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TRANSPORT TECHNOLOGIES AND EUROPEAN INTEGRATION

ABSTRACT

The paper deals with the main features of the technological development of transport modes in the frame of integration. Economic integration needs a special transport approach quite different from traditional one by transport turning into a propulsive logistical-distribution system. A new quality level of transport services being required ("just-in-time" principle) leads to the development of intermodal system, which warrants consideration of mode-independent requirements. Thus, the intermodality principle should be regarded as the basis for future integration processes. However, it is hampered now by an enormous development of road transport with its economic advantages and underutilization and low efficiency of railways and waterborne transport. Technical provision for the intermodality includes new rolling stock, new handling facilities and renovation of the network. The Trans-European transport network project (TEN-T) is being aimed at the intermodal (combined) transport development taking into account fuel consumption, ecological and economic efficiency features.

KEY WORDS

transport as an integrated logistical-distribution body, mode-independent approach, «just-in-time» principle, modal split, unitisation of cargo, intermodality as basis of integration, main features of technological progress in transport in the frame of integration

1. INTRODUCTION

European transport is showing an increasing modal split imbalance as well as signs of inefficiency. The gap between the changing economic development requirements and the ability of the different transport modes to cope with them is growing. The new transport policy should aim at increasing the flexibility of transport systems as a whole, at establishing an overall transport system, functioning as an integrated logistical-distribution body. Only such an approach can provide a well-balanced and efficient use of the available transport capacity (infrastructure, rolling stock, terminals and transport hubs, handling equipment, loading units, modal-based services and regulations) at different territorial levels and in different European regions and countries.

The new integrated European transport policy should proceed from the requirements of turning the transport modes with their task of serving the economy (this suggests the independent development of each transport mode and strong competition among them) into a propulsive industry, insuring not only economic growth, but also a principally new type of development: the structural changes to the economy as a whole. Such approach guarantees consideration of mode-independent requirements.

This extremely difficult and important task has required not only the modernisation of particular transport modes (as had been done earlier), but also a crucial reorientation of the transport system as a whole with the purpose of turning it into an integrated logistical and distribution system, providing a principally different quality level of transport services under the "just-in-time" principle.

These changes have become possible partly due to crucial alterations of cargo composition towards higher value of the unit cargo, lower unit mass and greater variety (hi-tech products). Transport users' requirements have changed considerably as a result. On the other hand, the transport share (F) of the consumer prices (CIF) has been shrinking due to the increased production costs (C), and, consequently, higher insurance (I). Hence, the occurrence of the main transport phenomenon: lower sensitivity of consumer product prices to changing transport costs. Today, transport costs make up less than 5-7% of the average production value in different economic sectors, even when taking into account the indirectly included transport costs. This situation is drastically different from the pre-war and immediate post-war period, when the carried cargo consisted mainly of mass and bulky goods and the transportation share in the production value reached 40-50%. So, the cost factor in the transport services has lost its decisive role for the consumer.

As was mentioned above, all these alterations occurred as a result of the economic and the overall society transition towards the post-industrial era, which can be defined as follows:

- globalisation of the economy;
- lowering of the resource-intensity production;
- alteration of the sectorial structure of the economy towards the tertiary sector;
- modifying the industrial sector towards the manufacturing and hi-tech branches;
- increasing openness of the national economies and the outstripping growth of international trade;
- growth of transport mobility of the population and of tourist sector,
- enormous geo-political changes in the past decade and expansion of the West-European integration eastwards;
- growth of ecological awareness within the society.

These shifts have unavoidably called for dramatic alterations in the traffic pattern and the transport system structure. This has primarily involved the following:

2. CHANGES IN MODAL SPLIT

It is a well-known fact that the chief actors in this game are now railways and road transport. The mode-dependent service requirements and the business-as-usual approach have prevailed in the transport sector for a long time, and it has caused a strong inter-modal competition and a spontaneous division of labour. This, in its turn, leads to heavy underutilisation of railways and water-borne transport capacities, whereas the road goods transport market share increased from 50% in the 1970s to 72% at present. The rail transport share consequently shrunk from about 32% to less than 15%. This tendency is likely to continue if present trends persist /4/.

