong on standardised mass-products and when overall demand for mass-products stagnated, the more flexible producers were in a better position to adjust to the new conditions (for the example the comparison of textile machinery producers in Massachusetts and Baden-Württemberg see Sabel et al. 1987).This mode of production is especially relevant for the fashion and design intensive industries (such as textiles), for specialised high-income consumer demand and within segmented markets (Julien 1996). It is characterised by strong intra-regional links. Some authors emphasise the "network-type" of the enterprises (Brösse/ Spielberg 1992, Dicken 1994; Camagni/ Rabelotti 1992), others the socio-cultural context, the so-called milieus, into which the transaction between those enterprises are embedded (Maillat 1995). In any case short distances between those enterprises have a strategic relevance, therefore so-called "industrial districts" emerge (Camagni/ Rabelotti 1992). This derives from the special requirements of "flexible specialisation", which can be best understood by a "production chain" (Dicken 1994), a "transactional cost" and an "external benefits" (see: Illeris 1992) approach of cooperation.

The transport needs of such regional production clusters are ambivalent (see: Capello/ Gillespie 1992). On one hand, short distances between interlinked business become a strategic success-factor - on the other hand regional production clusters are the basis for world market oriented success-stories (Porter 1990, Storper 1995) and hence require long distance transport. In general they are more transport efficient, than globalised activities, since at least the backward linkages of production are regionalised. Capello/ Gillespie (1992) argue, that the advantages of flexible specialisation already have been recombined with the advantages of mass-production. Hence mixed forms can be identified, such as the global network firm. They argue, that flexible specialisation and mass-production are no contradiction, but complement each other. The resulting "global networks" of large scale companies become integrated mega-organisations. This may create exponential transport demand growth and require a "top down" approach for high quality, high-speed and well interconnected international transport links (Nijkamp et al. 1995).

Of special interest for the future of a transport efficient economy are the economic structures in the field 3 of Storpers diagram, which are characterised by local production for local markets. Generally those sectors are perceived to be the losers of the internationalisation processes. Yet there is evidence, that regional production for regional markets remains relevant. According to Vickerman (1996, see also: Boes/ Hesse 1996; Holzapfel et al. 1992), in terms of the quantities transported , intra-regional transport is still dominant. A recent study by the EURES Institute (Scherer et al. 1997) shows, that regional production for regional products still plays an

important role in Germany. The authors estimate a potential for regional markets of eat least 15 - 20% of GDP. They identify strong regional differences even within Germany. In some regions markets are rather centralised - in other regions a very decentralised structure with a number of small-scale businesses have survived. They identify political and cultural factors as main reasons for the persistence of small scale production. Regional identity of consumers and manufacturers is a strong factor for the persistence of such regional markets (e.g. beer, construction). Other factors favouring regional markets are: re-use packaging systems, raw materials with a low value/ weight ratio, products where economies of scale play a minor role, the existence of regional retail and marketing systems. The authors of the study argue, that a decentralisation of retail systems could considerably increase the potential for regional marketing, especially in food, construction and furniture. As surveys for other countries, such as Denmark (Schipper et al. 1992, Buigues et al. 1991) and Switzerland (Brugger 1991) indicate, the high economic relevance of small scale industries producing for regional markets might be an important factor for the superior transport efficiency of these two countries compared to the EU average (Hey et al. 1992: 28). Flexible specialisation also offers new opportunities for regionalised production for regional markets (Gleich et al. 1992), however, this has not become a strong trend yet.

4.2 Material Production in the Information Society

Since the introduction of industrial mass production based on division of labour, planning, design and organisation have been increasingly separated from the concrete context of material production. This lead to the growth of service industries. At the same time new organisational techniques were devised for these activities - the concept of information grew in importance. Thus the ground was prepared for the development of special machines for the processing and distribution of information. The new electronic information technologies have facilitated a previously unforeseen jump in productivity in the service sector, and after only a slight delay have also fundamentally altered material production technology. Design, planning and control are now no longer bound directly to material processing, nor to the skill and knowledge of individual personnel. Information can be stored, processed, reproduced and transmitted and thus has the ability to influence production with a previously unforeseen degree of flexibility. With this, the creation of added valued has shifted from material to non-material production. In terms of control over the economic process, the ever more automated material production is tending to lose significance. Today, more than ever, wealth is created by information handling and innovation.

