**Faculteit der Economische Wetenschappen en Econometrie**

# SERIE RESEARCH MEMORANDA

A scenario study for investigating the implications of globalisation on international transport and the global environment:

Daniëlle B. van Veen-Croot
Peter Nijkamp
Jeroen C.J.M. van den Bergh

*vrije* Universiteit    *amsterdam*

# A scenario study for investigating the implications of globalisation on international transport and the global environment:

## A case study for the Dutch paper industry

*Daniëlle B. van Veen-Groot*
*Peter Nijkamp*
*Jeroen C.J.M. van den Bergh*

**Abstract**

This paper aims to trace the consequences of various global scenarios for the transportation system and the environment. After a review and the identification of four new world scenario's, the implications for sustainable transport are mapped out. The methodology is illustrated by means of a case study on a specific transport-intensive sector in the Netherlands, viz. the paper industry.

free university *amsterdam*
Department of Spatial Economics
De Boelelaan 1105
108 1 HV Amsterdam
The Netherlands

# 1. Introduction

The world-wide liberalisation trends created the conditions for the globalisation of our economies. The liberalisation of trade and finance, the emergence of new economic markets, new information and communication technologies and a decrease in transportation costs have been important driving forces behind globalisation. These globalisation trends may have large impacts on the transport system and the global environment. Especially the enhanced greenhouse effect is a major environmental problem (PCC, 1992). Carbon dioxide has been responsible for 55% of the enhanced greenhouse effect in the past, and is likely to remain so in the future. Transport is a significant contributor to the carbon dioxide emissions. World-wide, transport cause 20% of the emission of greenhouse gases, agriculture and deforestation cause 25% and power generation 25%. Although other sectors also contribute considerably to the emission of greenhouse gases, the contribution of transportation sector is expected to increase drastically. Several trends indicate a steady growth of goods as well as of passenger transport.

This paper focuses on the implications of globalisation on international transport and the global environment caused by the paper and pulp industry. International trade of paper and paper products was limited till the end of the 1960s. Global competition within the pulp and paper industry became important following the liberalisation of international trade of the 1970s. For example, the tariff duty on bulk paper fell from 18 to 9 percent between 1960 and 1973 and was further reduced to 6 percent in 1981 (Waitt, 1994).This liberalisation of world trade in pulp, paper and paper board has led to new competition patterns and a high increase of trade in paper and paper products. World-wide the consumption of paper has increased drastically (IIED, 1996). Due to globalisation the consumption, production and trade op paper and paper product is expected to increase further.

The relation between globalisation, international transport and the global environment involves a large number of processes and interactions. The future developments of globalisation, transportation and the environmental consequences are uncertain. How will the globalisation process develop? What will be the impacts on the use of international transport and the development of new technologies? How will this affect global environmental quality? One way to deal with uncertainty is to construct scenarios and examine the way that different strategies/policy options perform in each of them.

The central question of this paper is: What are the effects of globalisation on transport flows and what are the accompanying environmental effects? The paper aims to describe the scenario method for investigating the implications of globalisation on international transport and the global environment and to present some tentative results for the Dutch pulp and paper industry in four globalisation scenarios.

First, a description of the scenario development process and the method used for the construction of the globalisation scenarios is presented in Section 3 and 4. In Section 5, the four globalisation scenarios are described. An investigation of the implications of globalisation on international transport and the global environment in the Dutch paper and pulp industry is presented in Section 6 en 7. Section 8 evaluates the main findings.

## 2. Scenarios: definition, function, classification and development process

*Definitions of scenarios*

Various definitions of scenarios exist. Kahn and Wiener (1967) define scenarios as: 'hypothetical sequences of events constructed for the purpose of focusing attention on causal processes and decision-points'. In their view, scenarios answer two questions: (i) Precisely how might some hypothetical situation come about, step by step? And (ii) What alternatives exist, for each actor, at each step for preventing, diverting of facilitating the process? In this definition, a distinction is made between the scenario and the strategy; the "American approach" (Rienstra, 1998). RAND (1997) defines a scenario as "a description of a hypothetical future state of the world, including a consideration of the major uncertainties encountered in moving far into the future. The scenario pays attention to developments within the system and to developments outside the system that affect the system, excluding the policy options to be examined." Another important characteristic of these definitions is the use of an **actor**-oriented approach. In essence, the construction of scenarios aims at influencing policy-makers and support them in making policy choices.

In the "French approach", a comprehensive image of the future is used, in which dependent and independent variables are combined. A scenario in the French approach normally consists of three phases: (i) a description of the present situation; (ii) a description of a number of future situations; and (iii) a description of a number of events that may connect the present situation with future ones (Rienstra, 1998). In this approach the description of the external situation including the strategy to reach this hypothetical situation is part of the scenario.

*Classifications of scenarios*

Different classifications of future research can be found in the literature. First, a distinction can be made between 'objective' versus 'subjective' methods (Bijl, 1991). The question is how the descriptions of possible futures are reached. Objective methods make use of empirical data, whereas subjective methods make use of opinions of persons, often experts.

Second, Jantsch (1974) makes a distinction between exploratory and normative or 'backcasting'. scenarios. The *exploratory* scenarios start from the present, indicate which events might happen with the alternative developments and finally, describe the possible future outcomes. These types of scenarios indicate at which points in time certain decisions have to be made and which developments cannot be influenced by intervention. Exploratory scenarios are mostly descriptive images of future possibilities and are primarily used to stimulate thinking about possible futures. These kind of scenarios do not to describe desired situations. Normative forecasting implies the delineation of goals in the future and their translation into missions and tasks for scientific and technological development. Normative scenarios describe strategies to reach a given (desirable) future; the starting point is the desired future situation. Targets are set and then different paths are described that will lead to this future. Backcasting scenarios aims to present desired futures and to define different ways to achieve that desired situation.

Third, a distinction can be made between scenarios and strategies (in the case of firms) or policy (in the case of government). A scenario is a description of a possible future in which social, political, economic and technological developments evolve in a consistent order. Strategies or policies are defined as 'ways to achieve a specific goal'

(Leemhuis, 1985). In other words, scenarios are descriptions of possible futures and the strategies or policies describe how the future can be influenced. Within each scenario, different strategies or policy packages can be distinguished in order to achieve a certain future situation.

*Functions of scenarios*

Scenarios can fulfil different functions (Bood and Postma, 1998). Scenarios integrate different kinds of information, such as economic, demographic, technological and social data. Different scenarios explore alternative futures. Furthermore, scenarios can be used to evaluate and select policy strategies. In essence, scenario analysis aims at influencing the way decision-makers think by offering them several fundamentally different future perspectives on the world around them. Furthermore, scenarios can make decision-makers aware of external uncertainties and widen their scope by stretching their 'mental models'. Scenarios can be used for stimulating the process of learning and as communication tool among decision-makers. Because the scope of one scientist or decision-maker is limited, a group of people has to participate in the scenario development process (Bood and Postma, 1998).