An analysis of transport patterns shows that due to their specific economic and technical character, each transport mode has a different potential to adjust its activity to the principally new requirements of customers, such as flexibility, reliability, speed, punctuality, safety, access to information, improvement of tracking and tracing, cost-effectiveness, etc. All these requirements are covered by the just-in-time principle, which has generally led to a *substitution of inventories*.

The total demand for transport services has in general been higher than the economic growth. Forces driving this process include changes in the spatial organisation of economic activities (e.g. the development and the completion of the Internal Market, intensification of West-East trade links), reduction in real transport prices and changes in logistics systems. This process is being accompanied by a market shift (mentioned above) away from modes of transport that are relatively energy-efficient and, therefore, ecologically safe, towards road transport. An important underlying cause of this modal shift are the customers' new requirements: their dissatisfaction with quality and flexibility of these modes.

Apart from these objective factors, the subjective factors play a big role, too. Thus, the European railway operators, mostly state-owned and accustomed to their monopolistic position on the transport market established during the pre-war decades, were unable to rise to the occasion and in the post-war period were reduced to silently observing the drastic changes in the transport market patterns. Nevertheless, moves towards modernisation of railways have, in general, not been undertaken (except for some HST projects), state subsidies being capable of meeting exclusively the network servicing needs. Almost every railway enterprise has been unprofitable.

At the same time, due to its specific virtue (door-to-door delivery), road transport was developing rapidly. Its share of freight traffic during the three decades increased in the EU region from 35% to 72%, and of passenger traffic (private cars) — from 49% to 79%. Besides the already mentioned enormous economic advantages, road transport was actually relieved (unlike the railways) from the burden of infrastructure financing. Thus, the post-war modal split change was taking place more or less spontaneously, following market forces, while the different transport modes were placed in different competitive conditions.

3. STANDARDISATION AND UNITISATION OF CARGO

This approach was introduced about three decades ago in an effort to speed up cargo trans-shipment and the new transport process as a whole, to use the economy of scale principle by dealing with costly and smaller consignments being transported in growing amounts.

The process of cargo standardisation and unitisation has led to the development of special traffic facilities and loading units in accordance with the new requirements of transport services and their users. Harmonisation of standards for sizes, weights and other parameters across modes has facilitated the mode-to-mode transfers for a rising proportion of goods to be transported. New loading units and flexible trans-shipment technology allow for modular capacity planning and utilisation. This gave a powerful boost to the creation of an overall *container* system, including the establishment of container "land-bridges". Despite higher tonne-per-km tariffs, the total transport and overall costs of cargo incurred are lower due to quicker turnaround times that allow for a significant reduction in inventories and working capital that would otherwise have been tied up in goods awaiting delivery.

Developed initially as a means of speeding up dockside cargo transfers onto ships and reducing the amount of time vessels spend in port, the container has now become a dominant feature of all major transport modes apart from pipelines. The establishment of a comprehensive container system could be considered as a step of long-term evolution of the transport system characterised by a sequence of replacements in which faster and (this is crucial) higher-quality transport modes and technologies substitute traditional ones. The more the container system is developing, the less the specific features of particular transport modes are manifest. The smooth interaction provided by containers between different transportation modes is being shaped by the quest to increase speed, flexibility and quality in transportation turnover.

Such development has primarily provided for a restructuring of each transport mode: introducing new vehicles and rolling stock, telecommunications, operation and service systems and new handling equipment in specially built terminals. The main goal of this process has been to reach the standardisation of the transport chain in order to boost its economic efficiency. But container delivery within one specific mode of transport has failed to implement this task of increasing the efficiency of the system as a whole.