This development has consequences for the spatial organisation of material production:

- Economic wealth is mainly created by information activities and often at different places than material production
- The control of information flows becomes more important than the control of material flows
- The new flexible production techniques allow for economical, decentralised production in relatively small series (see above).
- Centralisation of power no longer needs to base itself upon the centralised flow of materials. Large companies can keep control of decentralised networks of production units by means of information and technology transfer.

This means that large companies can regionalise the flow of materials to a large extent, without losing control over the enterprise as a whole. This would correspond to a "lean transport" variant of Capello and Gillespie's global-local scenario (see above). Interesting examples for this approach can be found in different sectors, rather advanced seems to be the food business. Coca-Cola, the symbol of world-wide marketing and of the disappearance of local cultures, has

vigorously advertised its approach to establish in each of the new provinces in Eastern Germany an own production plant, which mainly rely on local supply - the only material link to the mother company should be small amounts of the secret Coca-Cola essence. Nestlé keeps under control more than 600 production units world-wide by centralised technological instructions with a rapid cycle of innovation. New production plants of Fiat and Mitsubishi in Poland which aim mainly at regional markets (here in the sense of a couple of countries), rely to over 80% on local suppliers. These examples show, that in the era of information the creation of transport-saving, small-scale material cycles need not always contribute to the strengthening of regional characteristics. They can be integrated into existing economic and power relationships.

However, the effects of the new communication technologies upon transport requirements are ambivalent - as in the case of flexible specialisation. While these technologies are in many cases suitable for replacing transport of goods and persons, nevertheless current estimates tend to the view that under present conditions traffic-generating effects have the upper hand. Electronic communication extends the accessibility to information about economic activities, and so increases "transport-generating contacts" (Marti 1991: 257).

4.3 The impact of logistics

Also new logistic strategies imply a re-evaluation of space. The main trends are :

- the downsizing of production and the regrouping of distributors (the logistic structures),
- the spatial reordering of relationships between companies; the building up of “strategic networks” and the development of a global supply network (pattern of trading links),
- the development of “JIT” (Just in time) and MRP (material resource planning) systems (scheduling of product flow): These lead to the flexible and quick transportation of small loads and at the same time shrink the distances between suppliers and users to a strategically favourable size,
- the reorganisation of the distribution of suppliers, leading to greater centralisation but also to a re-evaluation of freight flows.

These developments are complex and have opposing impacts on transport flows. Their concrete manifestation depends on numerous influences from both inside and outside the company. Generally speaking, they have a tendency to create extra freight-transport (McKinnon/ Woodburn 1996; Banister 1996; Ihde et al. 1995; CE 1996; Baum et al. 1994) but also raise the possibility of freight reduction (Hesse 1994; 1996; Gleich et al. 1993; McKinnon/ Woodburn 1996).

Leaner production is often associated with outsourcing of supply parts to a chain of suppliers and sub-suppliers. According to company surveys (Leifeld/ Wolff 1996 for Germany) manufacturers in the 90's are planning to outsource at average about 16 per cent of turnover. Increased division of labour usually leads to more freight (Holzapfel/ Vahrenkamp 1993; CE 1996:16) However, Strutinsky (1995) has shown that a higher division of labour is often connected with a reorganisation of the network of suppliers. If, for instance, one supplier can bundle the flows from a range of other suppliers, then transport may be reduced despite leaner production. According to Strutinsky, the “optimisation of the production chain” may have a significant potential for reducing freight (CE 1996:22). Also the concentration and centralisation of production does not necessarily lead to more freight transport. This is especially the case, if disperse and scattered structures of production (multi-focal production) might be consolidated and concentrated, so that the supply chains may become shorter (McKinnon/ Woodburn 1996).

The new logistic strategies are often associated with a rearrangement of spatial patterns of production. On the one hand a “Europeanisation” of the supply of components may be observed

(Ihde et al. 1995). For instance, the transport industry in Baden-Württemberg has seen average transport distance to rise by more than 100 km to 452 km between 1980 and 1992. Suppliers in Germany have found themselves replaced by others from other european countries (ibid.). Correspondingly, the imports from abroad have increased their share of total transport volume from 19 to 28 per cent. On the other hand, regional short distance suppliers were able hold their market shares. So a polarised development could be observed: Both regional networks and international trade-flows became stronger at the expense of the middle-range flows within Germany.

