

# TECHNOLOGY FORESIGHT ON TRANSPORT

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## Abstract

The study compiled by the chairman and the secretary of HTFP panel 'Transport' summarises the main aims, tasks and results of research on transport future analysis. It describes the characteristics and methodology of HTFP – based on scenario building, professional workshops and a large-scale Delphi survey – generally, and evaluates the concrete research methods and results of the panel 'Transport' in detail. The research results up to now are the panel guidelines, the panel images and the Delphi statements on transport. As further tasks can be mentioned scenario building based on the panel images, holding professional meetings to discuss possible future development ways, and writing a panel report summarising the results and giving recommendations for the transport policy.

*Keywords:* transport, technology, foresight.

## 1. The Hungarian Technology Foresight Programme (HTFP)

Governments have the main tasks to improve competitiveness and living standard. Analysing of opportunities and resources, as well as establishing and realizing appropriate strategy can serve for reaching these goals. Technology foresight may be an efficient instrument for collecting and processing information.

Different methods of foresight were elaborated in Japan and the USA, and are applied in several countries in the world. The Hungarian Technology Foresight Programme (HTFP) was initiated by the National Committee for Technological Development in 1997. It will end in 1999.

### 1.1. The Aims and Tasks of HTFP

HTFP aims to create sustainable competitive advantage and enhance the quality of life by bringing together business, science and government to identify and respond emerging opportunities in markets and technologies. It can be solved through analysing present circumstances and trends of the future, formulating the most advantageous possible image, and assigning the ways leading to this image.

The tasks of HTFP can be compiled as follows:

- collection and analysis of information on
  - world market opportunities,
  - trends in (technological) development,
  - strengths and weaknesses of the Hungarian economy and R&D system;
- elaboration of a national innovation strategy as a basis to help Hungarian firms improve their competitiveness;
- strengthening the formal and informal relationships between researchers, businessmen and civil servants;
- spreading the co-operative thinking;
- supporting the joining process to the European Union;
- giving recommendations for public policies.

### *1.2. The Methodology of HTFP*

HTFP is a holistic foresight programme based on both panel activities (scenarios, SWOT analyses, recommendations. . .) and a large-scale Delphi survey. The two-year programme is conducted in three stages:

1. pre-foresight – preparing and awaring;
2. main foresight – collecting data, analysis;
3. dissemination – summarizing, recommendations.

*Pre-foresight* HTFP started in June 1997 by establishing the HTFP office. Awareness seminars were held across the country to promote this new concept among experts and professionals. Several articles about HTFP were published in newspapers and magazines.

A Steering Group (SG) of 19 leading industrialists, academicians and government officials was set up in October 1997 to oversee the Programme. The SG accepted the holistic method of foresight mentioned above and defined the following panel topics:

- Human resources
- Health
- Information technologies, telecommunication, media
- Natural and built environment
- Manufacturing and business processes
- Agrobusiness and food
- Transport
- Finance.

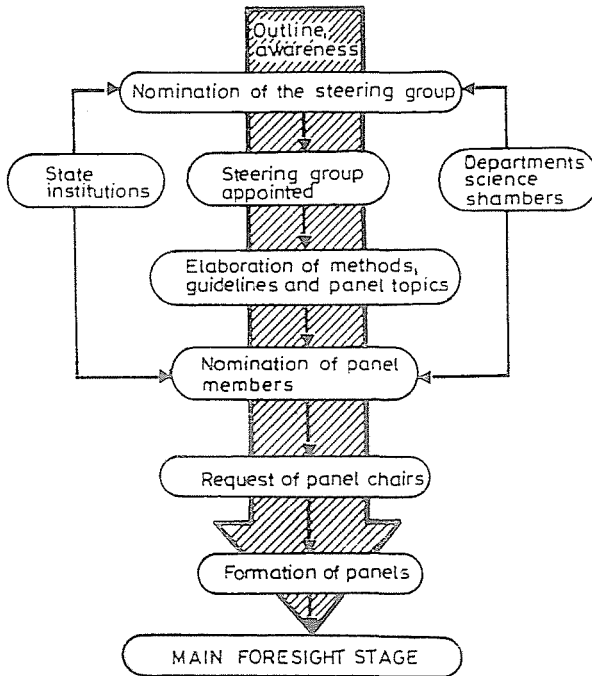


Fig. 1. The pre-foresight stage of HTFP

Panels were formed in March – April 1998. Each panel consists of experts of the disciplines who know the international tendencies and practical experience as well.

