Impact of interoperability on the global railway network

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Introduction

There are big changes happening in Europe’s railways. Interoperability is already becoming a reality. It affects every rail business, everyone who works in the industry and everyone who uses railway.

Interoperability means a completely open market for train infrastructure and equipment manufacturers.

Full interoperability demands mean same or compatible:

- Regulations, operating rules and working practices
- Safety and environmental standards
- Track, signalling and telecoms
- IT system and ticketing
- Locomotives and rolling stock
- Maintenance and repair programmes

The convergence towards interoperability (for each category as high speed, freight and conventional passenger traffic) is a four-stage process:

- EC directive to define the objectives and legal framework
- Implementation of the directive in member states
- Publishing TSIs and EU standards
- Application of TSIs and EU standards in member states

Interoperability work requires both to ensure that individual standards move forward to the benefit of the community, and to facilitate where possible their convergence, such that systems may effectively make use of more than one standards-based approach. We are -in our practice- generally speaking on technical interoperability but the scope is much wider as we are using it (political, human, intercommunity etc).

Interoperability and Globalisation

Many see globalisation as a primarily economic phenomenon, involving the increasing interaction, or integration, of national economic systems through the growth in international trade, investment and capital flows.

However, one can also point to a rapid increase in cross-border social, cultural and technological exchange as part of the phenomenon of globalisation.

Some economist defines it as a process in which geographic distance becomes a factor of diminishing importance in the establishment and maintenance of cross border economic, political and socio-cultural relations.

How interoperability affects globalisation?

Interoperable organisation: one should actively be engaged in the ongoing process of ensuring that the systems, procedures and culture of an organisation are managed in such a way as to maximise opportunities for exchange and re-use of information, whether internally or externally.

Assurance of effective interoperability will require often radical changes to the ways in which organisations work and, especially, in their attitudes to information.

It is useful to further subdivide the notion of interoperability, as follows;
Technical Interoperability: Consideration of technical issues includes ensuring an involvement in the continued development of communication, transport, storage and representation standards.

Political/Human Interoperability: The manner in which information is described and disseminated.

Inter-community Interoperability: Traditional boundaries between institutions and disciplines; researchers increasingly require access to information from a wide range of sources, both within and without their own subject area.

International Interoperability: Each of the key issues identified, above, is magnified when considered on an international scale, where differences in technical approach, working practice, and organisation have been enshrined over many years.

In today's Information age, there is a recognition that the knowledge to be gained from resources can be measured in a similar fashion to the wealth potential of steel and coal in the previous Industrial Age.

The knowledge is power. Why be interoperable?

Why joining the trend towards interoperation and openness? The actors of a given system e.g rail transport system have to find their benefits, interests in interoperability. The partnership in interoperability is basing on common interests and trusting cooperation (see Figure 1)

**OPERATORS:**
- define operational requirement and operate the system
- concentration on customer
- integrated logistic provider
- to improve business to increase market share

**INDUSTRY**
- to develop and design the rail products
- competition and cooperation
- Risk and revenue partnership
- LCC & RAMS optimisation

**R & D – ERRAC/EURNEX**
- customer oriented research
- industry driven research
- priorities and consensus
- from generic to applied research, from research to innovation and standards

**TSI implementation – European/World standards**

Fig 1 Partnership in Interoperability

The ORS (Operators requirement Specification), the SYRS (System Requirement Specification) and R&TD (Research and Technical Development) based on FRS (Functional Requirement Specification) which appears in TSIs (Technical Specification of Interoperability) and EU/World standards.
The railway interoperability is an International Interoperability including the technical, political, human and inter-community parts as well.

What is globalisation?

Many see it as a primarily economic phenomenon, involving the increasing interaction, or integration, of national economic systems through the growth in international trade, investment and capital flows. However, one can also point to a rapid increase in cross-border social, cultural and technological exchange as part of the phenomenon of globalisation.

Globalisation is the rapid increase in cross-border economic, social, technological exchange under conditions of capitalism.

From railway point of view globalisation is a framework to increase the possibility to apply all interoperability results obtained in different part of the world including Europe.

When did globalisation begin?

