

# **Registration and evaluation of transportation by means of product-related transportation analysis**

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## **1. Introduction**

Freight transport on roads has increased greatly over the last decades. But in general the volume of road freight expressed in tonnes is stagnating, whereas freight transport activity (the product of weight and distance) is increasing. This means that products are transported over longer distances. Only the freight transport activity follows the main stream of economic development, and is not the result of more production. It is the spatial spreading and the intensity of exchange in the economy that have grown, the quantity which is shipped has not increased in the same manner as the distances<sup>1</sup>.

Such structural changes, as shown here for the case of the growth of road freight transportation, are also decisive determinants of the environmental and social impacts. Even today there are capacity limits which become evident in the environmental field in the destruction of natural resources and in the social field in decreasing quality of life. Particularly environmentally sensitive natural areas (e.g. the Alps), or towns and conurbations suffer the main burdens of traffic and its consequences.

At the same time the activity of road freight traffic will increase dramatically: According to some forecasts, the total volume will increase by more than 70 % in Germany. The transfrontier volume, which depends on freight transport in the Single European Market, is expected to increase by even more than 100 %<sup>2</sup>.

But this forecasted growth, towards which all trends point, is insupportable, because there are physical limits. In the economic sphere this is mainly the impossibility of overburdening the infrastructure even more. Production concepts like "just-in-time production" (in which production-synchronized transportation takes place in order to synchronize the production process) do not work any more, because there is no longer any reliability in road transport.

One suggestion to solve the problem in road freight transport is to include the true costs in the transportation costs. Today large parts of transportation costs are externalized. This means they are transferred to the public infrastructure and natural environment. These costs have to be paid by society now and by following generations. An adequate use of scarce means of production (in this case the natural and human environments) can only be achieved if all costs are taken into consideration and if all these costs are included in the supply prices<sup>3</sup>.

Due to the Single European Market and the deregulation of transportation, the possibilities to externalize internal costs are becoming essential. Especially in Germany the prices will mirror the actual costs less and less. As a result, environmental and social impacts are

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<sup>1</sup> Hesse, Markus (1991, p. 3).

<sup>2</sup> Whitelegg, John (1990, p. 26).

<sup>3</sup> Teufel, Dieter (1989 and 1991) has estimated the external costs of freight transport.

growing more and more. But not only for these reasons, for economic reasons too, it is time to go another way.

An environmentally sound and socially equitable economy (including the transportation of goods) can be realized only by the manufacturers themselves. A prerequisite to this is the knowledge of the effects and connections of production processes internal and external to manufacturing as implemented by freight transport. In the following is described a possibility, how manufacturers can register and evaluate the freight transportation of goods. With this method freight transport can be organized not only under economic aspects, but also with regard to the natural environment and human life styles.

## **2. Product-related transportation analysis**

A detailed analysis technique addressing transportation processes at the microeconomic level still does not exist. In a general environmental analysis or eco-balance of a production method (or single product), transportation processes as the basis of any production have to be viewed, because the natural and social effects which result from freight transport are problematic and are growing constantly.

The aim of the transportation analysis is to model, as far as possible, all transportation processes in the life cycle of a product, mainly for the direct caused transportation processes of a manufacturer. The result shows how long one unit product was transported (by a lorry) and the conditions and impacts of this product specific transportation process in a quantitative or descriptive way (e.g. transportation costs, the reliability of transportation, the quality of the product, environmental and social impacts). Only then is it guaranteed that the manufacturer can react to future developments in the transport sector, and do so in a preventive way for the environment.

At the same time, this analysis is oriented to the consumer, as this can show the conditions and dependences connected with the production and consumption of products. Only then can the consumers realize an environmentally sound consumption behaviour.

This concept of a product-related transportation analysis has been realized the first time exemplarily with a milk manufacturer in southern Germany. The results of this analysis are reported here in summary:

## **3. The realisation of transportation analysis**

In this analysis among other milk products a strawberry yoghurt weighing 150g in a recycable glass jar was examined. In this examination all ingredients of the product are included: e.g. milk, jam, sugar and the packaging e.g. the glass container, paper label, aluminium cover, cardboard box and cardboard sheets, glue, foil.