Fig. 1 shows the steps of pre-foresight stage. *Main foresight* In the second part of the Programme panels have the tasks to analyse present conditions, to define images and write scenarios, to form Delphi statements, to write a panel report, and to organize professional meetings.

After defining possible images of development, panels have to write scenarios. Scenarios analyse conditions and consequences of different possible events, then set up possible series of actions, which may result in certain images. The most favourable image for the future of the country and its scenario can be chosen by results of Delphi survey and professional meetings.

During the Delphi survey the experts of different professional fields will fill in special questionnaires consisting of Delphi statements and concrete questions. Each panel should define cca. 60 – 80 statements. Typical questions to the statements will be the following:

- respondents' degree of expertise;
- degree of economic impact;
- degree of social impact (quality of life);

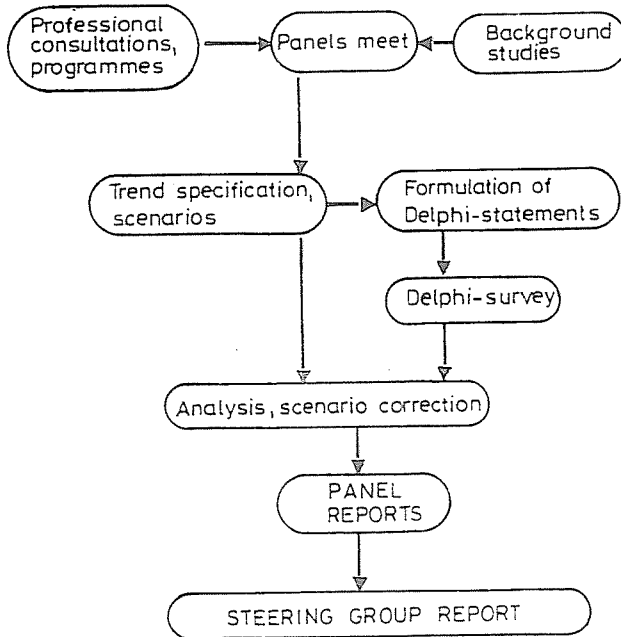


Fig. 2. The main foresight stage of HTFP

- expected realization time;
- position of Hungary compared to developed European countries (R&D, production and service);
- hindering factors (social/ethical limits, technological feasibility, market limits, profitability limits, not enough state resources/subsidy, regulation/standards, not appropriate education).

By processing data coming from the questionnaires professional public opinion can be analysed. The results will be taken into consideration when panel reports will be edited. The Delphi survey of HTFP started in March 1999.

The panels have to organise meetings, which help to create a common thinking about sector-specific problems, and to make formal and informal connections stronger.

Panels will have to summarise their research by writing a panel report. The panel report outlines the most favourable but, at the same time, realistic image, and also recommendations which can help to reach the desirable future.

The Steering Group will complete its final report on the basis of the panel reports. It will consider the broader dimension of initiatives and priorities across the sectors.

The steps of main foresight are shown by *Fig. 2*.

## Dissemination

The completed reports will start an on-going process, the last phase of the Programme, namely dissemination and implementation. This means publications, workshops, seminars and meetings, that should disseminate the results of HTFP. These results are expected to assist firms and enterprises in devising and implementing their strategies to improve competitiveness, to give recommendations for public policies how to realise the most desirable image, and to stimulate continuous constructive dialogue between science, industry and government.

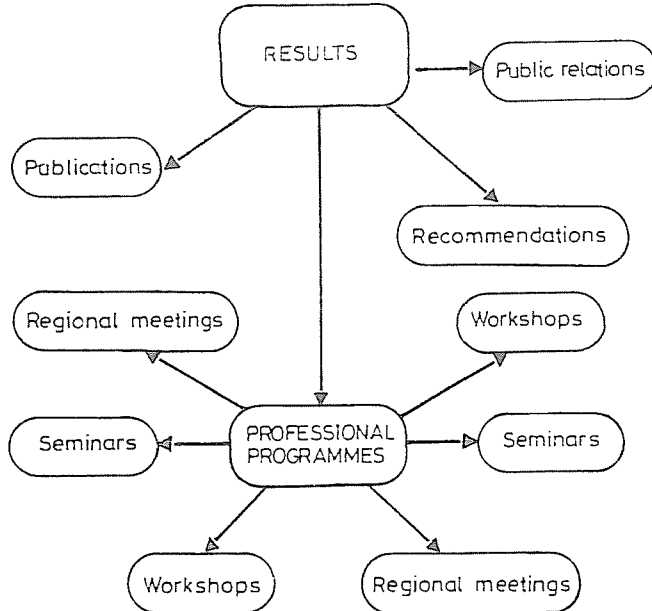


Fig. 3. The dissemination stage of HTFP

The process of dissemination phase is demonstrated by Fig. 3.