## The scenario development process

The construction of scenarios consists of a series of phases which are, at least intentionally, completed sequentially (see Figure 1). In practice, constructing scenarios results is an iterative process wherein people move back and forth between the interrelated phases (see RAND, 1997; Bood and Postma, 1998).
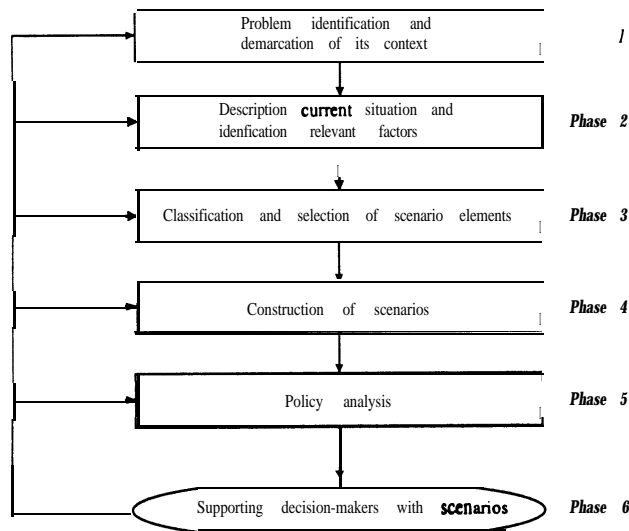


*Figure* 2. The scenario development process

Source:        Bood and Postma, 1998

## 3. Method of construction of the globalisation scenarios

### Characteristics of the globalisation scenarios

For the construction of the globalisation scenarios, the "American approach" is used. Four different hypothetical future states of the world are developed, resulting in four

different scenarios. The scenarios do not tell us what *will* happen in the future, rather they tell us what *can* happen (see RAND, 1997).

Furthermore, the subjective method is used for the construction of the qualitative scenarios. This method uses the opinions of experts for constructing scenarios For the quantification of the scenarios, the objective method which make use of empirical data will be used.

Our study can be characterised as an exploratory study. On the base of trends and driving forces, the alternative futures are identified. The globalisation scenarios can be seen as descriptive images of possible futures and are primarily used to stimulate thinking about possible futures. In a later stage, policy strategies which can bend transport and environmental implications will be developed.

*The scenario development process*
The six phases which are presented in Figure 2 in the previous paragraph are used for the construction of the globalisation scenarios. The first phase in the scenario development process is the identification of the problem and the formulation of the research questions. The aim of our research is to investigate the consequences of globalisation for international transport for global environmental quality as reflected in greenhouse gases. The second phase is a description of the current situation and the identification of relevant factor or driving forces behind globalisation, transport and environment. For this purpose, trends and driving forces are assessed (see Van **Veen-**Groot and Nijkamp, 1998). The validation of these driving forces is done by an electronic workshop with experts in the field of international trade, transport and the environment. The third step is the selection of the driving forces which are used for the construction of the scenarios. The classification and selection of the driving forces is done by means of an electronic workshop. Then the fourth step is the construction of the scenarios. After the classification and selection of the driving forces, the qualitative globalisation scenarios were developed. For this purpose, an international workshop with the expert group was held. The construction of the qualitative scenarios is based on a two-steps approach; a distinction is made between the globalisation and the transportation scenarios. Phase 5 consists of analysis of the different scenarios. This phase is a policy analysis, which determines the effects of different policy packages on transport and the environment. The implications of this analysis and policy recommendations are communicated to the policy-makers.

*Classification and selection of* scenario elements: *an* assessment *of driving* forces
For the identification of the driving forces behind globalisation and the assessment of the themes for the scenarios, a Delphi experiment was carried out. "Delphi may be characterised as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem" (Linstone (ed), 1975).

The choice of the expert group has a large influence on the outcomes of the Delphi experiment. For our purpose, experts in the field of transport and the environment are selected for participation in the electronic workshop and the meeting. The group consisted of 16 experts, mostly men. People participating in the Delphi experiment aged from 30 to over 60. The different age groups are represented, but, no people younger than 30 have participated. A large part of the participants are working on transportation issues. However, many people also work on issues related to environment, technology or policy. Furthermore, the largest share of the participants

of the expert group work at the university. And finally, most experts originate from Western Europe: Netherlands, UK, Germany and Belgium, some from south Europe (Italy, Greece) and the rest of the world (Israel, United States).

In our study, four different rounds were held; three electronic rounds and one workshop meeting. The electronic workshop had the following goals:

- to ensure that all possible driving forces have been put on the table for consideration;
- to select the driving forces which are uncertain and have an high impact (relevancy);
- to select different themes for the scenario construction.

The result of these three rounds was a general agreement about the conceptual framework and the identified driving forces. When general agreement about the conceptual framework and the scenario elements was reached, a meeting for the construction of the scenarios was held. The aim of this international workshop was to construct four consistent qualitative globalisation and transportation scenarios. The result of this meeting was four crude descriptions of the scenarios.

## 4. Conceptual framework for analysing the implications of globalisation on transport and the environment

Globalisation may have a large impact on transport and the environment. The conceptual framework which is presented in Figure 3 describes the implications of globalisation on transport and the environment. This framework is used for the construction of the globalisation scenarios.

The first part of the conceptual framework represents the driving forces behind globalisation. Investigation of these driving forces is important to understand the complex relationship between globalisation, international transport and the global environment. The five main categories of driving forces behind globalisation are the economic situation, population, the political situation, resource use and technological change. Consumer preferences and firm strategies are not really driving forces in the same sense at the other five, because both firms and individuals react as 'actors' to situations presented by the external driving forces. Changes in these factors create the conditions for the globalisation of the world economy.

The effects of globalisation on the economy, and whether these effects are positive or negative, gives rise to a broad debate among scientists and policy-makers. In general, viewed at the world level, globalisation should enhance efficiency; by making the international division of labour, economies of scale and competition more efficient. This will allow world output to expand, in the form of additional economic growth. The OECD (1997) distinguishes four effects of globalisation on the economy, namely *scale, structural, technology* and *product* effects. These effects do also have consequences on transport and the environment.

The second part of the conceptual framework represents the volume and spatial effects of globalisation and the effects on transport and the environment, by making a distinction between four interacting layers. The first layer represents changes in the volume of international trade flows. Globalisation will lead to larger world outputs: the so-called scale *effects* of globalisation. An increase in the volume of production and consumption may lead an increase in the

