FILT CGIL

ERTMS - a new technology for the railway sector Anticipating its IMpact on Employment and Social Conditions.

AIMESC PROJECT FINAL REPORT AND GUIDELINES

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AIMESC
ERTMS - a new technology for the railway sector
Anticipating its IMpact on Employment and Social Conditions

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EXECUTIVE SUMMARY

ERTMS is a new train signalling and traffic management system created to gain interoperability by using a unique signalling and communication standard throughout Europe. Trackside equipments send (e.g. via balises, via radio, etc.) information to the train and elaborated by an on-board computer by devising a dynamic speed profile to be respected by the train while running. It therefore envisages a dramatic change both in the way railways are managed, with noticeable impact over both employment levels and quality of work, and allows to really implement a unique railways market.

Notwithstanding wide communication campaign with lot of expense, currently, ERTMS is deployed over a small portion of European railways, most of them new high-speed lines within national states boundaries: the main transnational line is a small portion of the Bruxelles-Koln line.

This project addresses the impact of ERTMS on both employment and working conditions. It draws several indications for trade unions' action in order to catch the opportunities offered by this technology and to counter the possible negative effects on employment. Employment perspectives are strongly affected by the success in implementing the unique market, by capturing cross country freight and passengers flows, by generalizing the success of high-speed lines, thus reversing the long-term decline of railways, especially in their relative share. Several authors questioned the European Commission's "double track" approach which considers liberalization and ERTMS deployment going hand in hand: they rather stress the need to prioritize ERTMS deployment as unique market can work only when a common technological infrastructure is established.

2020 employment forecasts heavily rely on economic performance and regulatory policies. Unfortunately, available statistics about sectoral employment are very poor and thus do not allow any assessment of the Commission's views about the positive impact of liberalization over employment levels in railways, neither at EU nor at national level. This report calls on both Eurostat and the Commission to improve both timeliness and reliability of statistical sources, although the redesign of sectoral boundaries greatly complicates the picture, and on social partners to actively contribute to elicit better information.

ERTMS is a strong rationalization device, by formalizing learning processes and making the whole organization more "transparent" to supervise: as a consequence, management increases its actual prerogatives, especially in terms of increased pressure and control, but needs more employees' cooperation and to establish a "social compromise" on new basis, especially with train drivers and traffic controllers.

The present report investigates the ERTMS impact over working conditions amongst some of the most affected professional profiles, namely train drivers, traffic controllers and rolling stock maintenance staff. While they share an increase in hierarchical control, in complexity of their communication networks, and in psychosocial risks factors, there are noticeable differences amongst them.

Train drivers become closer to air pilots, by specializing over just ERTMS-equipped trains, showing a dramatic increase in mental workloads in those lines requiring continuous switches from "new" and "traditional" technologies, as on the Brussels-Koln line: further, as ERTMS is a young technology, they act as technology developers while driving.

Traffic controllers achieve a full professional recomposition, already started with AWS (automatic warning system) and APS (automatic protection systems) in the traditional environments, potentially able to take decision similarly to air traffic controllers, by gaining both in task complexity and autonomy: this marks a great discontinuity with the traditional environment, where their monitoring activities were highly partial and decisions were reserved to supervisors.

Finally, rolling stock maintenance staff report substantive deprivation feelings as diagnostics, the most valued activity, is retained by equipments' providers in order to keep their technology under control: thus, they report the strongest rationalization in tayloristic sense and increase in time pressure.

In general, equipping workers for ERTMS requires not only specialistic training, which is long and very expensive, especially for train drivers and in traffic management and control functions, with regular refresh, but also a and extensive training on transversal competences, such as communication skills, conflict management, linguistic skills and, apart train drivers, team working methodologies. Organizations need to be redesigned in order to make them flat and more reactive.

Social partners have already paved the ground with several very important EU framework agreements over employability in the industry, use of ICT in training, and on EU train drivers' licence for interoperability. In order to timely and adequately support its ERTMS implementation, by acting as "social architects",

- they have to promote both at national and EU-level advocacy and building coalition as ERTMS plays a pivotal role in implementing the EU "green economy" strategy in transport and logistics;
- they need a reliable and timely information about its impact on employment and working conditions;
- they have to design a proper governance framework for the industry, by overcoming national barriers;
- they have to adequately develop new skills in order to manage its implementation at work premises and tackle the risk of widespread feelings of uncertainty and inadequateness amongst employees by providing the adequate support.

The present report recommends social partners to set up at EU level a *working group on ERTMS* within the Sectoral Social Dialogue Committee, an *observatory on employment*

in order to overcome the current lack of information, to promote *extensive information campaign* amongst both employees and other stakeholders, pilot projects, joint guidelines and toolkits on several issues, such as training, personnel redeployment, and psychosocial risks.