There is no agreed starting point, but understanding of globalisation is helped by considering the following.

The first great expansion of European capitalism took place in the 16th century, following the first circumnavigation of the earth in 1519 to 1521.

There was a big expansion in world trade and investment in the late nineteenth century. This was brought to a halt by the First World War and the bout of anti-free trade protectionism that led to the Great Depression in 1930. Some see this period as an interruption to the process of globalisation commenced in the late 19th century.

A sense that the world was united was generated by the establishment of the International Date Line and world time zones, together with the near global adoption of the Gregorian calendar between 1875 and 1925. During that period, international standards were also agreed for telegraphy and signaling.

The end of the Second World War brought another great expansion of capitalism with the development of multinational companies interested in producing and selling in the domestic markets of nations around the world. The emancipation of colonies created a new world order. Air travel and the development of international communications enhanced the progress of international business.

The fall of the Berlin Wall ended the cold war between the forces of capitalism and socialism with capitalism triumphant (1990).

The development of the internet made possible the organisation of business on a global scale with greater facility than ever before.

The development of rail traffic was unbroken until the middle of 20th century, but has experienced a substantial reduction since the late sixties. Both rail passenger and rail freight transport declined in comparison to other modes.

Even the passenger and freight transport increased in the period 2002-2006 in absolute terms, but this was dwarfed by massive increase of road and air transport.

The development of rail passenger and freight traffic in the world in period 2002-2006 is shown below (source UIC statistics).
What are the causes for this decline of railway traffic?

The answer is that the costs of rail transport were not covered by revenues generated through core business: transport of freight and passengers. Consequently the railway was not competitive with road and air transports.

Why rail transport is expensive? It is because:

- Rail transport has been organised along national lines: national operator had a monopoly on the use of network, no competition on national network, no interests to reduce operational costs and to develop new market.
• Railway undertaking responsible for the construction, maintenance, renewal of infrastructure and the activity not always compensated by the States.
• Lack of international standardisation: The development of national network lead to differences in the technical specifications of the infrastructure (gauge, electrification standards, safety and signalling system). The train running from one country to another must be able to scope with all these differences and it is more expensive that using only a coherent network.

As the rolling stock concerned, national rolling stock manufacturers have had close relationship with the nationalised railway industry in the design and placing into service of rolling stock. Knowledge of national specificities became an in house competence for manufacturers and even for the state owned railway companies. This situation worked against to opening market.

European Union has started with a supporting policy in rail area at the beginning of nineties, in order to allow railways to have an impact on the way the business is managed. The major policy areas:

• Restructuring of the railway markets: railway undertakings have been separated from the management of infrastructure to allow for the introduction of competition. The freight market was opening 2003 and the full market opening started from 2007. the framework conditions necessary for market opening have been defined in several directives.
• Financial support to member states to invest in the infrastructure to build up the Trans-European Transport Network allowing faster rail services.
• Technical standardisation of infrastructure equipment and rolling stock: interoperability directives for high speed and conventional rail transport and TSIs.

State of the art of European Interoperability.

An unified European railway system should increase efficiency, reduce costs and lead to more attractive freight and passenger services. Rail transport will be able to compete much more strongly against road and air, which will benefit the environment as well as industry.

Main advantages of railway interoperability:
• Passenger train operators gain an enlarged market with opportunities of seamless cross-border operation, reduced journey time, joint fleets and joint services
• Freight operators will also have this freedom, allowing running from one side of Europe to the other without pausing at every border for locomotive changes, crew changes, inspections.
• Manufacturers will be able to offer the same product in every country, leading to economies of scale, lower costs, more competition and more choice for the buyer.

Since the beginning of the nineties the European Commission has presented several proposals to achieve interoperability of the railway network in Europe.

The high-speed rail directive 96/48 EC entered into force in 1996 and its implementation into national legislation by 1999. The Directive defines the framework conditions that shall apply to the construction of new high-speed rail infrastructure such as standard gauge (1435 mm), electrification standards and signalling systems. These requirements are further elaborated in Technical Specification for Interoperability, which contain detailed rules and standards applicable to high-speed infrastructure or rolling stocks. The first series of 6 TSIs for high-speed rail were adopted in 2002.