volume of transported goods and the number of trips made by passengers. However, expanding world output may be caused by a higher share of services, which have low volumes.
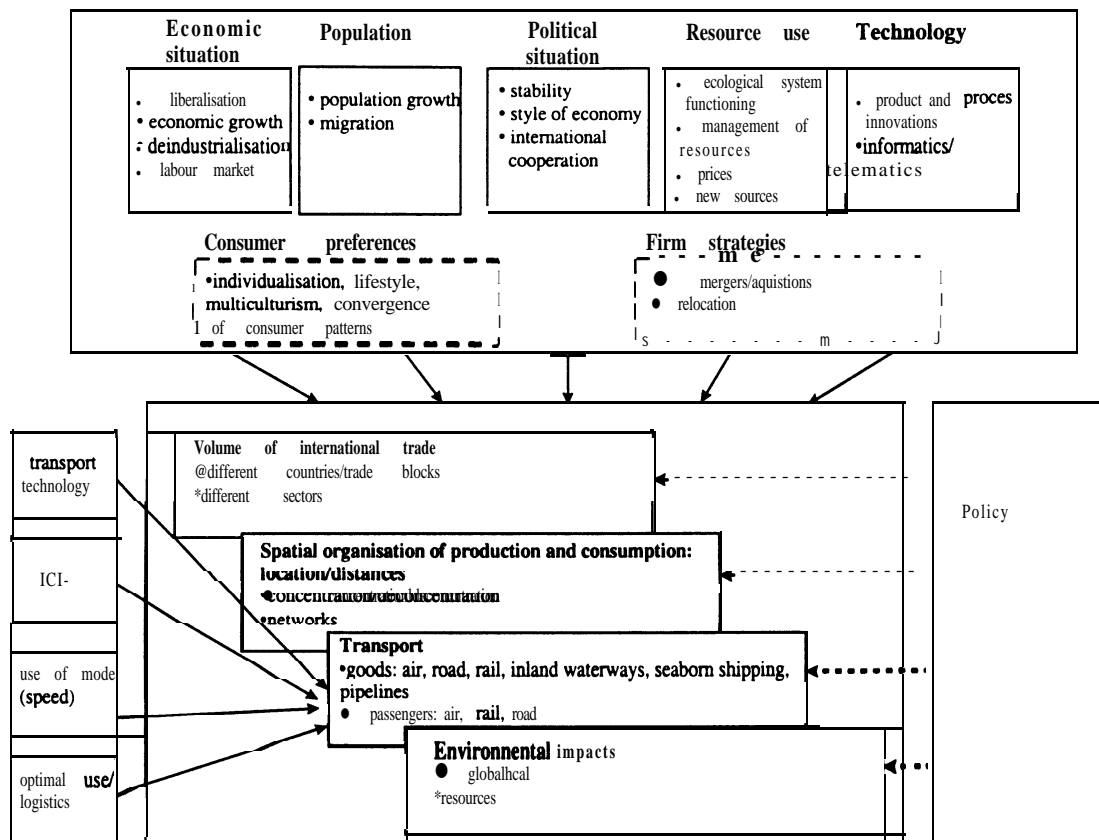


**Figure** 3. Conceptual framework for the construction of the globalisation and transportation scenarios

The second layer represents changes in the spatial organisation of production and consumption activities. Due to specialisation patterns, resulted from comparative advantages and scale economies, international trade will take place. Globalisation will then lead to shifts in the composition and location of production and consumption activities; i.e. the *structural effects* of globalisation. In other words, structural effects involve changes in the country of origin and destination of goods. If globalisation leads to the transportation of goods and passengers over a longer distance, the effects on the environment are negative.

The third layer includes all sorts of transport activities. The seize and nature of transport depends on the state of transport technology, the use of information and communication technology, the modal split and logistics. The *technology effects* refers to the innovation and dissemination of technologies on a global scale. Considering the transport sector this reflects changes in transportation technologies, the use of information and communication technologies, logistic systems and so on. Positive environmental effects can occur as a reduction of emissions per tonnes/km and passenger/km result from these new technologies. Finally, the composition of the

product mix ▪ or *product effects* -determine, for a large extent, not only the volume of the transported goods but also the transport mode which will be used.

Next, the fourth layer are the environmental effects of these transport activities such as noise and air pollution. Apparently, the implications of globalisation on transport and the environment depends on the scale, structural, technological and product effects. These effects are mutually dependent. An increase in the volume of transported goods or the number of passenger kilometres does not merely imply an increase in $CO_2$-emissions. This increase can be compensated by changes in the modal split in favour of the less environmental damaging transport modes or the development of cleaner transport technologies. It is clear that several linkages between the different levels exist.

## 5. Four globalisation scenarios for analysing the effects on transport and environment

Four different globalisation scenarios are developed. A distinction is made between the OECD and the non-OECD countries. The scenarios can be characterised with the following titles:
Scenario 1: 'high growth and strong technological development'
Scenario 2: 'polarisation and migration'
Scenario 3: 'dynamic economies and instability of OECD'
Scenario 4: 'low growth and environmental awareness'

In the following, the scenarios are described in more detail:

### Scenario 1: 'high growth and strong technological development'
*The high and accelerating speed of technological development is the most important force behind this scenario. Strong competitiveness and internationalisation of business are essential elements in this dynamic process, leading to high economic growth in all world regions. Economic systems are increasingly market based induced by a strong liberalisation of international trade. On a world level, international trade increase drastically.*

In Scenario 1, the circumstances for high growth in OECD as well as OECD countries are favourable. The world-wide political situation is stable and solid and democracy is gaining ground, especially in the non-OECD countries. As a result, a growing number of countries adopt open, market based economic systems, which spur economic growth and integration of the non-OECD countries in the global economy. Many countries lower their barriers to the import of goods, services and capital, which stimulates international trade. The high rate of innovation and diffusion of new technologies is an important driving factor behind this strong internationalisation process. The introduction of new products and processes contributes to expanding production possibilities and give rise to new opportunities for economic growth. Strong competitive forces dominate the economy; companies compete in a strongly competitive and internationalised world. Corporations interact on a global scale through a wide range of external alliances as joint ventures, subcontracting, licensing and inter-firm agreements. Firms relocate activities to other areas, on the base of cost rninimalisation and efficiency optimalisation. Because of high growth rates, OECD

countries are confronted with an overstrained labour market, due to labour shortages in these countries. Due to high fertility rates in some countries and a long-term trend towards longer life, high population growth in the non-OECD countries occurs. The abundance of labour in non-OECD countries, low wages, and the opportunities in the OECD countries stimulate economic migration from the non-OECD to the OECD countries. The high economic growth has negative implications for resource use and the environment. Especially in the OECD-countries, the volume effects exceed efficiency gains. In the non-OECD countries, the high technological and economic development is coupled with a rapid increase in the use of resources in these countries, result in large environmental problems such as deforestation, erosion, and so on. Consumer preferences in the OECD as well as the non-OECD countries change considerably. Consumer demand is directed more strongly to the products of other sectors, like services. Furthermore, changing lifestyles and exchange of cultural norms and values influences consumer preferences leading to a convergence of consumer patterns or a so-called 'global consumer'.

### Scenario 2: 'polarisation and migration'

*This scenario is characterised by high economic progress in the OECD countries and the non-OECD countries staying behind, resulting in strong polarisation between world regions. Prosperous economic situation in the OECD countries goes together with high technological progress, liberalisation of trade and finance and a lot of international trade. Unstable political situations, overpopulation and low incomes in the non-OECD countries result in large migration flows from the non-OECD to the OECD countries.*

Characteristic in this scenario, is the increasing polarisation between the OECD and the non-OECD countries. In the non-OECD economies, government policies in non-OECD countries are not market-oriented or outward oriented, the political situation is unstable and liberalisation tendencies come to a stand-still. As a result, among non-OECD countries international trade does not flourish. On the other hand, the OECD economies are characterised by market orientation, high economic growth rates, increasing internationalisation, strong technological progress and stability. Due to far-reaching liberalisation of trade and finance, international trade mainly occurs among OECD countries, and so do international investments. World population is expected to increase drastically, due to increasing life expectancy and high fertility rates. Population is sharply rising in the non-OECD countries, but is diminishing in the OECD countries. Overpopulation together with unstable political situations in a large part of the non-OECD countries, high unemployment rates and low incomes result in large migration flows from the non-OECD to the OECD countries. High technological progress is the ultimate cause of fast growth in the OECD-countries. Due to the unfavourable market circumstances in the non-OECD, new technologies in the OECD are not quickly disseminated to the non-OECD. This lowers economic growth in the non-OECD, even to a longer extend. The economy in OECD countries is more information and service intensive, leading to 'dematerialisation', due to the innovation and diffusion of new technologies. Furthermore, government policies stimulate more sustainable production and consumption by strict environmental regulation. However, less strict regulation in the non-OECD countries leads to a relocation of polluting activities to these countries. Fast raising wealth in OECD affects consumer preferences. Changes in lifestyles resulting from an ageing population, more one and

two person households, and the increasing participation of women in the workforce lead to the use of more ready-made products and services. The less favourable development in non-OECD implies a relative higher demand for agricultural and manufacturing goods.