## 2. Activity of HTFP panel 'Transport'

### 2.1. Research Results Up to Now

The panel 'Transport' was formed in April 1998. It has the task to identify the main long-term trends in transport fields. The panel consists of several well-known scientists, researchers and experts of transport.

As a beginning of the work the panel was seeking for the most important questions relating to market opportunities and scientific and tech-

nological developments supporting them. The panel members had received special questionnaires and they answered questions like:

- trends or issues and their driving causes that may influence the transport sector up to cca. 2020;
- possible new market opportunities arising from trends or issues;
- possible new products or services to meet the needs of the market opportunities;
- technologies, scientific advances or innovations needed to underpin products or services.

### *2.1.1. The Panel Guidelines*

The panel guidelines for the analysis were set up on the basis of the systematised ideas and the general directives of the Steering Group. The analysis guidelines summarise the main research issues concerning the whole transport sector and its branches. The main statements of the guidelines:

- Development of the Hungarian transport system will be determined by joining the European Union. We have to prepare for law harmonisation and a more competitive transport market. It is important to develop our infrastructure, mainly on the transit corridors.
- Because of the globalisation of trade the international division of labour will be growing, and therefore logistics will be more and more important. We have to prepare to meet logistic and transport requirements by building logistic centres or business parks, and developing the main transit ways.
- Globalisation will make the transport market more competitive: companies have to adapt to the changes, to new conditions. Some of the enterprises will probably go bankrupt which leads to a concentration in the transport market (mainly in road transport sector).
- Preferences of 'sustainable development' can influence the changes in modal split. When the more environment-friendly transport forms are supported by the state or the EU, modal split can have different composition from today's in the future (increased share for rail and waterway, and smaller for road transport).
- The transport market will be co-ordinated by market forces: liberalisation has an important role. The state has special co-ordination fields like public transport or internalising externalities, etc., but it prefers market conform regulatory instruments.
- The most important instruments to develop our transport sector more competitive are innovations and R&D. Hungary does not have big developing potential in basic research fields, so it is more reasonable to adopt international R&D results. On the other hand we can achieve

- new solutions in special fields like diagnostical appliances, etc., new economic, management methods for increasing the efficiency or effective procedures for different environmental examinations.
- The technological development needs well educated and trained human resources – it is an important competitive factor of the country. We should develop our educational methods: the manpower needs mainly new technical, informatical and management knowledge.
  - The right organisation of transport planning and development can help to avoid territorial inequality. Building of transport infrastructure stimulates industry and trade, which attracts capital and creates work places.
  - ‘Sustainable development’ of transport has the main point to protect environment and human life: when planning and developing transport systems aspects of environmental protection and safety have to be taken into consideration. Environment-friendly transport forms, technologies and technical solutions should be supported, externalities of transport should be internalised.
  - Financial resources are limited: not all investment opportunities can be financed. Financial and social cost and benefit have to be considered, economical analysis should be taken in the case of every investment. Investments of public interest can be financed by the state, but the others should be realised in financing by public – private partnership. National capital is not enough, the development needs international financing as well (EU cohesion funds, credits etc.).
  - Poor financing of maintaining transport infrastructure can lead to problems: the technical level of the infrastructure will decrease. Transport companies have to adopt new management methods (controlling), and users should pay for using the infrastructure (road pricing on the basis of time, place and distance).
  - Informatics and telematics have big developing potential in transport fields. Important areas can be: automatic traffic control, optimisation of transport organisation, electronic data interchange (EDI), controlling information systems, etc. By developing information society transport demand can be reduced, which contributes to sustainability of long-term development.
  - Through the technical development there can appear new production technologies, materials and energy sources in transport. Vehicles of the future will be safer, lighter, more environment-friendly and energy saving. They can be driven by alternative power sources, that are different from the traditional engine: solar cells, electricity, bioenergy or hydrogen cells.

Further guideline statements about the different branches of transport are the following:

### *Road Transport*

- Because of joining the EU and the globalisation, liberalisation will go on, the competition will be harder, the environmental requirements on road vehicles will be stricter. In consequence of the former tendencies Hungarian road transport market will be probably more concentrated.
- The growing road transit transport needs well built up motorway network: the main road network needs to be improved.
- Road transport is more flexible, and so more competitive than rail or waterway. According to today's tendency the share of road transport will be growing continuously. This can lead to congestion in certain roads. The problem can be solved by building bypasses, broader use of traffic control systems based on telematics or by restricting road traffic.
- Road traffic should be safer. It needs safer vehicles, better morals – teaching people how to drive on the road rightly – and intelligent co-ordinating systems.
- Road transport causes environmental pollution: traffic should be restricted or vehicles should be made less polluting. Technical development can contribute to solution of this problem: alternative power sources, new recycleable materials and cleaner manufacturing technologies will help to protect our environment.