The conventional rail Directive 2001/16/EC entered into force in 2001 and its implementation into national legislation was required by April 2003. The Directive required a first group of TSIs to be adopted in the areas of control/command and signalling, telematics applications for freight services, traffic operation and management, freight wagons, noise and infrastructure, which have been adopted in 2005 and 2006. A second group of TSIs is under preparation.

The EU legal framework on railway technical regulations consists of EU directives, technical specifications of interoperability (TSI), EU technical standards and national standards. Nevertheless
UIC leaflets still used in different railway field filling the gaps in the existing regulation especially in the subsystem interfaces.

The changed European standardization process is demonstrated in the figure 2 below.

In 2004, the second railway package was adopted by the European Parliament. It contained a Directive on railway safety that sets the framework conditions for a harmonised approach toward railway safety in Europe. One of the elements of the safety directive is the requirement for Member States to set up a national safety authority that deals with the safety issues and that shall examine the compliance of railway undertakings with common and national safety rules. The directive also foresees the creation in member States of an independent accident investigation body.

The second railway package contained as well the establishing of European Railway Agency, which shall deal with railway interoperability and safety issues and shall prepare the TSIs and the common safety rules.

The TSIs were produced by the European Association for Railway Interoperability (AEIF) until 2004. The work on TSIs continued by European Railway Agency (ERA) started from 2005.

The TSIs are the results of different EU projects and development of different working parties of AEIF, ERA, CER, UNIFE, and UIC in consultation with interested parties throughout the industry.

We are in a period of transition, until all interoperability directives and TSIs have been adopted, national safety authorities are set up and able to place rolling stock in service. Currently, rolling stock accepted for operation within one Member State is not necessarily cross-accepted in any Member-State.

The cross-acceptance of rolling stock depends on different national regulations to be fulfilled by approval. International operators have to go through repeated approval procedures in each Member State where they intend to operate.

The European Rolling Stock Register is to support the application of Rolling Stock TSIs to set up a safe legislative framework.

For this purpose ERA Working Group and ERA support group were set up including experts of CER, UIC, EIM and other organisations to complete the work on different domains.

The rail system subdivided into structural or functional sub-systems in the TSIs and this approach applied in all other regulation process including the Rolling Stock Register as well.
The European Register of Rolling Stock (RRS)

The basis of RRS is the Second Railway Package (2004).

- Regulation 881/2004: European Railway Agency (Establishes tasks, processes and authorities of the Agency).
- Directive 2004/50: Interoperability (amends two earlier Interoperability Directives, high speed (96/48) and the conventional (2001/16) rail system, harmonized process requirements, responsibilities of Railway Agency)

The RRS is imposed by the directives 96/48/EC, 2001/16/EC and 2004/50/EC

“Member States shall ensure that a register of infrastructure and a register of rolling stock are published and updated annually. These registers shall indicate the main features of each subsystem or part subsystem involved, e.g. the basic parameters, and their correlation with the features laid down by the applicable TSIs. To that end, each TSI shall indicate precisely which information must be included in the registers of infrastructure and of rolling stock.

A copy of those registers shall be sent to the Member States concerned and to the Agency and shall be made available for consultation by interested parties, including at least the professional actors from the sector”.

The RRS will be a database of type approved vehicles in which are mentioned the essential technical parameters (technical design parameters). It can be considered as a link to the NVR and therefore be handled in the same way as the NVR (National Vehicle Register).

The RRS will not be a dynamic database and therefore, it will not be used as an operational database by the RU

The main users of the RRS will be:

- The national Safety Authority (NSA): who can easily track technical data
- The Infrastructure Manager (IM): who can check the main technical design parameters and study the compatibility with the parameters of concerned infrastructure parameters as set in the infrastructure registers.
- The railway Undertaking (RU): who eventually can get some technical data out of this database

The Register Rolling Stock (RRS) which gives the main technical characteristics of the Rolling Stock should ease the process of authorisation for placing in service between EU Member States.

The RRS provides to each European Member State (MS) an initial overview of the Rolling Stock (RST) technical characteristics for the cross acceptance process.