## Scenario 3: 'dynamic economies and instability of OECD'

*Strong economic blocks in the non-OECD countries arise, as a result of liberalisation of trade and finance, the adoption of free market principles, and more outward oriented government policies. High economic growth rates in these areas are accompanied with severe ecological problems. On the other hand, the OECD countries are confronted with low economic growth rates caused by limited availability of resources, shortage* **of** *labour and a slowing down of the process of technological development.*

In Scenario 3, the political system in most non-OECD countries is stabilised. Government policies are based on democratic principles, are more market based and outward oriented. Trade and finance are more and more liberalised, resulting in an arise of strong economic blocks in the non-OECD countries such as the dynamic Asian economies and in the countries of Latin America, Africa and other Asian regions. The political situation in OECD is unstable. Due to international economic conflicts between the European Union, the United States of America and Japan about imports, agriculture and services, trade liberalisation hampered. The OECD countries are confronted with low economic progress. Labour shortage, limited availability of resources and a slowing down of the process of technological development in the OECD area hinder growth in this region. Population is diminishing in the OECD-countries, while in the non-OECD countries population growth is high. Migration to OECD countries is limited, because of good economic prospects of the non-OECD regions and increasing labour demand. The restrained economic and political situation in the OECD does not stimulate the development of new technologies. The non-OECD countries have a high rate of imitation of technological innovations of the OECD countries. Based on this knowledge, new technological opportunities are developed by the non-OECD countries, resulting in high rate of product and process innovations. The use of resources in the non-OECD countries increases rapidly, following the pace of economic growth. High economic growth causes main ecological problems such as erosion, deforestation, etc. These problems are not tackled in the non-OECD because a strict environmental legislation is missing. In the non-OECD countries, young people are the majority, which are focused on an international youth culture with large similarities in consumption behaviour. A growth in this age group lead to an increasing global demand for products these young people tend to consume (walkmans, etc.); a global convergence of consumption patterns occurs. Firms, particularly those based in non-OECD countries, will tend to internationalise quickly. Large multinational companies from OECD countries profit from good economic conditions of the non-OECD countries. However, bad economic conditions in the home country, do not stimulate further investments and alliances.

## Scenario 4: 'low growth and environmental awareness'

*In this scenario, qualitative aspects of life are more important: the emphasis is on happiness, the local environment and efficiency rather than an increase in income and the physical amount of goods. Norms and values change towards more awareness of environmental problems, more green values, family values, etc.. Production and consumption are localised in stead of internationalised.*

In this scenario, the world decides to insist on a low growth economy due to voluntary agreements. This involves an overall low growth scenario with low growth in OECD countries and modest growth in non-OECD countries. Modest growth in the non-OECD countries is necessary to fulfil main needs and a certain quality of life. The focus is on quality of life, happiness and an increase in efficiency rather than an increase of income and the physical amount of goods. Low growth occurs together with successful voluntary international environmental agreements. These voluntary agreements include norms and goals for the environment and emissions. A stable political situation throughout the world is a condition for successful international agreements. In this scenario, registered unemployment is low in OECD as well as non-OECD countries. Because well-being is more important than prosperity, work is equally distributed over population on the base of equity principles: working hours a week are reduced and leisure time increases. In Scenario 4, the world population increases less than in the other scenarios. Qualitative aspects of life are important in Scenario 4: education levels are higher, better health care services arise, water quality improves, systems of social security improve, etc., leading to an improvement of quality of life, especially in non-OECD countries. As a result, less political violence and conflicts occur, resulting in a decrease of the number of political refugees. As a result of the improvement of the quality of life in non-OECD countries, economic migration decreases. Technological development is forced by ecological awareness. Overall technological progress is not directed to raising production, but is focused on environmental technology. Furthermore, the distribution or spread of technology is based on equity principles. The OECD-countries will export environmental friendly technology towards the non-OECD countries. Due to the extensive international cooperation, non-OECD countries also use the more environmental friendly technologies in stead of the older polluting technologies from the OECD, which are cheaper. New technological opportunities are oriented towards recycling, reuse, improvement of energy and material efficiency, new energy and material sources, etc. Values of consumers change drastically in this scenario: less consumerism, more green values, more awareness of global warming problems, community/ family values etc.. Local products are more important than global products. Finally, scenario 4 is characterised by localised production and consumption. Firms produce for the local economy. Multinational companies relocate their activities to other continents for local production.

In Table 1 the main characteristics of the four globalisation scenarios are summarised.

Table 1. Overview of the globalisation scenarios

| Scenario 1 | Scenario 2 | Scenario 3 | Scenario 4 |
|---|---|---|---|
| **1. Economic situation** | | | |
| • high economic growth rates in OECD and non-OECD | • high growth rates in OECD, low in non-OECD<br>• polarisation | • high economic growth non-OECD, economic crisis in OECD | • low economic growth rates<br>• voluntary international agreements |
| **2. Political situation** | | | |
| • stable in OECD and non-OECD<br>• increasing market based economic systems | • stable in OECD, unstable in non-OECD<br>• strained political relations due to high migration | • unstable in OECD stable in non-OECD<br>• increasing market based systems in non-OECD | • stable in OECD and non-OECD<br>• increasing market based systems |
| **3. Technological development** | | | |
| • strong technological development<br>• catching up of the non-OECD | • strong technological development in OECD<br>• hampering diffusion technologies to non-OECD | • high technological progress in non-OECD<br>• slow down of technological development OECD | • focus on environmental friendly technology<br>• less increase population in non-OECD |
| **4. Demographic development** | | | |
| • strong increasing population in non-OECD<br>• diminishing population in OECD | • overpopulation in non-OECD<br>• diminishing population in OECD<br>• high migration | • increasing population in non-OECD<br>• diminishing population in OECD | • diminishing population in OECD<br>• sustainability |
| **5. Resource Use** | | | |
| • improvement of material and energy efficiency<br>• ... | • improvement of material and energy efficiency in OECD<br>• use of resources in non-OECD increase modest | • severe ecological problems<br>• rapidly increase of resource use in non-OECD | • strict environmental legislation |
| **6. Firm strategies** | | | |
| • internationalisation ...<br>• ... | • internationalisation of business<br>• relocation of polluting activities | • internationalisation of non-OECD firms<br>• convergence of consumer patterns | • localised production and consumption |
| **7. Consumer preferences** | | | |
| • convergence of consumer patterns | • no convergence of consumer patterns | • strong youth culture in non-OECD | • green values<br>• local products |

Scenario 1 is a prosperous scenario from an economic point of view, because economic growth is high in the OECD as well as the non-OECD countries. Scenario 2 is characterised by polarisation of the OECD and the non-OECD countries. Scenario 3 differs from the other scenarios in the sense of high economic growth rates in the non-OECD countries, whereas the economic growth comes to a standstill in the OECD. Characteristic for Scenario 4 is the emphasis on the qualitative rather than on economic growth. In this respect, this is an optimistic scenario from an ecological point of view.