The slimming down of companies and the new supply strategies relate to the new logistic strategies "Just in Time" and "Material resource planning" (Crowley 1995; Brösse/ Spielberg 1992). Both imply a more flexible scheduling of deliveries: smaller quantities are transported more frequently. This in itself creates more traffic. In JIT components are ordered at short notice in response to demand, whereas in MRP the orders are planned more in advance. The JIT strategy tends to create the greater quantity of freight traffic, because of the considerable resources required for flexibility (CE 1996a, Tanja 1991:153; Leifeld/ Wolf 1996:36f.). The market potential of JIT production however is limited because of these high demands. (Lempa 1990; Sauer 1990; Leifeld/ Wolf 1996:36f). These strategies themselves influence the development of the spatial patterns of production. Particularly in the automobile industry, a corresponding reorganisation is taking place. In Baden-Württemberg for instance, most suppliers of Mercedes are located in Stuttgart (Ihde et al. 1995). Certain components, particularly those with high quality requirements, are ordered to the hour and must be available within a radius of 100 km (Sauer 1990: 249). JIT therefore creates an incentive for short distance relations and hence ultimately also for the reduction of freight traffic (McKinnon/ Woodburn 1996: 152).

So even if new logistic trends and company strategies obviously have created additional traffic in the past, this is far from being a necessity in the future. Furthermore, as McKinnon/ Woodburn (1996) argue, the logistical changes, which could be observed during the last decade might be a once for all adjustment to the new possibilities offered by the motorway programmes of the seventies and eighties. A realistic scenario is, that a relevant share of production will take place within regional production clusters, which offer opportunities for outsourcing and flexible scheduling of high-quality supply parts, whereas only a minor share of supply parts is really traded internationally. This offers opportunities for increased transport efficiency.

5 Reducing the spatial range of material flows

As a consequence of the above considerations it is possible to distinguish four main strategies for reducing the spatial range of material flows or the average transport content in a given end product:

- strengthening regional consumer markets
- promoting regional production networks
- encourage the decoupling of information and material flows
- slow down de-territorialisation caused by efforts to strengthen international trade.

5.1 Strengthening regional consumer markets

5.1.1 Life-style oriented policies

One key to regional markets is the lifestyle of consumers. Information can be a very powerful tool in this sense, as consumer awareness is raising. Overall, a positive identification with their own region will raise the openness of consumers to look for regional products in order to fulfil their needs. Awareness of specific regional life styles and product styles can be developed systematically within the framework of ongoing activities from school curricula to tourism promotion. Informing consumers about locally produced goods and about the local economy can strengthen local markets. Especially in the food sector the superior quality of fresh food, local specialities and the controllability of the origin can be additional arguments. To provide a declaration of transport "content" for products in the framework of eco-labelling may have a noticeable influence on consumer choices. Labels showing the regional origin could be developed and promoted more systematically.

The considerable purchasing power of local public institutions could also be used to develop regional markets and to enhance the visibility and distinctiveness of regional lifestyle profiles. Regional networks are not only interesting in the field of production but also for the marketing of end products. The development and cultivation of characteristic regional products not only in the food sector, but also in construction, furniture design etc. could be enhanced by encouraging the cooperation of manufacturers. Retailers could be encouraged to offer a high share of regional products.

However, all such life-style oriented policies should not lead to a narrow-minded regionalism. Interregional exchange which enriches the variety of lifestyles, gives new impulses and opens new opportunities is vital, but does not need an overall increase in material flows.

5.1.2 Market-oriented policies

Also market-oriented policies show a considerable potential in this respect. Regional markets can be strengthened by modifying present economic policies. EU regional funds and national economic support programs could have a stronger focus on the development of intra-regional markets instead of strongly relying on the “export basis” concept. Manufacturers aiming primarily at local markets should not be disadvantaged as often is the case today (Schleicher-Tappeser 1992). European and national legislation in the food sector as well as the Common Agricultural Policy might be reviewed with respect to regionalisation: Currently, industrialisation and concentration processes as well as the exporting of agricultural products tend to be supported at the expense of regionally marketing, small scale production units (Hey 1996: 76, Reimer 1996).

Finally, higher transport prices would favour short range procurement, especially for goods with a low value density. In food, e.g., average transport costs make up for 12% of final product prices. Ecological taxes could therefore enhance these markets to a certain extent.