The purposes of the Register of Rolling Stock are:

- Eases cross acceptance process.
  The RST cross-acceptance is subject to the different national rules in the MS for authorising the placing of rolling stock in service. Experience demonstrates that this results in delays and costs when placing rolling stock into service.
  The RRS provides to each MS an initial overview of the RST technical characteristics for the cross acceptance process.

- Transfer of registration from former railway companies to new entities as defined by MS
  The current EU legislation foresees:
  o The National Safety Authority (NSA) having the task to authorise the placing into service of RST, - only new or upgraded vehicles.
  o An authorisation for placing in service of RST in each MS where it is intended to be operated.
The RRS which gives the main technical characteristics of the RST should ease the process of authorisation for placing in service between EU MS. – the Technical File must be used for this process.

- Registration of TSI technical data in addition to administrative data
  The technical file provided for the authorisation for placing in service is very detailed, the possibility to have the main technical characteristics of the RST in the RRS is a helpful tool for interested parties.

The process of establishing of European Rolling Stock Register executed in two steps:
- Drafting the condition and content of National Vehicle Register
- Drafting of European Rolling Stock Register

Content of the National Vehicle Register (NVR)

The NVR covers vehicles:
- authorised to be placed in service;
- the case of existing vehicles, which was originally outside the scope of this working party,
- particular items with the 1520 mm system will be discussed separately.

The main use of the NVR as follows:
- Record of authorisation and the identification number allocated to vehicles,
- Looking for European wide, brief information related to a particular vehicle,
- Follow up legal aspects like obligations and juridical information,
- Information for inspections mainly related to safety and maintenance,
- Enable contact with the owner and keeper,
- Check safety requirements before issuing Safety Certificate,
- Follow up a particular vehicle.

Items required by the Directives:
- References to the "EC" declaration of verification and the issuing body
- References to the Register of Rolling Stock
- Identification of the owner of the vehicle or the lessee
- Any restrictions on how the vehicle may be used
- Safety-critical data relating to the maintenance schedule of the vehicle

Additional Items agreed as part of the NVR: identification number (IN), manufacturing year, Member State and NSA, placing in service, approval number, withdrawal, MS where the vehicle is authorised.

Scenarios for the implementation of the NVRs have been analysed taking the different, existing national systems into account.
Two main solutions have been identified and analysed:
- centralized system
- de-centralized system.

The centralized solution will be composed of:
- Database of records, which will serve both for the search service and as the repository for NVR data in all MS.
- A common software application, which will serve for both inserting and updating data into the system, and retrieving information from the system.
The decentralized solution will be composed of:

- several independent NVRs, one for each MS
- one common software application, which will serve as the search service, connected to all the NVRs, and be used to retrieve data.

It is recommended the decentralized solution. The European Centralized Virtual Vehicle Register (EC VVR) is composed of two sub-systems:

- the Virtual Vehicle Register (VVR), which is the central search engine in ERA
- the National Vehicle Register(s) (NVR), which are the LR in the MS.

**Register of Rolling Stock**

After having the draft of Register of Rolling Stock the following questions need to be answered: use of the RRS, content of the RRS, management of the RRS, entity responsibility, availability of the data, link with other information systems such as NVR, (RSRD (Rolling Stock Reference Database), WIMO (Wagon and Intermodal Operational Database)).
Additionally there are some questions to be answered concerning Register of Rolling Stock (RRS) and National Vehicle Register:

- How avoid duplication between the RRS and NVR?
- To identify the roles of assessing the compatibilities
- How does the Register of Rolling Stock contribute to railway safety?
- How does the Register of Rolling Stock achieve this when it is not an operational database?
- As non real time register cannot include the specific instance of variable data for operational purposes

The process is in progress and the possible solution needs more comprehensive investigation after having the updated Interoperability Directive, Safety Directive and TSIs.

Nevertheless the evaluation of Rolling Stock register when promoting the interoperability process revealed at the same time to the complexity of the interoperability as well.

The effect of EU Rolling Stock Register on Interoperability is unambiguously positive. The existence of RRS is necessary for interoperable and safe operation. The European experiences could be an example and should be used theoretically world-wide promoting the harmonised global railway network.
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