The environmental problems and resource extraction are highest in Scenario 3. Due to high economic growth rates in the non-OECD countries, severe ecological problems, arise. In Scenario 1, new technological improvements increase material and energy efficiency, however, the volume growth exceeds these efficiency gains. In Scenario 2, the OECD countries produce and consume more sustainable, whereas resource use in the non-OECD countries increase modest. The most ecologically preferable situation occurs in Scenario 4 in which voluntary international agreements leads to less material and energy use.

## 6. Case study: the Dutch paper industry

In this part of the paper, an analysis of the Dutch paper industry is presented. The four globalisation scenarios can be seen as the external environment in which the paper industry operates. Within each scenario, assumptions have been made about the development of import and exports. A distinction is made between the imports and exports of pulp, paper and paper board, and waste paper. The implications for transport and environment are derived from the development of trade flows.

### 6.1 Characteristics of the Dutch paper industry

In the Netherlands, paper consumption is high. Between 1961 and 1990 paper consumption increased from 1 million tonnes to 3 million tonnes (OECD, 1962; OECD, 1993). The consumption of paper is largely related to the economic situation in a country. A high income per capita and the strong economic development in the Netherlands, therefore, results in a high consumption of paper per capita.

Table 2. Paper production and proportion inputs, 1960-1995, x 1000 tonnes

|  | production | proportion inputs | | | |
|---|---|---|---|---|---|
|  | paper and paper board | pulp | % | waste paper | % |
| 1960 | 1.025 | 877 | 80 | 220 | 20 |
| 1970 | 1.589 | 1.034 | 64 | 580 | 36 |
| 1980 | 1.714 | 831 | 49 | 857 | 51 |
| 1985 | 1.885 | 639 | 36 | 1.158 | 64 |
| 1991 | 1.901 | 824 | 30 | 1.901 | 70 |

*Source:* (CE, 1988) (for the years 1960-1985); (FAO, 1994) (for the year 1991)

For the production of paper and paper products, the Netherlands are dependent on the import of pulp from other countries. Since the 1970s, waste paper is an important input in the production process. As can be seen in Table 2, the proportion of pulp decreased from **80%** in 1960 to 30% in 1991, whereas the input of waste paper increased from **20%** to 70%.

## 6.2    The Dutch paper industry in four globalisation scenarios

### Scenario 1: 'high growth and strong technological development'

In this scenario, the production and consumption of paper and paper products in OECD as well as non-OECD increase significantly, induced by a favourable economic development. In the non-OECD countries, the increasing population and the changes in consumption patterns leads to a high increase in the consumption of paper. The strong liberalisation of international trade, stable political situation in most countries and increasingly market based economic systems stimulates trade in paper and paper products.

International trade to and from the Netherlands increase: to OECD as well as to the non-OECD countries. The non-OECD countries increasingly participate in the world economy resulting in more imports and exports to these countries. High technological development leads to new opportunities for the use of waste paper as input in the production process which result in a higher proportion of waste paper in the production process. As a result international trade in waste paper further increase, to OECD as well as the non-OECD countries. On the other hand, the Netherlands remain dependent on the import of pulp for the production process. The import of pulp increases, whereas the export of pulp remains very limited.

### Scenario 2: 'polarisation and migration'

The prosperous economic situation in the OECD-countries leads to an increase in the production and consumption of paper and paper products. On the other hand, production and consumption in the non-OECD countries are lagging behind. As a result, international trade in pulp, paper and waste paper is mainly concentrated in the OECD-countries. The participation of the non-OECD countries decreases.

For the Dutch paper industry this implies an increase of import and export of paper and waste paper to OECD-countries, whereas a decrease of imports and exports of the non-OECD countries takes place. The export of pulp remains limited. The import of pulp stagnates as due to unstable political situations in the non-OECD countries. This results in an increase of the use of waste paper, with accompanying trade effects.

### Scenario 3: 'dynamic economies and instability of OECD'

The stable political situation, the favourable economic situation and increasing population in the non-OECD countries lead to a strong increase of the production and consumption of paper and paper products in these countries. Bad economic prospects in the OECD, leads to a decrease of the production and consumption of paper and paper products decrease in the OECD countries. The liberalisation of trade and finance en outward oriented government policies in the non-OECD countries stimulates international trade.

For the Dutch paper industry this implies that the import and export of the OECD countries decrease, whereas the participation of the non-OECD countries highly increase. The volume of international trade to and from the Netherlands of paper, waste paper decreases.

### Scenario 4: 'low growth and environmental awareness'

The awareness of the need of sustainability leads to a more efficient use of paper and paper products. International agreements include the protection of forests. New technologies such as information and communication technologies, are a real

substitute for the use of paper. Besides, the use of recycled paper increase. In sum, the consumption and production of paper and paper products decrease. Furthermore, paper and paper products are mainly produced for the local market. Production and consumption of paper is more localised.

This imply for international trade to and from the Netherlands, a strong decrease of import and export of pulp, paper and waste paper. The use of waste paper as input in the production process increase, but international trade will diminish. International trade is mainly directed to and originated from countries of the European Union.

## 7. An analysis of the effects of globalisation on international transport in the Dutch paper industry

For the analysis of the effects of globalisation in the Dutch paper industry, a distinction is made between the imports and exports of the pulp, paper and paper board, and the waste paper industry. Because transport is a derived demand, changes in transport flows can be derived from changes in trade flows. The consequences of globalisation in the Dutch paper industry, for transport and the environment, are described in scale and structural effects. Technological and product effects are left out of consideration.

The four globalisation scenarios can be seen as the external environment in which the paper industry operates. The implications for transport and environment are derived from the development of trade flows. For the investigation of the development of imports and exports in the four scenarios, historical data of imports and exports are used for the period 19614990. These historical trends are the base for the scenarios. It should be noted that the scenarios are linear extrapolations of the historical data. Therefore, it should be emphasised that the results are rather tentative. In a later phase, a more sophisticated method will be used for the investigation of the effects of globalisation in the paper industry on transport and the environment.

Table *3*. Assumptions of growth of imports and exports in four scenarios, % per year, base year 1990

|  |  | Scenario 1 | Scenario 2 | Scenario 3 | Scenario 4 |
|---|---|---|---|---|---|
| **import of pulp** | . O E C D | +1% | +0,5% | +0% | -1% |
|  | • Non-OECD | +5% | -10% | +5% | +0% |
| **export of pulp** | . O E C D | +2% | +1% | +0% | -2% |
|  | ● Non-OECD | +0% | +0% | +0% | +0% |
| **import of paper** | . O E C D | +3% | +2,5% | +1% | -2**0** . |
| **and paper board** | . Non-OECD | +10% | +1% | +7,5% | +2% |
| **export of paper** | . O E C D | +3% | +2,5% | +1% | -2% |
| **and paper board** | . Non-OECD | +7% | +1% | +6% | +2% |
| **import of** | . O E C D | +3% | +2,5% | +1% | -2o |
| **waste paper** | • Non-OECD | +16% | +1% | +15% | +2% |
| **export of** | • OECD | +3% | +2,5% | +1% | -2% |
| **waste paper** | ● Non-OECD | +7% | +1% | +6% | +2% |

Within each scenario, assumptions have been made about the development of import and exports. In Table 3 the assumptions of the growth rates of imports and exports in the four scenarios are presented. It can be seen that growth rates in scenario 1 are highest. In this scenario, both OECD and non-OECD countries are confronted with high economic rates. This imply also growth in imports and export. Growth rates for the non-OECD are much higher than the OECD, because of increasing participation of these countries in the world economy and the relatively low participation in 1990. In scenario 4, it is assumed that imports and exports from the OECD countries will decrease. For the non-OECD countries a slight increase is assumed. Furthermore, in scenario 2 it is assumed that imports and exports from the OECD countries increase significantly, whereas characteristic for scenario 3 is the high increase of imports and exports from the non-OECD countries. For the OECD countries it is assumed that imports and exports increase slightly. In all scenarios, it is assumed that the import and export of pulp remains limited. Waste paper will be used as an alternative for the use of pulp in the production process.