### *Railways*

- Railway transport should be made more competitive and attractive (the EU prefers this effort), therefore it needs financial and technological reorganisation, and new market-oriented management attitude.
- It would be important to separate infrastructure and operation. Developing infrastructure is a state competence. Operating the network can be practised on market basis. The infrastructure company should provide free access to the network for more operators – at least on the main transit lines. Operating companies should pay fee for using the rail infrastructure, which covers maintaining costs. The state should completely cover the costs of public rail services – public services are ordered by the state on the basis of special agreements.
- Joining the European rail network needs interoperability and appropriate infrastructure. Main lines should be improved, remaining lines should be developed selectively (according to demands). Lines of low transport volume should be closed or given to regional operating companies being formed by local authorities.
- Railway is not as flexible as road transport, so rail is less competitive. But rail can improve the quality and make stronger the marketing of special promising activity areas like long-distance international freight transport, complex logistic services, and high speed or suburban passenger transport.



- Rail should improve the efficiency by rationalising the organisation and establishing integrated operation co-ordinating and management controlling information systems.
- Most of rail vehicles are in poor state of repair. Modernising cannot be postponed, but there are not enough financing sources.
- The rail system is not an environment polluting form of transport, so it could be preferred by the state through financial or regulational support.

### *Waterway*

- Waterway has a limited role in Hungary. Although ships are environment-friendly means of transport, they are not competitive enough as compared to road or rail. Shipping does not have the appropriate infrastructure – well built-up ports or well navigable waterways – either. Ships and shipping technology (push-shipping) must be superseded.
- By joining the EU transit shipping on the Danube can develop in the long run, but it needs improved port and terminal network, and a safe waterway during the whole year. The Hungarian fleet should consist of smaller but more flexible and modern ships. Shipping can be made safer and more efficient through using telematic control systems.

### *Aviation*

- The Hungarian national airlines are not ready for the complete liberalisation of the market, they need to be prepared for the new conditions.
- Regulation of the air transport and state ownership will be reduced, the national airlines will probably join a big international airline company. There can be established new regional airline companies as well. Their activity should be extended to the near regions of our neighbour countries, because national air transport in Hungary is not reasonable – the distance of air transport is unlikely to be profitable.
- Before the open access the Hungarian airlines should be made more competitive through improving the central airport and the aircraft fleet.
- Making too much noise and air pollution are general problems of the air transport. The technical development is likely to result in new manufacturing methods and technologies, which makes it possible to build bigger and safer airplanes, and to develop cleaner and less noisy engines.

### *Multimodal Transport*

- Multimodal transport does not have a considerable share in transport market, however, it is preferred by the EU. It has many development opportunities, mainly in long-distance transit transport. Logistic centres built all over Europe will establish logistic networks, which can be integrated by multimodal transport. Companies organising multimodal transport will be concentrating and internationalising

- We have to prepare for growing demands and improve multimodal capacity: supply should be given in order to stimulate demand for multimodal transport (dense terminal network, road – rail – waterway connections, modern and fast vehicles).
- Multimodal transport is not as flexible as road transport, but through raising service quality and making the co-operation between different means of transport more efficient it can be more important factor in the transport market of the future.
- Multimodal transport needs to be supported and stimulated by the state and the EU in order to enforce its advantages: less environmental pollution, more reasonable modal split.

### *Pipelines*

- Pipeline transport has become more and more important for the decades past, because it is safe and cheap. On the other hand, it needs special transport goods, which are mostly oil, natural gas or chemicals.
- It is recommended to extend the connections of our pipeline network to several directions – to have smaller dependency.

### *Urban Transport*

- Increasing congestion, air pollution and noise cause more and more problems in European big cities. Possible solutions are: city planning, traffic control and organisation – based on information technology – traffic diversion and reduction; restriction of individual car traffic and preferring public transport; making public transport more attractive by increasing supply and quality. These methods should be put into practice in Hungarian cities – mainly in our capital – as well.
- Bringing city planning and traffic organisation into harmony is the competence of the state and the local authorities.
- Going by car is generally more convenient than using public transport. Means of public transport should be modernised, quality level should be improved. Public transport should create attractive supply, an alternative to car. Local authorities have to take part – by giving directions – in making urban modal split more reasonable.