4. INTERMODAL TRANSPORT

The door-to-door delivery approach, which reflects the new transport service requirements, tends to transfer from each mode-oriented approach to the mode-independent, *intermodal* one. The promotion of intermodality is a tool enabling a system approach to modern transport. This principle is regarded now as the core of alteration of the transport system as a whole. The intermodality goals are:

- to realise the standardisation benefits;
- to utilise the cargo unification requirements;
- to use the advantages of each transport mode and mainly shorten or optimise the length of haulage;
- to utilise the spare capacities in non-road transport modes.

However, there are some obstacles, which are preventing the optimal use of an intermodal system. These include the lack of a coherent network of modes and interconnections, the lack of technical interoperability between and within modes, a variety of regulations and standards for transport means, and data interchange procedures. There are as yet uneven levels of performance and service quality between modes, different levels of liability and a lack of information about intermodal services. As a result, mode-independent door-to-door intermodal carriage has up to now been underdeveloped.

The concept of intermodality does not aim at or relate to a specific modal split, but rather addresses the integration of any mode (in most cases road transport is participating) at three levels:

1) infrastructure and transport vehicles;
2) operations and the use of infrastructure, especially terminals;
3) services and regulations (from the modal-based to the mode-independent approach).

As mentioned above, in the framework of intermodality, each transport mode is being put in a different (non-uniform) competitive position due to some objective as well subjective circumstances. These differences have been materialising at various levels: of spare capacity, of operational costs, of flexibility, of energy- and resource-intensity, of safety and security, of internalising external costs, of the effect on the environment and of riding comfort. And above all — the different level of transport service quality, which is especially sensitive to customer demand. This explains the role of road transport within the modern transport system.

It is quite clear now that *intermodality* is the only way of improving the potential of rail and waterborne transport by offering effective alternatives to uni--modal road traffic. It has proved impossible to remove its participation in the intermodal system; instead, it has been limited to a certain level reflecting the specific features of the road transport. Intermodality is, therefore, the most important part of an overall strategy for developing sustainable mobility.

The speedy development of road transport is fraught with some serious drawbacks: congestion, increasing accident rate, noise and rise in carbon dioxide emissions. There has been a marked shift away from the relatively energy-efficient modes towards road and air transport.

Due to a progressive shift towards road transport, the growth in energy demands and consequently in carbon dioxide emissions has been outpacing the rates of production and consumption. Transport energy demand is currently supplied almost entirely from fossil fuels, mainly oil. Carbon dioxide emissions from non-transport sectors appear to have been de-coupled from fuel switching (in electricity generation), structural change and improved energy efficiency. Only in the transport sector did emission growth outstrip the economic growth. In the EU the share of transport-generated carbon dioxide emissions in the overall volume of emissions increased from 19% in 1985 to 30% in 1999, and road transport share amounted to 85% of total transport emissions.

The estimated specific emissions of carbon dioxide (per unit of traffic) amounted in freight traffic by road to 190 grams, by rail – to 30, in passenger traffic – to 125 (cars) and to 65 respectively. Since road transport is relatively energy-intensive, economic development has increased energy use per tonne of freight shipped and passenger–km performed. Besides, the relation between t-km and mileage in road freight traffic does not seem to have changed much: 30% of the trucks are running empty and the loading ratio does not exceed 50%. Passenger road transport, especially by private cars, is even more under-utilised.

All these circumstances suggest that the positive growth of the prospective transport system depends to a large extent on the future technological development of road transport. But the so-called "diffusion of innovations" has its own, often unpredictable, ways. However, that is where the phenomenon of inertia of the transport sector comes in (especially in the case of infrastructure) caused by its capital-intensity and low intra-sectoral efficiency.

The thrust of joint activities of the European countries in the 21st century will, therefore, be directed towards further development of modern transportation means and traffic systems with respect to reduction of fuel consumption, environmental impact, enhanced safety and riding comfort. But these conditions will unavoidably lead to certain technically conflicting situations (for more details see also / 2,6/).