The following paragraphs describes the changes in imports and exports of pulp, paper and waste paper in the four globalisation scenarios.

## 7.1 The import of pulp

In Figure 4 the development of the import of pulp to the Netherlands from 1961 to 2030 are presented. It can be seen that the import of pulp strongly increased in the period 1961-1970. After 1970, a stabilisation of the import of pulp occurred. The import of pulp mainly originates from the OECD-countries. However, an increase of non-OECD countries as origin for pulp can be observed; from 1% of total imported pulp in 1961 to 8% in 1990. According to these trends, a stabilisation of the import of pulp at the 1990 level and an increase of the participation of non-OECD countries in the import of pulp can be expected.
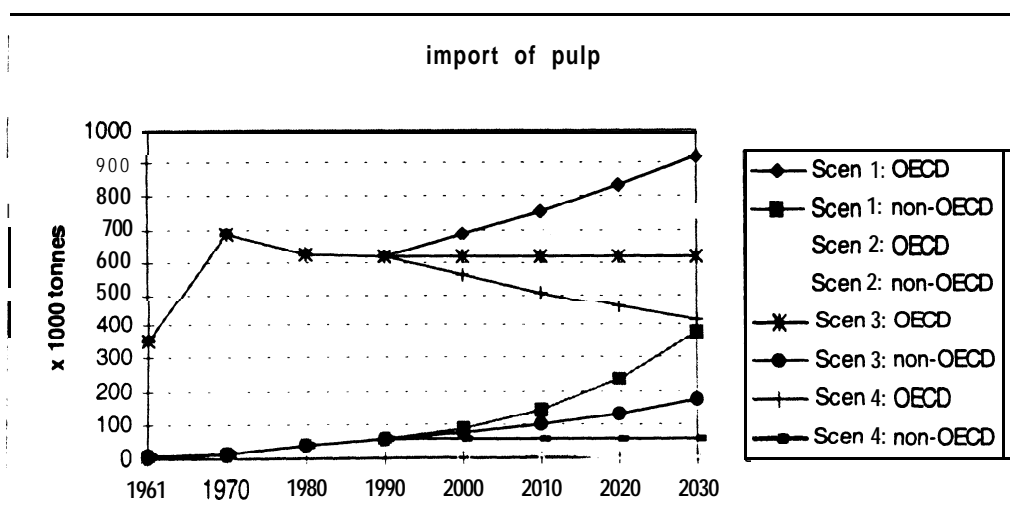


*Figure* 4. Development of the import of pulp to the Netherlands till 2030

Figure 4 shows a high increase of the import of pulp of the OECD as well as the non-OECD countries in scenario 1. In scenario 2 the increase of import from the OECD countries increase less than in scenario 1, because of the unstable economic and political situation in the non-OECD countries. It can be seen that the import from the non-OECD countries decreased most in this scenario. In scenario 3, the non-OECD countries have high economic growth rates resulting in an increase of imports to the Netherlands. Finally, scenario 4 is characterised as a low growth scenario. Pulp imports from the OECD-countries decrease. Pulp imports from the non-OECD countries stabilise: to quarantee a certain quality of life in these countries,

## 7.2 The export of pulp

In Figure 5 the development of the export of pulp from the Netherlands from 1961 to 2030 are presented. The Figure shows that the export of pulp from the Netherlands is very limited. Absences of forests in the Netherlands are the reason for this. Moreover, the export of pulp decreased in the period 1961-1990 and is mainly directed to the OECD countries. According to these trends, it can be expected that the export of pulp remains limited and will further decrease. Furthermore, the export of pulp will only be directed to OECD-countries.
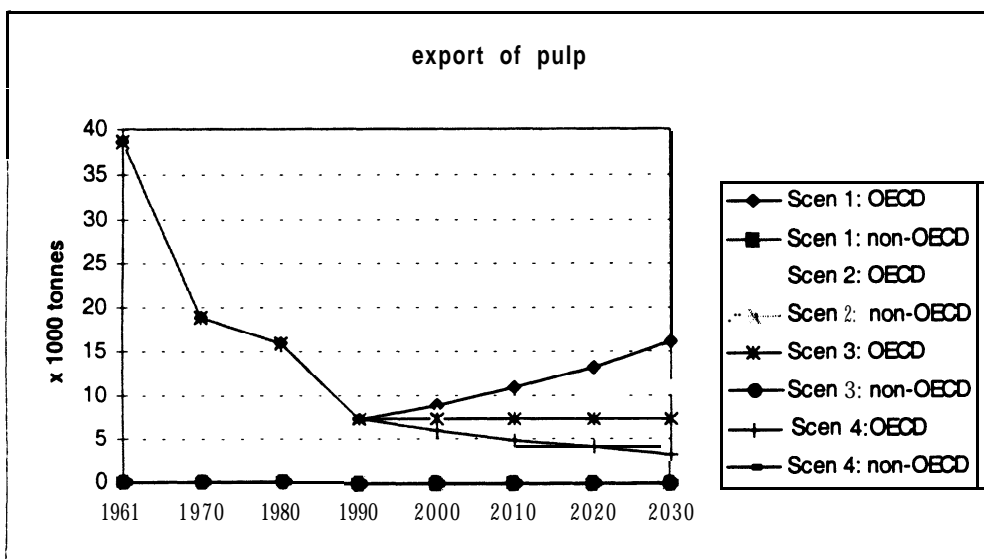


Figure 5. Development of the export of pulp from the Netherlands till 2030

From Figure 5 it can be seen that the export of pulp remains very limited and is directed only to the OECD countries. Scenario 1 and 2 shows a slightly increase of the pulp exports, whereas in scenario 3 and 4 the exports further decrease.