The product has no extreme, but rather standard transportation processes. You can find transportation connections like this in any product and with any manufacturer. The results are shown here in the following categories: space specific, product specific and vehicle specific.

### **Space specific results**

Figure 1 (see end of the text) shows the transportation relations of the ingredients (included the main ingredients of the subcontractors) and of the whole product to distribution outlets in southern Germany.

### **Product specific results**

In the following there are illustrated the trip segments per product in metres or the transport intensity respectively. The whole distance is hereby first placed in relation to the specific transport weight, so that it is possible to calculate the specific distance for the product under examination.

Trip segment subcontractor:	5.1 m
Trip segment manufacturer:	3.1 m
Trip segment trade:	1.0 m
Total distance:	9.2 m

If one 150g strawberry yoghurt is purchased in a supermarket in southern Germany, it includes 9.2 m or one lorry has to be moved at least 9.2 m.

### **Vehicle specific results**

To bring one truckload of product to a distribution outlet in southern Germany, one "theoretical" truck (including all examined relationships) must be moved 1,005 km. In the year 1992 theoretically 24 fully packed lorries with 150g strawberry yoghurt had to be moved each over this distance to supply the southern German area with this product.

### **3.1 Effects of product-related distance**

Obviously large trip segments are not only problematic for the manufacturer in future, but also today for the natural and social environment, particularly for cities. Simultaneously the behaviour of consumers supports the trend towards increasing freight transport on roads.

The reliability and rapidity with which the necessary goods for production are transported on roads also depends on the motor vehicle density on the roads used. Long distances are, especially in future, risk factors for reliable and punctual supplies and deliveries of the inputs and the examined product, because the motor vehicle density is increasing more and more in all road categories. In peak times the roads are continuously overloaded.

Higher transportation costs, which depend largely on higher petrol or diesel costs, have considerable impacts on the internal cost structures of the manufacturer producing the examined product. With the increase of diesel costs in which the external costs are internalized so far as possible, the total transport costs of the yoghurt manufacturer would increase by about 21% - 65%.

The energy consumption, pollutant emissions and the effects on the natural environment from road freight traffic entail the increasing use of natural resources and increasing environmental degradation. The calculated trip segments in this transportation analysis give a clue as to how a daily product contributes to the increasing environmental pollution with its transportation process.

On the basis of the specific distance covered, one 150g strawberry yoghurt has used 0.004 l diesel, if it is distributed in southern Germany. To sell the sales quantities for 1992, 24 lorries had to be used and for them 10,200 l diesel.

Of course, the examined product has only a low share of the pollutant emissions caused by all freight traffic. However this product is also participated with its transportation. E.g. with 22.8 g/tkm NO<sub>x</sub>, 1.9 g/tkm SO<sub>2</sub> and 1.52 g/tkm dust. In general the quality of a product decreases as a result of high trip segments which are connected with pollutant emissions. Especially vegetable components, fruits and sugar are affected. SO<sub>2</sub> causes a breakdown of chlorophyll, NO<sub>2</sub> is a precursor to ozone. Ozone also damages plants.

The primary pollutant emissions from the traffic sector have negative effects on human health, especially for children<sup>4</sup>. These pollutant emissions are carcinogenic, they cause respiratory diseases and circulatory disorders. Some react with each other and form secondary air pollutants such as ozone and smog. They also have adverse health effects.

Adverse affects on human living space caused by freight shipments become clear mainly in cities and conurbations. Space used by motorized traffic can not be used for parks, playgrounds, pedestrian or bicycle traffic. Urban planning depends on the demand of traffic, especially on freight traffic. The width of roads has been planned according to their demands.

Also the recreation areas are affected by the land use of (freight) traffic. Urban recreation and recreation areas in the immediate vicinity of cities are affected because of pollutant emissions, noise and monotonous planning of the urban structure. If the recreation value decreases in and around cities, human beings drive out and use distant recreation areas. And as a result in these areas noise also increases, visual impairments by road building increases and destroys the landscape.

Healthy food, a calm environment and fresh air are important aspects for a healthy life style, as impressively illustrated by the the advertising pictures. But in reality the facts of transportation of each product give quite a different picture.

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<sup>4</sup> Holzapfel, Helmut (1991, p. 239).