As for the safety factor of road vehicles, the joint efforts will have to be directed towards developing a new Electronic Stability Programme (ESP), which consists of:

- an Anti-lock Braking System (ABS);
- a system for automatic regulation of braking forces distribution;
- a system for the regulation of driving wheel skidding;
- a system for avoiding vehicle swerving.

With buses and lorries, disc brake mechanisms will have to be used, which are more reliable in operation and easier to maintain as compared to conventional drum braking mechanisms.

It is a well established fact that about a third of all traffic accidents happen at night, therefore, the method of lighting the road by vehicle lights should be aimed at reducing the incidence of blinding the motorists in oncoming cars. There is a need to establish automatic electro-mechanical regulations for the headlights angle, giving advantage to dynamic regulation: an electronic regulation device, which is, on the one hand, connected with an appropriate sensor on the front and on the rear axle, and on the other hand, with electric motors on the headlights.

Fuel consumption level depends on many factors, but a major factor is the engine efficiency. There is a limit to improvements that can be made to the internal combustion engine. Therefore, the technological answer to the problem of fuel efficiency, and, consequently, to carbon dioxide emissions, lies in the development of alternative propulsion technologies. But even with the traditional engine, motor vehicle manufacturers in Europe plan to reduce fuel consumption within a decade by one-third, through modifications to the engines and appropriate structural solutions on the vehicles themselves. Greater use of Diesel engines for the propulsion of passenger vehicles can affect the ecological situation, because they emit little CO_2, but they produce important quantities of other pollutants, including fine particles.

The volume of harmful traffic-generated components is not related exclusively to direct emissions from the vehicles due to incomplete fuel combustion and fuel evaporation from the vehicle tank as well as to turning off a warm engine, but it is also indirectly related to the production of electricity, fuels and lubricants.

Certain saving in fuel consumption can be achieved by improving the current aerodynamic design of the vehicle body, by reducing the rolling friction of the pneumatics, with a certain reduction in the rolling friction factor.

There are big opportunities for fuel savings through a reduction in vehicle mass (by a quarter within the next decade) due to replacement of steel by lighter materials: welded panels, steel sandwich panels consisting of two steel sheets, adhesive bonded together by polypropylene material, metal foams produced by special treatment of metal powders (these foams are used to produce sandwich plates for certain parts of vehicle body and are 36 times lighter than full steel sheet of the same thickness), aluminium and artificial materials.

As for the new type of engine, greater use of electric propulsion cars in urban traffic would significantly improve the ecological situation. But first it is necessary to remove the main drawbacks of such cars: short range of movement without recharging the battery and relatively poor performance. Longer-term solutions are fuel cells, where energy, chemically contained in the fuel, is directly converted to electricity, which can be used to propel the car. The total energy efficiency of the process of producing, delivering and using the fuel in a methanol-fed fuel-cell vehicle is 27%, compared to a mere 17% in petrol engine vehicles. The efficiency of the fuel-cell engine itself amounts to 60%, compared to 40% of the Diesel engine.

The fuel cell engines have lower operating temperatures, very flexible service behaviour and great amount of stored energy; also they do not have the liquid aggressive electrolyte. They work by combining hydrogen with oxygen extracted from air. The result is energy in the form of electrons which are used to power an electric motor, while the waste is water. But by using methanol (most common initial substance) a chemical reactor (reformer) is needed to release the hydrogen. Besides, the calorific value of liquefied hydrogen is four times lower than that of petrol. Therefore, the main concern is cost reduction, system simplification and improved lifetime and reliability. Currently, the unit cost ($ per kwt) to manufacture a fuel cell engine amounts to 4000 compared to 40 for an internal combustion engine. In the next 5-10 years, cost reduction to an acceptable level is expected to be achieved through higher volumes of manufacture — up to 250 thousand engines a year.