While at national level social partners are recommended to develop a framework agreement by adapting EU-level indications to the national institutional context, ERTMS impact on employees' should be effectively managed according a *training-and-deployment plan* that social partners agree at local level, encompassing interventions on employment, training and health and safety.

Trade unions are recommended to carry out extensive training for both their officers and workers representatives by developing general analytical skills first of all, by further focussing on specialistic competence according to the occupational health and safety representatives and the UK Unionlearning representatives models: they must be able to act as "social architects" at local level, by attributing high value to employees' experience and cognitive maps.

The guidelines pose at their heart the *training-and-deployment plan*, negotiated on the basis of a national framework agreement as an encompassing tool managing in a unitary way, thus reflecting ERTMS piece mail implementation by subsystems.

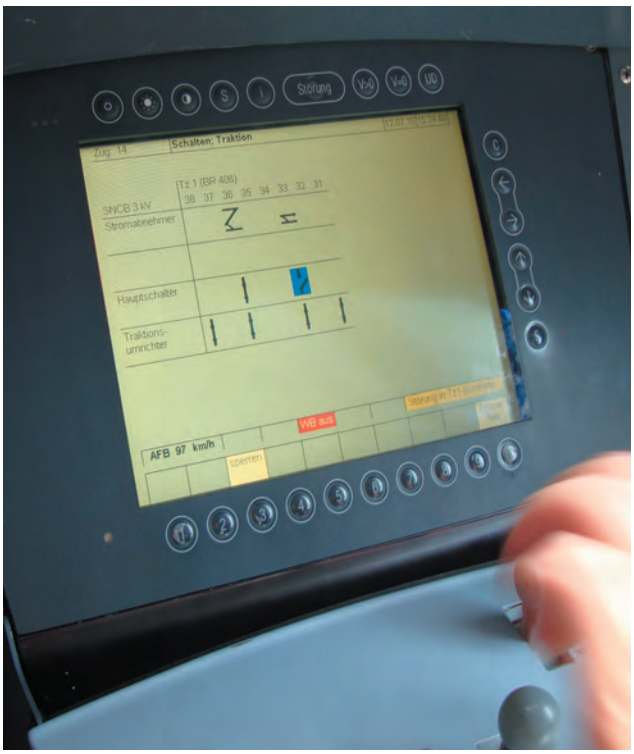
INTRODUCTION: OBJECTIVES AND ASSESSMENT

Initial Objectives

The project AIMESC set the following general objectives and specific objectives (SO).

The General Objectives of the project were:

1. Update trade unions with the information on the process of implementation of the ERTMS throughout the EU Member States and the countries' infrastructures involved in the next and far future,
2. effects of ERTMS on employment and social conditions;
3. foresee possible quantitative employment effects (drops or increases)
4. foresee possible other effects on employment such as:
   a. migration from old to new tasks linked to trains circulation;
   b. definition and creation of new professional profiles linked to trains circulation.
5. foresee the effects that the development of the ERTMS will cause on the different railway professions as regards:
   - professional competences;
   - training needs,
   - health and safety at work, work environment,
   - human factors (human – machine interface),
   - working tasks (e.g. change of responsibility),



   - work organisation.
6. to support trade unions in better anticipating changes due to the ERTMS system, developing training programs for trade union representatives and preparing for social dialogue on this matter.

The **Specific Objectives (SO)** were basically focused on collecting information, conducting an analysis and drawing up guidelines in order to:

1. identify effects on workers of the ERTMS level 2 already implemented and collect information on possible consequences of the level 3 technology to be implement in the future;
2. define the different railway professions affected by this new technology, e.g. drivers, controllers, maintenance staff (working on locomotives, rolling stocks and infrastructure), staff working with signal-systems, conductors, etc.,
3. identify the critical aspects and the positive effects on the different railway workers' jobs (indicated in point 2) following the development of ERTMS:
   a. monitoring tasks changes already happened in the workers working lives;
   b. foresee possible new job opportunities or drop of employment for some professional profiles to be identify,
4. to prepare trade unions developing training measures for trade unions representatives on:
   a. ERTMS technology
   b. Workers anticipation and adaptation strategies
5. to create specific trade unions policies in order to better manage consequences of the development of ERTMS among the EU States' rail workers.

Planned tools

The project initially envisaged three activities in order to raise awareness about ERTMS and its impact on employment and working conditions:

- an exploratory questionnaire amongst a selected group of employees affected by ERTMS across participating countries, when relevant, in order to collect information about its extent, its broad impact on working times, quality of work, health and safety and salary;
- a kick-off EU-level conference "Understanding ERTMS" and national-level workshops in order to both mainstream ERTMS features and deployment, present the results of the preliminary investigation, and elicit participants to witness about ERTMS impact on their working lives;
- a final conference in order to present the final report and the guidelines for trade unions.