## 7.3 The import of paper and paper board

Figure 6 illustrates the development of the import of paper and paper board to the Netherlands from 1961 to 2030 for the four scenarios. In the period 19614990, the imports of paper and paper board increased strongly. The pattern of origin countries is

relatively stable: imports are mainly originated in the OECD countries. It can be expected that the imports of paper and paper board will further increase and that the pattern of origin countries remains relatively stable.

import of paper and paper board
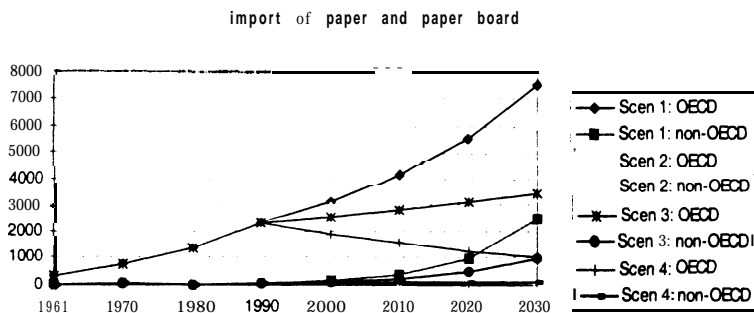


6. Development of the import of **paper** and paper **board to** the Netherlands till 2030

Scenario 1 is a prosperous scenario in which the import of paper and paper board from OECD as well as from the non-OECD countries strongly increase. In scenario 2, the imports from OECD countries increase, but the imports from the non-OECD countries decrease and are relatively small. In contrast with scenario 3 in which the imports from the non-OECD increase, as a result of good economic prospects in these countries. The total volume of imports decreases in scenario 4, in which the imports from OECD as well as the non-OECD countries drop.

### 7.4 The export of paper and paper board

The development of the export of paper and paper board in four scenarios is shown in Figure 7. A strong increase of exports of paper and paper board can be observed.
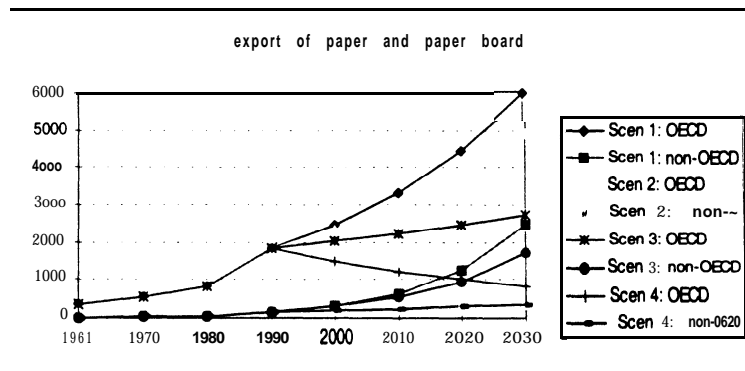
export of paper and paper board



*Figure 7.* **Development** of the export of **paper** and **paper** board to the Netherlands till 2030

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Remarkable is the increase of non-OECD countries as destination; the share of the non-OECD countries in total exports increased from 4,9 in 1961 to 8,3 in 1990. Based on these trends, the following developments can be expected; (i) a further increase of the exports of paper and paper board; and (ii) a further increase of exports towards the non-OECD countries.

The exports of paper and paper board increase drastically in scenario 1, 2 and 3, whereas it decreases in scenario 4. In scenario 4, paper is mainly produced for the locality; this implies less exports of paper and paper board. In scenario 1 and 3, the exports to the non-OECD countries increase significantly due to increasing participation of these countries in the world economy.

## 7.5    The import of waste paper

The development of the import of waste paper from 1961 to 2030 in four scenarios is shown in Figure 8. The Figure shows a very strong increase of the imports of waste paper in the period 19614990. Furthermore, the origin of imports waste paper is mainly concentrated in the OECD countries. According these trends, it can be expected to develop along the following lines: (i) a further increase of the imports of waste paper; and (ii) imports are mainly originated from OECD countries.
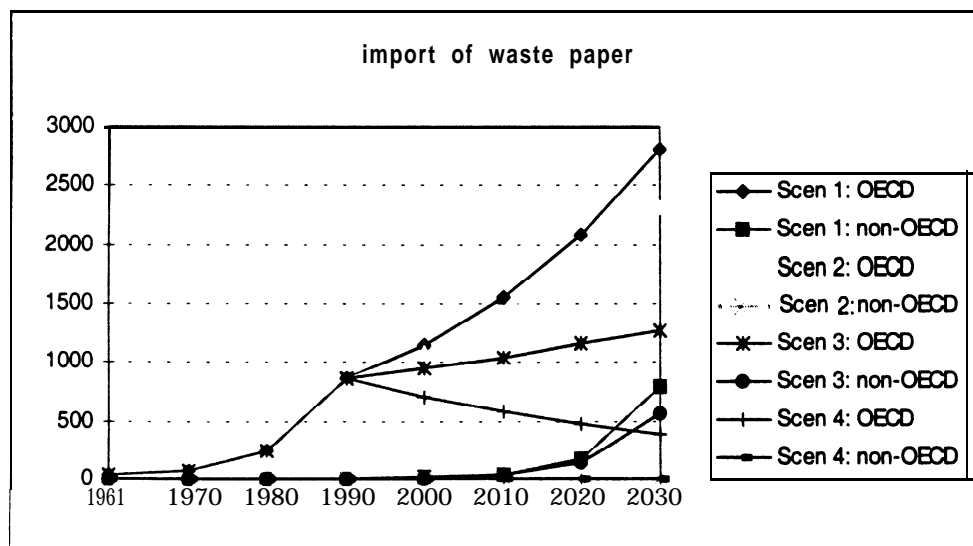


8. Development of the import of waste paper to the Netherlands till 2030

Figure 8 shows a strong increase of the imports of waste paper from the OECD countries in scenario 1 and 2, in which the OECD-countries are confronted with high economic growth rates. Furthermore, a strong increase of imports can be observed in the non-OECD countries in scenario 1 and 3. In scenario 4, imports decrease as a result of more local production and use of waste paper in the production process.

## 7.6 The export of waste paper

The development of the export of waste paper from 1961 to 2030 in four scenarios is shown in Figure 9.



**export of waste paper**

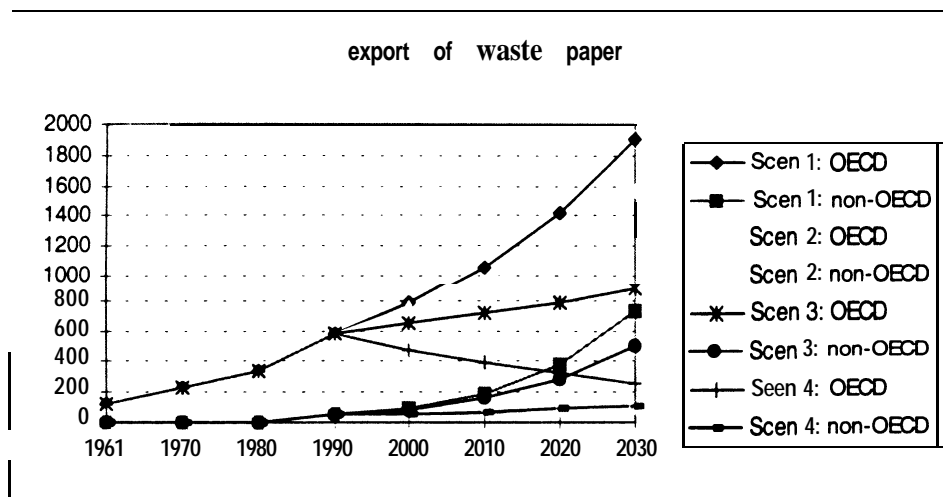| | Scen 1: OECD |
| | Scen 1: non-OECD |
| | Scen 2: OECD |
| | Scen 2: non-OECD |
| | Scen 3: OECD |
| | Scen 3: non-OECD |
| | Seen 4: OECD |
| | Scan 4: non-OECD |

Figure 9. Development of the export of waste paper to the Netherlands till 2030

A strong increase in the export of waste paper can be observed from 1961-1990. The destination of the exports is mainly to OECD-countries. Furthermore, an increase of non-OECD countries as destination of waste paper can be noticed. According to these trends, in a business-as-usual scenario a further increase of the export of waste paper can be expected. Also an increase of the non-OECD countries as a destination for the export of waste paper can be expected.