The potential of new fuels to reduce carbon dioxide emissions and operational costs depends on a number of factors: their production costs, production capacity, the availability of adequate distribution infrastructures and storage. The main alternatives to conventional fuels without any special modification to the Otto and Diesel engines might be considered to be the following: liquefied gas, rape-seed oil (bio-fuel), which by esterification into methyl ester obtains some characteristics very similar to conventional Diesel fuel, with a somewhat lower carbon monoxide and hydrocarbon emission, and natural gas. The latter produces emission levels less than a quarter of those produced by conventional fuels. The main drawback in using natural gas is increased emission of methane. Therefore, natural gas-fed vehicles (about 1 million in the world at present) have to be fitted with special methane-oriented catalysts to filter the exhaust gas emissions, since conventional catalysts do not give satisfactory results.

5. PROSPECTIVE RAILWAYS DEVELOPMENT

The trends in the development of an integrated transportation system are towards providing the highest possible quality of service, lowest cost, lowest possible fuel consumption, lowest possible environmental pollution, easiest servicing of technical assets, highest possible riding comfort and highest traffic safety. As was mentioned above, all these conditions at the latest stage could be met by the extension of the intermodality principle.

In this respect, railways will in the future represent an increasingly important share of passenger and goods transportation, due to their obvious advantages, such as relatively low cost, high safety, low fuel and energy consumption and relatively low impact on the environment.

As for passenger traffic, the quality of services will see further improvement, with the shortening of overall travel time playing an increasingly important role. The first stage should therefore, see greater flexibility of traffic on conventional tracks (existing lines). This could include the introduction of double-decker vehicles to augment capacity on selected routes, and tilting trains to improve performance on conventional tracks. The tilting trains allow for higher speeds in negotiating curves. In this case, the increase in maximum speed could amount to 25%. Tilting trains are expected to find increasing application since they make it possible to increase the average driving speed on conventional tracks without greater investments into their modification. Conventional railway lines will remain a crucial element of the whole railway network since the user is interested not in a single link but in the whole transportation chain throughout the entire journey from origin to destination.

The European Union has already embarked on an ambitious long-term High-Speed Train (HST) programme, which concerns most travelled lines. These transportation corridors are indeed the only ones that could justify heavy investments. The HST system in Europe is rapidly, and possibly irreversibly, expanding in France, Spain, the UK, Italy Sweden and Germany (the ICE network). In these conditions, the reorientation of the HST programme towards the so-called Transrapid (Maglev) technology has been offered as an integration tool /1,7/. The Transrapid project — currently the most advanced version of magnetic levitation technology — appears to have a number of advantages over alternative modes, and particularly over HST systems, such as the ICE and TGV. The Transrapid is supposed to incur less unit costs and less environmental damage. The new network will enable trains to run at higher speeds and reach them more rapidly and climb steeper gradients. The investments are comparable with those for the HST. However, the Maglev projects should be considered in the context of the economy-of-scale principle. In this case - with due regard for two rather contradictory factors: the shortest distance between points of origin and destination, and the largest possible transport flow. Therefore, even in the future decades only some of the busiest routes could become viable for introducing Maglev-trains. Up to now the only project under implementation is a Germany-originated system for China.

6. COMBINED ROAD-RAIL TRANSPORT

Combined road-rail transport is especially important to alleviate the overcrowded roads and highways and is dedicated for better utilisation of railways capacity, putting down the transport impact on the environment, the fuel consumption and raising the level of traffic safety. In this connection a definition of combined transport has been developed by the European Conference of Ministers of Transport (ECMT), which means - Intermodal transport, where the major part of the European journey is by rail and any initial and final legs carried by road transport are as short as possible. Besides the containers themselves this technology includes swap-bodies, freight road vehicles and trailers-on-flat-car (piggyback), double stack container block trains etc. The most common European combined system is the container one (whereas in the US - the piggyback). In 1999 the amount of containers in 1000 (the containerised goods, in mio. t) carried by railways reached in Austria 646 (9.2), in France 716 (9.0), in Germany 2175 (22.1), in Ireland 83 (0.9), in Portugal 40 (0.4), in Switzerland 380 (2.7). The combined transport share in the railway traffic is growing on the average quite fast - in the last decade - from 4% to 15%, but only in Austria - 28%, Switzerland -16%, in France – 18% it reached a considerable level /4/. It can be seen that the potential of such traffic is far from full usage. Similarly, a much broader combined system of private car - flat-car should be considered.