5.1.3 Regulation-oriented policies

The reach of regulation-oriented policies seems to be much more limited. To prohibit long-distance trade of certain goods within Europe is no promising approach, the free circulation of goods within the European Community should not be put into question. However, as mentioned in different examples above, some regulations could be modified in order to favour short-distance material flows. E.g. regulations concerning the public procurement should make it possible to favour products and services with low "transport content".

5.2 Promoting regional production networks

5.2.1 Life-style-oriented policies

Lifestyle-oriented policies seem to be essential in order to exploit the potentials for decoupling in this direction. The emergence of regional production networks is strongly linked to cultural factors which - within limits - may be fostered by appropriate policies. Policies aiming at a "territorialisation" of production will enhance local communication, encourage entrepreneurship and cooperation, and provide consultancy. Identifying core competencies and developing specialisation strategies can help the relevant players to develop a shared vision. Adequate information services which simply facilitate access to nearby suppliers may have important supporting functions (Hey and Schleicher-Tappeser 1998).

5.2.2 Market-oriented policies

Market-oriented policies can very effectively work in the same direction. Financial burdens or incentives could be reviewed taking transport into account, favouring businesses with a low transport intensity of their production chain. Public expenditure - which in European countries constitutes a high share of GDP - could also play an important role in this context.

5.2.3 Regulation-oriented policies

Concerning regulation-oriented policies the options are about the same as discussed above for regional markets.

5.3 Localising material flows in large companies

The potentials for decentralising material flows in large companies without endangering the coherence of the corporation are considerable. Strengthening the awareness for the changing role of large companies in the information society could be a key element in decoupling strategies. If large, especially transnational companies are essentially seen as information and innovation transfer organisations, reducing the spatial range of material flows can become an interesting challenge and issue of competition between leading edge companies. Politics could reinforce this change in the general way it negotiates with companies. Subsidies, research grants etc. could be more systematically linked to efforts going into this direction. A useful instrument could also be to require environmental audits of transport impact for companies serving international markets. This would lead to a greater transport awareness of all players involved.

5.4 Slowing down deterritorialisation

In the past years freight transport has increased considerably and the rate of increase has also grown. The projections which forecast nearly a doubling of freight transport until 2020, rely on a moderated continuation of these trends. This seems reasonable considering that the main economic driving forces for increasing transport such as economies of scale, economies of specialisation and comparative cost advantage (Petschow et al. 1997) will not completely loose their validity.Additionally, the increase of long-distance relationships or globalisation also has a cultural dimension. Global communication, the highly concentrated cinema and film industries and global tourism lead to an international diffusion of tastes, lifestyles and consumption patterns - often dominated by the “American way of life” but also by the import of “exotic” products and tastes. According to Giddens (1997) global communities (diasporas) emerge, which share certain values, tastes and lifestyles. So “territory” looses as a focal point for different cultures. This leads to a de-regionalisation of consumption patterns and to an intensification of international exchange. New trends in favour of territorialisation as we described above will probably not outweigh this general tendency in the next 20 years.

On the other hand we also observe a series of politically driven developments in the last decade which have "released" or enhanced these driving forces at a impressive pace:

- international trade-liberalisation: the WTO and GATT-regimes have considerably facilitated free international trade and reduced tariff and non-tariff barriers
- the internal market programme of the EU had a considerable effect on the intensification of the trade links between EU member countries and hence on transport demand
- regional development policies have gained importance and still very often have an export-oriented bias, which leads to deterritorialisation of the production processes.
- the common agricultural policies still subsidise exports to the world market, favour large specialised production units and encourage Europe wide shipment of products locally available in most places.
- the way in which public procurement has been liberalised has made it much more difficult to consider the vicinity of a supplier
- the deregulation of the transport markets in the EU has led to a sharp decrease in transport costs
- regulation and deregulation in the field of environmental and consumer protection at the bottom line seems to have increasingly favoured large-scale Europe wide marketing producers. Hygiene and safety standards required for long shipments and mass-production have become compulsory for all.

It might be argued that the transport-promoting effect of these political measures might be exhausted within a few years and that continued growth in freight transport would presuppose a continued intensification of political measures in this direction.

An immediate measure for promoting decoupling of transport and economic growth by slowing down “deterritorialisation” could therefore be to analyse the transport impact of policy measures prior to their introduction. The examples above show that there are often alternatives which would not restrict economic growth at all.