In the months past the panel held several meetings. These meetings were organised as moderated brain storming sessions, and they had the task – according to the guidelines – to establish images and then Delphi statements about the future of the Hungarian transport sector.

### 2.1.2. The Panel Images

The images of the panel were compiled using the analysed and systematised results of the meetings. The images present two different developing directions, the third alternative is a special version of the first one. The images show the possible developing zones of the Hungarian transport sector up to cca. 2020 – 2030.

#### *Image I – optimistic version*

Hungary will be quickly integrated into the EU and will be able to adapt itself to globalising world economy. The country will actively take part in international trade and industry, therefore the home transport system will be an integral part of the European logistic/transport system. Economy will develop at a rapid pace, capital import will grow continuously.

The EU-member Hungary will have intensive economic relations with the EU and the neighbouring countries as well. Smaller regions will have many local contacts. Due to previous processes there may appear new demand on transporting goods and passengers.

The economic circumstances will make favourable conditions to improve transport infrastructure: building motorways in main transit directions, increasing the speed of main rail lines, making main waterways well navigable. Along the Hungarian TEN-corridors logistic centres will be established. Due to these development steps the quality of the Hungarian transport facilities will come near to the European average.

Due to economic development social values will be changing gradually: environmental requirements will be as important as economic conditions. This means that principles of 'sustainable development' of transport will be practically realisable, which makes the composition of modal split more environment-friendly. Influencing mobility demand (by mobility management) and technological development can contribute to this process.

In the transport the market liberalisation will have a ruling role. State regulations will decrease, but in special fields will be more important: giving general guidelines and conditions, maintaining public transport services, financing certain investments, integrated area and transport planning, enforcing externalities and environmental/social preferences. Local authorities will have more competence to operate regional transport networks.

The transport market will be more competitive, which makes it essential to increase quality level of services and to develop quality management systems. This process may rearrange the market structure. Stronger road transport and forwarding companies will be bigger, smaller companies will fail: the concentration rate will be growing. Rail infrastructure and operating will be fully separated. The state-owned rail network will be accessible for more operating companies, which will pay for using the infrastructure. Minor lines of poor transport volume will be operated by regional railway companies. Shipping will be operated mainly by international shipping com-

panies. Infrastructure of air transport will be owned by the state, the Hungarian airlines will be operating as an affiliated company of an international air transport holding. There may appear some regional airlines, too. Urban and suburban public transport will be arranged by local and regional transport associations.

Growth of national economy and international capital investment will give favourable conditions to finance improvements. State will finance investments of social priorities and considerable capital requirements. On other occasions public – private partnership (ppp) financing will be quite widespread.

It will be natural to pay for using the transport infrastructure. Tolls will cover the maintaining costs. Operators of railway network will pay to the state-owned infrastructure company. In road transport tolls will be based on measuring utilization.

Integration and economic development will make a good background to adopt and widespread use of innovations. Goals of technology development will not only be to improve efficiency and profitability, but to protect human life and environment as well.

Informatics and telematics will gain a widespread use in transport. In road transport the use of board navigating systems helping to choose the right way will be general. Systems based on GPS will help to identify moving vehicles. Due to electronic vehicle registration transport performance will be measurable, which makes tolls well founded. Automatic – mainly urban – traffic control systems will provide safe and fast traffic even in jam-packed roads. Development of simulations technics will allow to examine and model traffic flows, which can optimise planning and operative control.

Vehicles of public transport will be equipped with passenger information systems. For passengers personal information systems may be available, which help to plan journeys.

In rail transport computerisation of transport control and management will be realised. Automation of network management will be growing. Shipping will be safer by using telematic instruments. Airports and airplanes will be equipped with automatic navigation devices GPS serving as background.

There may appear new technologies in transport infrastructure network building. Road surface will be more long-lasting and less noisy. Railway track building will be more mechanised. International rail transport control and energy supply systems will be integrated. Waterways can be used more efficiently. Intermodal transport terminals will be well built up and equipped.

Means of transport will be safer, cleaner and more efficient. Engines and construction of road vehicles will be improved continuously. Then there may appear and spread new engine conceptions like hydrogen or solar cells, bioenergy as power source, or electric driven cars. Noise and pollutant emission of cars will be reduced notably.

Construction of rail vehicles will meet the requirements of passengers.

Composition of goods wagon pool will be modernised and more specialised. The old ship fleet will be replaced by modern and more flexible ships. International air transport will use planes of big capacity, regional flights will be carried out by modern smaller planes. Air planes will be less polluting and quiet. Modernising of means of intermodal transport will go on.