As with the import of waste paper, scenario 1 and 2 show a strong increase of the exports to the OECD-countries. The export to the non-OECD increases in scenario 1 and 3 as a result of strong economic growth in these regions. Exports in scenario 2 and 4 shows a slightly increase of the exports to the non-OECD. Total exports drop in scenario 4.

## 8. Implications for transport and environment

The effects of the four globalisation scenarios on transport and the environment are summarised in Table 4. The implications of globalisation on transport and the environment in the paper industry are described qualitatively. A quantitative analysis of $CO_2$-emissions caused by the transport sector should include data for modal split, distances and transport technologies. Because this paper focused on scale and structural effects, the implications for transport and environment can be described only in a tentative and qualitative way.

In Scenario 1, the volume of international trade in pulp, paper and waste paper to and from the Netherlands increase. This leads to an increase in the volume of international transport (scale effects). Furthermore, the distance of transportation increase due to increasing participation of the non-OECD countries in import and export figures of the Netherlands (structural effects). International trade and transport

remains highly concentrated in the European area, but a higher share of intercontinental transport takes place. Thus, in general, an increase in the volume of international transport and an increase in average distance will lead to a strong increase in $CO_2$-emissions. It should be noted that product and technology effects are left out of consideration.

Due to a strong polarisation between OECD and non-OECD countries in Scenario 2, international trade is mainly directed to the OECD countries. A strong 'Europeanisation' can be observed: transport is concentrated in Europe whereas less intercontinental transport takes place. The volume of transport to the OECD countries increases significantly, whereas international transport to the non-OECD countries decrease. The overall effect will result in an increase in emissions.

In scenario 3, the economic crisis in the OECD countries leads to a decrease of the volume of international trade and transport. The share of the non-OECD countries in import and export of pulp, paper and waste paper increase, resulting in an increase in volume and distance. The volume of transport slightly increase and so do the average transport distance. This may imply that overall the emissions will slightly increase.

*Table* 4. Summary effects of globalisation on transport and the environment

|  | Implications for transport | Implications for the environment |
|---|---|---|
| Scenario 1 | • *scale:* increase of the volume of international transport<br>• *structural:* increase of average distance due to increasing participation non-OECD | • strong increase of emissions |
| Scenario 2 | • *scale:* increase of volume to/and from OECD<br>• *structural:* strong 'Europeanisation' , less intercontinental transport | • increase of emissions |
| Scenario 3 | • scale: decrease of volume to/and from OECD, increase of volume to/and from non-OECD<br>• *structural:* increase of distance | • slight increase of emissions |
| Scenario 4 | • *scale:* decrease of total volume of international transport.<br>• *structural:* less intercontinental **transport,** decrease of distance | • decrease of emissions<br>• local instead of global environmental problems |

Finally, in Scenario 4, decreasing international trade leads to less international transport. Because production and consumption of paper and paper products is localised in stead of localised, international transport has a European rather than a intercontinental character. New information and communication technologies substitute the use of paper, leading to a reduction of the volume of international transport. The decrease of volume and distance will lead to a reduction of $CO_2$-emissions caused by transport in this scenario. Because production and consumption are localised and less internationalised, the environmental problems will also more localised that internationalised.

# 9 Summary and conclusions

This paper focused on the effects of globalisation on transport `flows` and the accompanying environmental effects? The function, use and method of the construction of the four globalisation scenarios are described. The effects of globalisation are described in scale and structural effects for four globalisation scenarios. The scenarios have the following characteristics:
Scenario 1: 'high growth and strong technological development'
Scenario 2: 'polarisation and migration'
Scenario 3: 'dynamic economies and instability of OECD'
Scenario 4: 'low growth and environmental awareness'

The effects of globalisation on transport and the environment are described more detailed by a case study of the Dutch paper industry. The liberalisation of trade in the paper industry has had large influence on global competition in the paper industry. The effects of globalisation are operationalised via imports and exports of pulp, paper and waste paper.
The following tentative results can be drawn:
- In the last four decades the import and export of paper and waste paper has increased significantly. The import and export of pulp has decreased because waste paper is used as alternative in the production process.
- The import and export of waste paper has increased drastically in the past decades resulting in more international transport. The use of waste paper leads to a decrease of emissions in the production process of the paper industry, however, environmental effects of transport increase.
- Transport volume increase in three of the four scenarios as a result of economic growth (scale effects);
- In scenario 1 and 3 average transport distance increases because of the internationalisation of world trade patterns, in scenario 2 trade and transport is mainly directed to Europe leading to a reduction of transport distance, whereas in scenario 4 transport distance decreases because of localised production and consumption (structural effects);
- An increase of $CO_2$-emissions is expected in scenario 1, 2 and 3;
- Scenario 4 is an environmental benign scenario. However, the implementation of strict environmental policies and the existence of green consumer values are main assumptions behind this scenario.

# Appendix A: Overview import and export of pulp, paper and waste paper

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*5.* Import and export of pulp to the Netherlands, in 1000 ton

| Pulp | 1961 | 1970 | 1980 | 1990 |
|---|---|---|---|---|
| Total imports | 353.4 | 697.2 | 660.9 | 672.4 |
| OECD | 349.7 | 684.3 | 624.5 | 619.1 |
| non-OECD | 3.7 | 11.3 | 36.4 | 53.7 |
| Total exports | 38.7 | 18.9 | 16 | 7.3 |
| OECD | 38.7 | 18.8 | 16 | 7.3 |
| non-OECD | 0.0 | 0.1 | 0.0 | 0.0 |

*Source:* OECD, 1962; OECD, 1972; OECD, 1982; OECD, 1993

*Table* 6. Import and export of paper and paper board to the Netherlands, in 1000 tonnes

| Paper and paper board | 1961 | 1970 | 1980 | 1990 |
|---|---|---|---|---|
| Total imports | 333.5 | 826.7 | 1383.0 | 2345.2 |
| OECD | 326.3 | 772.1 | 1358.5 | 2290.9 |
| non-OECD | 7.2 | 54.6 | 24.5 | 54.3 |
| Total exports | 359.7 | 586.9 | 893.3 | 1997.8 |
| OECD | 341.9 | 543.9 | 837.1 | 1832.9 |
| non-OECD | 17.8 | 43 | 56.2 | 164.9 |

Source: OECD, 1962; OECD, 1972; OECD, 1982; OECD, 1993

*Table* 7. Import and export of waste paper to the Netherlands, in 1000 tonnes

| Waste paper | 1961 | 1970 | 1980 | 1990 |
|---|---|---|---|---|
| Total imports | 29.9 | 75.8 | 247.1 | 861.4 |
| OECD | 29.9 | 74.6 | 245.7 | 859.3 |
| non OECD | 0 | 1.2 | 1.4 | 2 1 |
| Total exports | 131.6 | 225 .0 | 339.5 | 635:0 |
| OECD | 126.9 | 223.4 | 337.5 | 586.0 |
| Non-OECD | 4.7 | 1.6 | 2.0 | 49.0 |

Source: OECD, 1962; OECD, 1972; OECD, 1982; OECD, 1993

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