Especially urgent is the situation on the Alps transit routes where the annual traffic volume is growing very fast (by 360% in 1972-1999) and amounts to 138 mil t and the rail-road correlation is alarming: 37 to 63. Only on the Swiss routes - Simplon and Gotthard, the railway traffic prevails whereas the French and Austrian routes show the railway share at 32% only. The main measures to change this situation are: strict ban on night movements of the lorries, weight limitation (up to 28 t), drastic lowering of the empty movements of the lorries (now - 25%) and introducing the Road-Pricing (special dues in accordance to the haulage length). The collected money should then be used to reinforce the railways for broader introduction of piggyback traffic.

7. COMBINED MARITIME TRANSPORT

The global experience shows that containerisation as well as intermodality as a whole and other developments in maritime transport, such as electronic data interchange and considerable alteration in the cargo structure have greatly reduced and changed the demand for port services in Europe. The excessive duplication and overcapacity are growing and interport competition is getting more severe. In Western Europe, during the last three decades the only large port being built was Dunkerque, and the German maritime trade requirements still by more than 50% are being covered by foreign ports capacity. All these facts should be taken into account when considering the future of Central and East-European port development in the frame of European integration.

Maritime transportation of general cargo has been actually revolutionised by overall replacement of break-bulk ships by container and roll-on-roll-off (Ro-Ro) vessels. But the port themselves can no longer be secure that even cargoes generated by their host cities will be bounded across their own quays. Thus, seaports are becoming marginal in the routing of container flows. Shipping lines are now the major actors in the non-bulk commodity trade, and they possess a more varied choice of ports of call than ever before.

The lines demand ever larger terminals, with ever deeper channels, equipped with ever more expensive and sophisticated handling equipment while the economic benefits for the particular ports are uncertain. The vast majority of European ports not to lag behind have developed container handling terminals and berths over the last 25 years. However the containerisation is often being hampered by free area shortage, cargo mass piling for containerisation (annual traffic to justify the container shipping amounts to no less than 400-500 thous. t) and finally by the need of well organised feeder service system. Therefore the overall tendency, due to concentration of economic activity, shows the acceleration of the growth of Megaports which function as hubs or loading centres of international transport. They co-ordinate secondary centres through spokes or feeder services. Such system allows the lowering of the per container-unit cost by 200-300$ compared with direct delivery. Overall introduction of such two-stage system needs of course some co-ordination efforts at the inter-governmental level.

8. AIR TRAFFIC PROBLEMS

The airlines find themselves at present in a severe position. The enormous growth of air traffic made the shortage in air space and insufficient facilities on international airports more obvious. The creation and planning of modern infrastructures has improved the capacities, however, it could not compensate for negative developments in the existing fields of organisation and transport policies. The recent (July 2001) tragic incident in the Lake Constance area clearly showed the extreme inadequacy of the flight control system within the European airspace.

In the US, where the intensity of traffic (pass.-km per head) is six times greater than in Europe, different airports cater for regional and long-haul traffic. In Europe this is not the case - such division exists only in few cases. The other feature is the stable development of living standards and level of consumption in Europe, which causes the share growth of the tourists and holidaymakers in the overall airborne traffic flow, which has already reached 63-65%. On the other side, the emission growth by air transport is the highest (5.9% p.a.) among transport modes, its share in the total transport emission amounting already to 12-13%).