But at the same time it is remarkable, that so called "environmental" products are not environmental, if the moved distances are included. Specifically, the greater distances are from the manufacturer to the supermarket. The longer the distances are for a product, the more environmental impacts result. The demand of the consumers to buy everything everywhere and everytime has direct consequences on freight shipment. Increasing demands in this direction increase the effects on the environment and on life style. The existing production system with the strategies of externalisation is supported. Consumer behaviour plays a part in forming production and distribution systems. Last but not least, there is no detailed information for consumers on the connections between production and consumption.

#### **4. Conclusion**

Product-related transportation analysis is mainly a manufacturer specific instrument, which makes it possible to see product-related transportation processes with all their connections and therefore organize them in a socially responsible way.

One can not suppose that only the manufacturer should show the good will to realize an environmental economy by taking the transportation procedures into account. It is a fact that policy has to set other general conditions which motivate to produce and transport in an environmentally and socially responsible way. The consumers, on the basis of appropriate information and changed behaviour in consumption, can contribute only to a certain extent to create a better environment.

In general there are three basic options for manufacturers:

- reduction of shipments from nearer subcontractors,
- improvements to existing transportation vehicles,
- shift to environmentally sounder freight shipment vehicles.

To reduce distribution shipments fundamentally, there is the possibility to create decentralized or regional production structures. To reduce distances in transportation processes from manufacturing to trade means in the end a reduction of transport costs for the manufacturer. The more decentralized the economy organizes its production structures the faster can the aim be achieved to create freight shipping in an environmentally sound and socially equitable way. This can not be realized by the technical optimization of vehicles alone, although that is a desirable contribution.

In addition, policy has to develop and put into effect measures to create appropriate general conditions. To limit freight traffic growth and organize it in an environmental and social way, there is a debate revolving around three points:

- reduction of trips in business/commercial traffic
- improvement of vehicles and infrastructure
- shift to other modes of transport.

It is profitable to build small freight traffic and distribution centres allowing better coordination of freight movements and avoidance of unnecessary shipments. In general, measures like the internalization of external costs in freight shipment with a change in fuel and motor vehicle taxes as well as freight taxes for certain goods is necessary. Fundamental, far-reaching measures, like the realization of decentralized urban settlement and economic structures with short distances should, however, receive priority.

At the same time the information of consumers has to be improved in the direction of comprehensive product information, which includes the transportation processes of a product. It should be encouraged that manufacturers can give their products a regional label, issued by a government organization. This label can prove that the ingredients of a product come e.g. to 80 % out of the region. Product-related transportation analysis can give the basis for such a scheme. With such a label the consumer can see whether he is buying a product with less "distance" or high "distance".

Many consumers also have the intention to do something for a better environment. But this "better" behaviour must first be critically assessed, because consumption always has effects on the environment and has to do with the ways of manufacturing products. Only with direct changes in the behaviour and basic changes in attitudes can an environmentally sound consumption really be practised.

The examined individual strawberry yoghurt 150 g includes a distance of approximately 10 m. This does not seem a lot, but it is enough to look in your own trolley or refrigerator at home: In it there is a great sum of distances, which mostly result from far distant manufacturing places of these products. Beside the consumption of these products, distances are consumed, which have, because of the means of transportation (the lorry), considerable effects on the natural and human environment.

Those negative effects of products which are the result of their transportation processes can be reduced by paying attention to buying regional and seasonal products. "Ecological" products are regionally and seasonally differentiated products. With the purchase of food which has been grown in the neighbourhood and in the appropriate season, long distances of freight shipment are also avoided.

The existing and impending environmental disaster, which depends also on road freight shipment, has meanwhile been realized by every person with any degree of awareness. Still the situation is getting worse, because of an outdated attitude towards the existing standard of life or prosperity predominates which depend on mass production and mass consumption.

The direction for a changed awareness leading to a life style which does not make life for following generations extremely worse has to be found. The described analysis contributes to this by showing connections between freight transportation, economy and consumer behaviour and the resulting effects on the natural and human environment. It is clear enough that these effects contribute to a progressive destruction of space and with that to a destruction of the foundation of life and of its quality.



## 5. References

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# Transportation Relations

## Strawberry Yoghurt 150 g