5.5 Decoupling potential

Very little research and little useful statistics are available for making reliable estimates for the impacts of the polices discussed in the preceding sections. However we would like to risk rough guesses for the decoupling potential of a mix of policies that would not seem to create strong conflicts in order to indicate at least an order of magnitude.

Concerning the enhanced development of regional consumer markets it does not seem unrealistic that compared to forecasted trends total freight transport could be decreased by at least 5% until the year 2020 by a combination of policies discussed above. No major conflicts or economic drawbacks are to be expected. In the food sector, farmers could increasingly support such strategies, whereas the large distribution chains may be the most reluctant players involved.

Housing and food are the "fields of need" which seem to have the most significant potential for the development of regional consumer markets. The food sector alone makes up for ca. 10% of total freight transport and seems to have a considerable potential: in a case study in Wuppertal/ Germany Mildner and Böge (1996) found that the transport intensity of basic foods from a local supermarket was 6 to 85 times higher than that of comparable products from a bio-farm shop.

Also the policies for the enhancement of regional production networks can be estimated to contribute more than 5% to a reduction of all freight transports in 2020 compared to present forecasts.

Baum et al. (1994: 158), referring to interviews with the German automobile industry, state that by reviewing the choice of suppliers (i.e. relying on nearby suppliers) and minimising the additional transport resulting from outsourcing, the reduction potential would exceed 33% of all supply transport (i.e. excluding distribution) in this sector. Unofficial guesses say that the in Germany automobile industry causes about 10% of all freight transports. A similar case may be made for the electronics and machinery industry in Germany and the rest of Europe.

For the third strategy, the "glocalisation" of international companies a separate guess makes no sense, the effects should be included in the two previous ones. Finally, we estimate that efforts for slowing down the pace of "deterritorialisation" could make up for a considerable decoupling potential of 10 to 20 percent until the year 2020.

Overall the strategy of "reducing the spatial range of material flows" could probably reduce the forecasted freight transport volume by 20 to 30%.

6 Consequences for transport policies

Given the limitedness of present knowledge of the interrelationships between economic development and transport growth, all estimates on decoupling potential are highly speculative. However, they might give some realistic indication of the order of magnitude. To acquire an overall picture, an additional decoupling potential in the field of transport organization of about 10% would have to be included which could not be discussed here (comp. Baum et al. 1994). Summing up, the overall potential for decoupling freight transport growth from economic growth could be estimated at 30 to 50% for the year 2020 compared to present trends. That means, that instead of growing by 80% between 1995 and 2020 freight transport might remain more or less stable (90-110%).

These rough estimates which have been mainly based on German literature would have to be corroborated by a more in-depth European analysis. However, the fact that Japan achieved a decoupling of 31% between 1970 and 1990 (GDP +133%, Freight Transport +60%, see OECD 1994) indicates that they are not exaggerate.

These results show that decoupling has a considerable potential for solving problems associated with growth in freight transport which deserves much more attention than it has attracted until now.

Proposing to retard the considerable growth in freight transport often creates fears that this would have negative effects on the economy and the labour market. Our analysis showed that there are considerable countervailing trends and that policies aimed at decoupling freight transport from economic growth would mainly mean to accelerate structural change in a certain direction. This change creates winners and losers, acceleration may therefore increase conflicts. The losers represent the old, ripe material-oriented industries, the protagonists of the era of mass production which still have considerable influence and power. The winners are linked to the rising service and information based industries. The potential of decoupling therefore is mainly limited by political and not by economic difficulties.

Decoupling strategies are not a single, easily understandable solution. They must consist of a multiplicity of individual measures which complement each other and which will take time to be implemented. This is at the same time a weakness and a strength of this approach. On one hand it is difficult to come up with highly visible, spectacular projects (such as high-speed trains) which attract public attention and funding more easily. On the other hand, there are a multitude of approaches by which decoupling can be promoted and a multitude of fields where efforts can begin immediately.

Politicians favouring rather different policy orientations can find useful policy instruments according to their preferred approach in order to promote decoupling. As we have shown, life-style-oriented, market-oriented and regulation-oriented policies can make valuable contributions. Broad coalitions in politics and in business are conceivable, but still need to be forged. Obviously there will be vested interests opposing such a strategy. However, they do not seem to belong to the most dynamic and future-oriented parts of business.