Such peculiarities stimulated certain innovation searching - developing of modern Airship models. Using inert helium instead of hydrogen and taking advantage of space-age technology and materials and modern avionics the new airships are aiming at new transport markets in bulk freight carriage and a certain sector of tourist travel. The cargo version of the airship - Cargo-lifter has the lifting capacity of 160 t. Acting as a flying crane it could transport such items as generators, turbines, components of oil refiners directly and in one piece. The market for such heavy lifting is enormously large and growing very fast. Since 1997 the new technology Zeppelin project is being developed to carry 80-100 passengers. The Dutch Rigid Airship Design project is supposed to have a payload of 30 t and would be able to carry 240 passengers. These new technical features will be in the position to attract a certain sector of tourist and bulk cargo traffic.

9. PROSPECTIVE COMMUNICATION SYSTEM DEVELOPMENT

To facilitate the management and control of the transport chain from door to door, to increase its efficiency, the information and communication system should cover several modes as a united entity. The systems will provide the users with time information on possibilities for intermodal transport and on the status of their consignments. They will enable an optimal co-ordination between operators in the transport chain. Tracking and tracing of cargoes carried across modes in Europe will need the adoption of standard procedures for Automatic Equipment Identification (AEI) and for reading barcodes.

The use of the existing information infrastructures fixed or mobile as short range communications, satellites or GSM to determine and communicate the position of consignments considerably enhance the tracking and tracing of cargo. But this quite sophisticated technology is mostly limited to modal-based systems. To create an intermodal freight logistics system which would be interoperable at the European level the following issues should be covered - standardisation requirements (message formats and type of information transmitted), the choice of transmission means (frequencies, infrastructure), and the systems financing on an intermodal basis. Up to now documents and procedures differ between modes and operators. The starting transition from paper-based documents to electronic messages provides an opportunity for creating a uniform system for electronic transport of documents and procedures.

Special attention is now paid to the satellite navigation which is becoming central to all forms of transport and many other activities. These systems will play a crucial role in creating the integrated European transport system It means that Europe should develop a new satellite navigation constellation, combined with appropriate terrestrial infrastructure - Galileo /3/.

The combined transport-related communication and Galileo navigation data could be directly beneficial to rail, assisting in train movement control and collision avoidance. It will be part of an intelligent infrastructure, helping to ensure safety, streamline traffic operation, reduce congestion and environmental damage, and, this is especially important - support multi-modal development.

New methods of transport organisation resulting from the introduction of modern information and communication technologies (ICT) are of particular importance for an efficient traffic policy. Such a policy cannot only be based on technical measures, like ICT, but has to comprise also organisational, regulatory and also pricing ones. Alternative sets of measures, so-called options, were developed and investigated with regard to their feasibility, their effectiveness and their impacts. The first option concentrates on the information aspect of ICT; while the second one also regards pricing instruments and the final, third one concentrates on the possibilities for improvement of the attractiveness of public transport. Within the first option, different traffic management concepts on the basis of new ICT in the selected German cities were compared with regard to achieving the goals to be analysed. In the second option, the efficiency and the impacts of pricing instruments in transport policy were investigated on the basis of model calculations, while the third option analysed the potential of the willingness to shift road traffic to environmentally sounder means of transport on the example of the new city-train-concept in the German city of Karlsruhe.

It has been concluded that measures for relieving the transport network and shifting road traffic to environmentally sounder transport means by new Information and Communication Technologies (ICT) in transport systems will only be successful if these new technologies meet the following requirements:

1) ICT systems have to be implemented in such a way that they contribute to an integration of the different transport means of a region.
2) ICT systems will only have noticeable effect on the transport situation, if they include effective instruments (administrative regulations and pricing) for the control of traffic flow. Pricing instruments that

can be implemented by ICT mainly focus on the charging of fees for the use of roads (road pricing) and parking space. Administrative instruments mainly include prohibitions of access or entry.

3) Outdoor pollutant concentration may serve as another control parameter for permissible transport flow.