Demand on well educated transport experts will raise: more-level education, high-level technical and management knowledge will be required. Users of transport systems will be more informed about rules, tariffs, fare reductions, travelling opportunities, etc.

Position of the different transport branches may be the following:

- Road transport is more flexible and has higher service quality than the other sectors of transport, so it will surpass them. By growing of the motorisation certain roads at certain times can be overloaded. To avoid big congestion and environmental damage, transport demand should partly be diverted to alternative branches.
- In rail transport market orientation will be growing. The network will be used by more operators, which raises competition and makes service quality higher. Railway companies will be able to adapt themselves to requirements, and to provide complex travelling and logistic services.
- Shipping will be carried out by less but more modern instruments. EDI will gain a widespread use in shipping.
- The role of international and regional air (passenger) transport will be more important. The central airport may become an international freight transport centre.
- Intermodal transport will be more profitable: transport organisation and cooperation between different transport companies will be more efficient by using computerised control systems. Intermodal transport may reach a bigger share in the transportation market.
- In the urban transport city planning and transport organisation will be brought into harmony, city logistics will be well organised: from the point of view of mobility a better city structure will be developed. Public transport can provide high-quality services and so an alternative to car; computerised traffic control will moderate congestion: there will be no need to considerably reduce individual car transport.

It will be important to develop the whole transport system, instead of giving preferences to certain interests. Transport planning and improvement should contribute to equal territorial and regional development and making modal split more reasonable.

Summarised: we manage to establish such a transport system that reaches a compromise between our main goals: high quality of human life, arranged environmental conditions and efficient operation.

*Image I/A - consolidated version*

The EU-integration of Hungary will be postponed – it requires longer preparation. Hungary will be an entitled member of the EU later, so it will get

in a temporary situation and have a rather peripheral status. Our international economic connections and the capital investments will be developing step by step. The growth of the national economy will be at first moderate, but later it will be accelerated.

As a result of the previous trends the national transport system will be able to reach the quality level which is needed for the integration only later. The support of transport development will be smaller. The lower grade of integration and economic development make the processes analysed in image I slower.

*Image II – pessimistic version*

Hungary will not be a member of the EU, or very late and at disadvantageous conditions. The country will not participate in international economic processes, the national economy will be less opened and our business relations with the developed countries will not be extended significantly. Hungary may have a dominant peripheral role.

The development of our neighbouring countries will be the same as ours: it will be falling behind the European level. The countries of the region will have to develop their internal contacts. The eastern countries of Europe may have anarchic characters, and will be more and more isolated. Because of the postponement of integration and globalisation there will not be considerable demand for growth on transport.

The national economy will stagnate or reach a growth rate of 1 – 2% per annum. There will not be considerable capital import either. Therefore there will not be available enough financing resources to realise important infrastructural improvements.

Instead of developing infrastructure there should be made more efforts to use the existing capacity better. Limited financing resources should be used more efficiently. The gap between the Hungarian transport system and that of the EU continues to grow, the national transport will not be able to meet the requirements of interoperability. The road network will not be extended, its quality will get worse. The rail network will not be maintained properly, only some of main lines will be improved. Waterways will be less navigable, the capacity of central airport will not be improved, regional airports will not be built up. Realisation progress of logistic centres will be slow, their utilisation will not be considerable.

Society prefers economic development to 'sustainable development', because living standard and welfare conditions will get worse. Environmental priorities will get of minor importance. Therefore a strong state regulation will be required to stop unfavourable tendencies, but these not market-oriented forced measures will not be enough efficient: the share of road transport will strongly increase, rail will be pushed into the background, and shipping will be marginable.

The failed EU integration means that law harmonisation cannot be realised in transport sector: unregulated and unfair conditions may dominate in transport market, social interests cannot be enforced. The state

will have a rather problem solver role: possible enforcing of environmental priorities, deficit financing of public transport services, and financing of necessary investments.

Because of the failed globalisation, the transport market will not be competitive enough. The road transport and forwarding market will remain rather divided (many small enterprises, lower concentration). The rail sector will be dominated by state-owned national operator, which needs financial support again and again. Shipping will be operated at low transport volumes. The national airlines will be able to survive at strong state preferences and support.

The limited financing resources will not allow to realise many investments: improvement alternatives should be analysed thoroughly. Financing will be carried out mainly by state, participation of private capital will be rather marginable.

Using and financing transport facilities will not be connected: the society will not accept tolls. Maintaining costs and their resources will be independent, which will lead to financing problems. These problems will require state support.