Transport policy has traditionally seen itself in a mere service function and did not consider to influence such a wide range of policies as needed for success in decoupling. A stronger integration of transport policy considerations into other policies becomes imperative. A first step however, is more simple and would be of great importance for a large part of the wide range of policy options discussed in this paper: to improve information about the transport implications of decisions in all fields. To implement appropriate methods of analysis and labelling systems could be an important first contribution of European transport policy towards decoupling.

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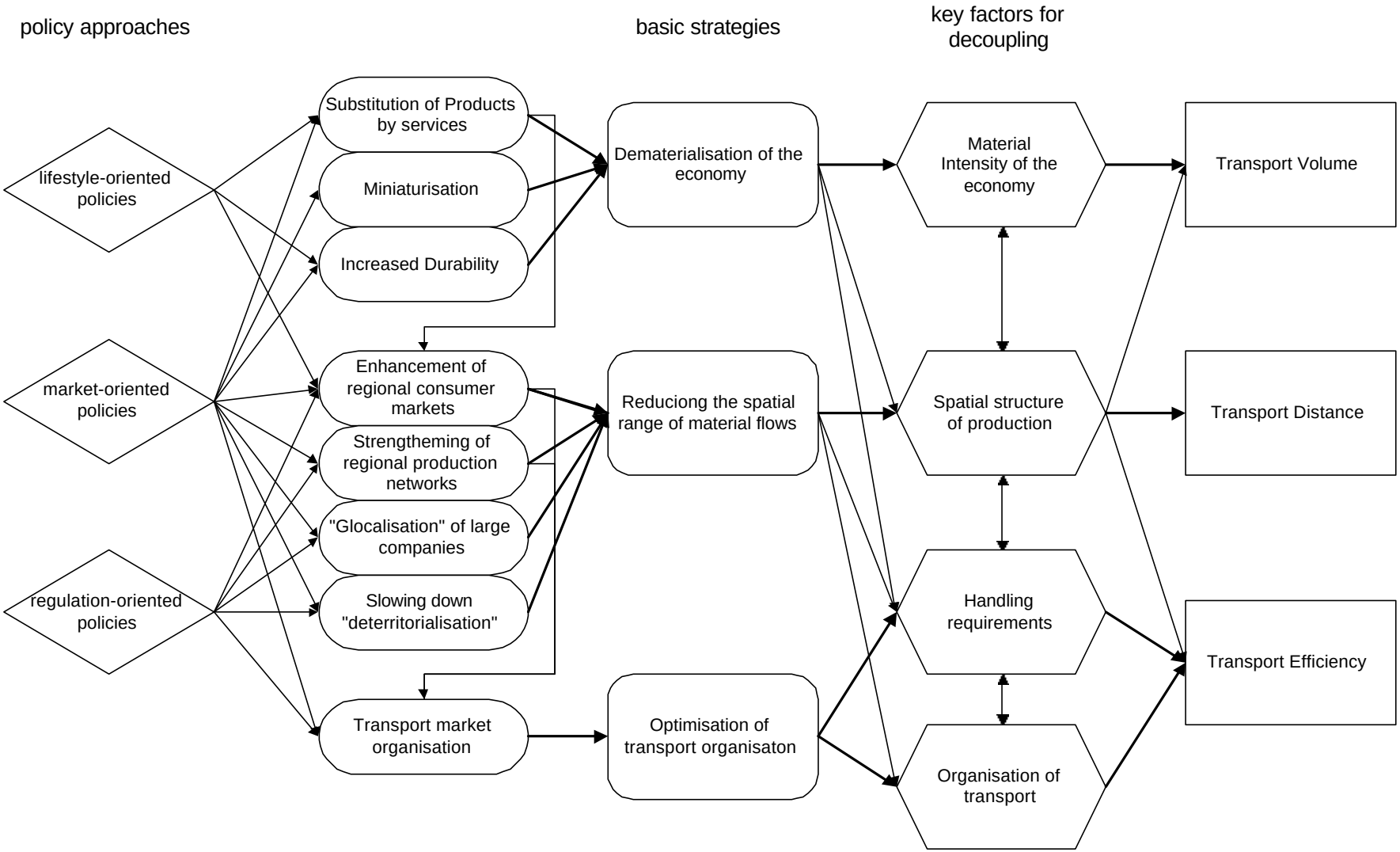

Figure 1: Strategies for decoupling freight transport from economic gropwth