Furthermore, for a medium- and long-term success in achieving the intended goals, the above mentioned measures have to be accompanied by regional development planning efforts. It is of crucial importance to study those obstacles which aggravate the practical implementation of the regional development.

10. CONCLUSION

Economic integration needs a special transport approach quite different from the traditional one. The integration of countries with high economic development level and more or less uniform structure of their economy can be realised only by a specific transportation feature. The transport in this case should become a propulsive sector, insuring not only economic growth, but also a principally new type of development and international trade. In its turn such approach warrants consideration of mode-independent requirements.

To turn into a united logistical system, the transport industry has to develop towards an intermodal system which needs certain reorientation and reconstruction of each transport mode. Only under these conditions can a new quality level of transport services under the just-in-time principle be provided.

However, intermodality is hampered now by an enormous development of road transport with its economic advantages. The competitive position of the road transport remains very strong, which is being reflected in the present-day modal split. At this stage, only the intermodality principle promotion can optimise the modal split toward better utilisation and efficiency increase of railways and waterborne transport.

Quite different is the situation now in Russia and in other Eastern European countries - the extreme underdevelopment of the road transport and of the road network /5/. Such modal split cannot correspond to the integration needs, to the crucial changes of the economic structure. In such conditions the intermodality approach could be regarded as a substitute to some extent for the road transport development.

As to the technological development in transport, the technical provision for the intermodality (containers, Ro-Ro ships, piggyback systems, ferries, etc.) is well known. The problem is to introduce this technology on a broader scale. A number of obstacles, however, prevent the extensive use of intermodal features – the major one being the lack of co-ordination of performance modes and of their development on the European, national and regional levels.

As conclusion, it can be said that the intermodality principle should be regarded as the basis for further integration processes. The main technical innovations within the transport field concern in the long-run the road transport (reducing fuel consumption level and the impact upon environment, raising the safety), railways (raising the speed by developing new technology and introducing HST and - in the future - the Maglev trains), air transport (realising Air Ship projects), etc.

The EU is currently advancing with the implementation of the Trans-European transport networks (TEN-T), designed to promote a better integrated European transport system. The network is scheduled to be completed by 2010. Plans have been developed for high-speed trains and for intermodal (combined) transport, road building and the development of inter-operable networks for inland waterways, as well as for the upgrading of conventional rail links, airport infrastructure and drastically improving the flight control system, and seaports.

The aim of implementing TEN-T is to make traffic faster, safer and more environmentally compatible. It is vital for the future continental integration that the processes of implementation of TEN-T take into account the expansion of the EU towards the East, in particular through the creation and strong development of trans-frontier links with the countries of Central and Eastern Europe.

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РЕЗЮМЕ

ТРАНСПОРТНАЯ ТЕХНОЛОГИЯ И ЕВРОПЕЙСКАЯ ИНТЕГРАЦИЯ

Об основных направлениях технического прогресса на транспорте в условиях интеграции. Экономическая интеграция требует новых подходов к транспорту, весьма отличных от традиционных.При этом транспорт постепенно превращается в пропульсивную логистически\распределительную систему, Высокий уровень транспортного обслуживания («точно/в/срок» принцип) приводит к формированию интермодальной системы, отражающей требования клиентуры, не зависящие от вида транспорта. Таким образом, принцип интермодальности можно считать базисом интеграционного процесса. Он, однако, тормозится преобладающим развитием автомобильного транспорта с его огромными преимуществами при значительном отставании железнодорожного и водного транс-

порта. Проект Трансевропейской сети направлен на развитие интермодального (комбинированного) транспорта с учетом требований к экономии топлива, защиты среды и экономической эффективности.

КЛЮЧЕВЫЕ СЛОВА

Транспорт как интегральная логистически/распределительная система, принцип "точно/в/срок", распределение перевозок между видами транспорта, агрегирование груза, интермодальная система как основа интеграции, направления технического прогресса на транспорте в условиях интеграции.

LITERATURE

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