The lower rate of national economic development, the lower capital concentration and the peripheral state of the country will not provide chances to the technological development, but the critical state of transport infrastructure will require at least a minimum level of innovation. The adoption of new technologies can be carried out only later, which results in lower improvement of efficiency.

The extended use of informatic and telematic instruments will be unavoidable. Congestion in roads will be a considerable problem, which needs a solution of computer integrated traffic control. The rail should improve its transport organisation and management systems in order to become more competitive. The international standards of aviation will require the improvement of air navigation and information systems.

Instead of development of transport networks the maintenance will be more emphasised. Protection of the national infrastructure from backwardness is to be solved.

The composition of vehicle stock will be generally unadvantageous. The average age of cars and lorries will not fall significantly, more modern and environment-friendly, safer types of vehicles can gain a widespread use only later. Rail will have many obsolete locomotives and waggons, which need to be sorted out. The old vehicles of poor state make the rail less competitive and attractive. The old technology of shipping will not be competitive. Air transport will be carried out by old planes as well. Instruments of multimodal transport cannot be improved, because of the unprofitability of this transport form.

The educational level of human resources will remain rather low – there are neither demand nor chance to develop education on transport. There will not exist information channels to inform people about transport facilities.

The Hungarian transport system will be less competitive than the ones of EU-member countries. Under these hard circumstances position of transport branches may be more differentiated than in the previous versions:

- Road transport will enforce its advantages (profitability and flexibility) over other branches more intensively, and so will be able to increase its share in transport market. Congestion will be more intensive, and old vehicles will cause serious environmental damages. Society will not be aware of these problems, and there will not exist alternatives – undeveloped rail and waterway – to pass demand into other branches. The state regulation itself will not be able to stop these dangerous tendencies.
- Efficiency of rail transport will be hardly better, its organisation and management will be improved rather slowly. The national railway company will require continuous state subsidies. The minor lines of small transport volume will be liquidated gradually. The rail transport system will not be able to stop decreasing demands.
- Transport volume of waterway transport will be marginable. Because of missing infrastructure and low service quality the demands will strongly decrease.
- Our national airlines operate at strong state support, but it will be more and more defenceless in international competition.
- Because of its poor profitability intermodal transport will not be a competitive transport form, its deficit will be financed by the state. Intermodal transport will not be able to offer appropriate service, so its role will be smaller and smaller.
- Urban transport networks will not be able to cope with increasing traffic, environmental pollution and congestion will be growing. Decreasing quality level of public transport will not stimulate people to change for tramway or bus. Traffic may be partially and periodically reduced.

The goals of national transport planning will be subordinated to some priorities instead of coping with problems of the whole transport system. Territorial development differences cannot be moderated, which can lead to social tensions. There will not be many possibilities to influence the unadvantageous modal split either.

The national transport system may get into a dangerous process, which makes it impossible to keep up with developed countries.

The combination of different trends mentioned in the images can lead, of course, to other image versions.

The images were sent to the panel members and to other experts, who expressed their opinion about it. Considering the comments corrections were made to specify the ideas about the transport development.



### 2.1.3. The Delphi Statements

On grounds of the images several Delphi statements were formed for the Delphi survey. From these statements 58 were picked out by the panel, which will represent the images. The distribution of selected statements is shown in *Table 1*.

*Table 1.* The distribution of Delphi statements

Transport branch	Number of statements
the whole transport system	13
the road transport	16
the rail transport	9
the waterway transport	2
the air transport	3
the intermodal transport	3
the urban transport	9
$\Sigma$	55

### 2.2. Further Tasks of the Panel

The Steering Group and the Direction of HTFP are going to make a scenario about the possible general trends of Hungarian development (called *general macro scenario*). The alternatives of the macro scenario give a special 'frame' to the panels, which helps to create their own scenarios.

The panel has the task now to prepare for scenario building on transport development. Main topics have to be defined, which need to be examined in detail by writing background studies and holding professional meetings. There should be defined considerable (technological) turning points with their effects, and the strengths and weaknesses of Hungarian transport system. The topics are the following:

1. How will/can the transport demand develop in Hungary up to 2020 – 2030?
2. Should we influence/reduce/rationalise transport demand on mobility? If yes, then how? How will mobility change through developing the 'information society'?
3. What will the attitude of society be to 'sustainable development'? Will it influence modal split?
4. How will/can the modal split develop? Should we influence the tendencies? If yes, then how?
5. What tasks should the state have in transport regulation/development/financing?

6. What conditions will be ruling in transport market of the future? Will it be more or less competitive? How will these conditions influence service quality and market structure?
7. What development steps are needed to improve national transport infrastructure? What order of priority can be settled between them?
8. What financing opportunities and constructions will the infrastructure development have in the future?
9. How will the maintenance of transport infrastructure be financed? Will tolls have an important role?
10. How will informatics and telematics be used in transport?
11. What kind of new technologies will be applied in building transport networks?
12. What technological innovations can influence designing vehicles?
13. What kind of educating methods will be able to contribute to establishment of a well-prepared expert staff on transport?
14. How can territorial development and transport planning be brought into harmony? How can transport development contribute to reducing regional inequality?

The panel is going to invite experts to write studies on topics mentioned above, and organise professional meetings as well. In these meetings experts from universities, research institutes, transport companies, government organs, chambers and other interests protection organisations can discuss the main issues, which contributes to panel's work, to making scenarios.

Starting point of scenarios will be the panel images and the general macro scenario. Then several possible future turning points and main events will have to be defined and ordered into series of actions and events. In the scenarios the possible interfering opportunities should also be shown and analysed.

The results of Delphi survey will help to choose the most appropriate image of transport development by asking several experts on transport.

After the most possible image – and so the most possible scenario based on the image – has been chosen, recommendations can be made, how to take advantage of possible opportunities and how to avoid possible dangers.

### 3. Macro Scenarios for Transport Policy

In this phase of the work – according to the main conclusions of the professional workshops, the background studies and the international experience – three macro scenarios of the transport development have been identified to meet the targets for 2020-2030. The scenarios are designed to show different combinations of policy alternatives, combining strategic and external elements.

The strategic elements are the following:

- technological improvements, new fuels, improved load factors and modal shifts (*Technology*);
- decrease in transport intensity of GDP, that will allow the volume of transport to increase at a rate which is less than the economy at large (*Decoupling*).

All scenarios rely on both strategies, but in different proportions. Three combinations of strategic elements are used:

1. fast dissemination of cleaner technologies and fuels combined with a moderate degree of decoupling (Technology+++/Decoupling+);
2. a moderate pace of technological improvements combined with a considerable degree of decoupling (Technology+/Decoupling+++);
3. both fast technological improvements and a considerable degree of decoupling (Technology++/Decoupling++).

The external elements – A successful handling of many environmental problems requires agreements and cooperation outside the market, either by political intervention or by ‘grassroots’ initiatives by those affected, or some combination of both. Hence the attitudes towards cooperation in society will affect the possibilities of meeting the targets – three alternatives are distinguished:

1. *Local cooperation*: polarisation at the global level, politics is mainly driven by local and regional initiatives (bottom-up politics). Local and regional aspects are high on the political agenda, while global issues are a bit lower down.
2. *Global cooperation*: free trade and striving for consensus on environmental issues. At the local and regional levels the attitudes towards cooperation are more passive, as the political agenda is mainly driven by national and EU politicians. The focus is more on high level problems (top-down politics).
3. *Glocal (Global – Local) cooperation*: promotes an accord between local, regional and supranational initiatives and objectives – a kind of harmony between bottom-up and top-down politics.

The possible macro scenarios are shown *Table 2*.

The scenarios result from the combination of the three strategies based on cooperation at the local, global and combined levels, together with differing levels of technological development and decoupling. In total there are nine combinations, from which three have been selected for further detailed development:

- Scenario T2 has been chosen as the most interesting and internally coherent case in column 1 where technology will be pushed hardest – this is Global Cooperation for Sustainable Transport.

Table 2. The nine scenarios obtained from combining the two dimensions (selected scenarios in bold)

	Technology+++/ Decoupling+	Technology+/ Decoupling+++	Technology++/ Decoupling++
Local cooperation	T1	<b>D1</b>	TD1
Global cooperation	<b>T2</b>	D2	TD2
'Glocal' cooperation	T3	D3	<b>TD3</b>

- Scenario D1 has been chosen from column 2 where decoupling is seen as being most important - this is Co-ordination of Active Citizens.
- Scenario TD3 has been chosen from column 3 where a balance is sought between technology and decoupling - this is the Accord on Sustainability.

#### 4. Conclusion

As the country is undergoing fundamental economic and social changes - transition towards market economy -, major institutions are currently shaped. Therefore a systematic analysis of the future has to be done to assess Hungary's future position.

Hungary has joined the developed countries having launched foresight programmes. The HTFP is the first foresight programme in Central and Eastern European transition economies. Technology foresight is being made on several branches of the economy, on transport as well. The research results of HTFP panel 'Transport' can help to plan future trends or tendencies, and necessary influencing measures on transport fields by stimulating co-operation between science and practice.

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