After the kick-off conference held in Brussels on 4-5 May 2010, the Steering Committee opted for further investigation about the impact of ERTMS according a double track:

1) in those countries where ERTMS deployment is wider (IT, ES), workshops combine an informative session on ERTMS deployment, as in other countries involved in the project, with an analytical session. According the focus group methodology it was accurately investigated the impact of ERTMS over the way to carry out the

tasks, changes in competence, discretion at work, impact over health and safety, with a special focus on the feelings of uncertainties (Analytical-focused approach). Participants were invited to fill a grid and share it on a web forum. Such an analytical session was not performed in those countries where ERTMS deployment is much more limited: in this latter case information on investment plans and on the potential impact of ERTMS was much more extensive and detailed.

2) Steering Committee meetings were complemented with visits to training centres (such as the Italian at Milano-Martesana, where a simulator were installed), and to traffic control commands, combined with a travel in ERTMS equipped cockpits, which differ for their size, specialization, and switches from the old to the new technological environments.

Such additional investigations provide considerable amount of knowledge.

The outcomes of the workshops where useful:

- To verify and to define the impact on workers
- To use as a base for the elaboration of the Guidelines.

Achieved objectives

The project is the first investigation at EU level about the impact of ERTMS on employment and working conditions, by taking into account the ongoing changes in the product-technology-market combination in the railways industry. It reviews the available sources for monitoring employment dynamics in the railways sector, which are widely unsatisfactory both in timeliness and accuracy, and advances a proposal in order to overcome such lack of information, at least in an approximate way.

Although the investigation of ERTMS impact is carried out at a pretty early stage of its implementation by mainly using qualitative methods, it greatly increases both the knowledge about the impact of such technology on working conditions, by stressing the different impact across professional profiles, the extent of changes over some of the most directly affected, and highlights the possible changes in work organization.

Further, the report contains several indications for training activities in favour of both affected employees and trade unions. Indications in favour of the former are mainly in terms of transversal skills in order to increase employees' ability to cope with both technological and organizational changes, aimed to complement training on specialistic skills usually offered by employers.

We expect that such training would improve effectiveness, relationships with both colleagues, superiors and customers, thus contributing to primary prevention of psychosocial risk factors, in particular feelings of uncertainties about their work perspectives, inadequateness while facing the new technology when this latter requires problem solving and timeliness, meaninglessness of their work as a consequence of task redesign.

Trade unions' training needs mainly focus on both general information, in order to understand the extent of the undergoing change, and analytical skills in order to achieve a better understanding about the extent of changes both at macro and micro-level, by connecting organizational and individual needs.

Such competences are needed in order to face the transformation of the railways sector into a fully competitive industry: employees as individuals must be regularly informed about the ongoing processes, in order to understand the direction of change, while as collective they need to renew, sometimes in depth, their professional identities and their sense of work, and to understand the new organizational context they are working in. Finally, trade unions can play a key role both in monitoring and in promoting change according to a human-centred approach, and regulating working conditions, professional development and reward policies, by fostering both objective and procedural fairness.

From such a preliminary investigation it is possible to compare ex ante assessment carried out by ergonomists and job designers relatively to train drivers only: such assessment need to be carefully contextualized in order to take into account skill bias effect, namely that railways companies select train drivers for ERTMS amongst those having the reputation of keen-on workers, with "above average" competences, as they are developers of a new technology. Further, it establishes links between working conditions and employment perspectives.

Assessment of different tools

Preliminary questionnaire

The preliminary questionnaire was a key tool in eliciting information about ERTMS impact on the quality of work: because of its exploratory nature, information collected are both quantitative (employment and equipments involved) and qualitative, according to an open structure. As employees affected by ERTMS employment are a little share over the total of railways employees, the steering group aimed to collect information amongst at most two employees per professional profile in each country, thus opting for the qualitative information and in order to draw

"indications".

The questionnaire was devised by trade union officers at the very start of the project, with an adequate coverage of issues affected by ERTMS deployment: its design provides important indications about the trade unions' officers training needs, especially analytical skills. Such skills are in fact necessary when discussing with their constituency in order to elicit information (mainly the employees' cognitive maps) which are necessary for any regulatory intervention with management about work organization, quality of work, new technology implementation and their impact on health and safety, training needs, career perspectives, compensation policies and organizational change.

European conference

The conference "Understanding ERTMS", held in Brussels on 4-5 March 2010, was a key moment in order to collect all the available information about ERTMS, its deployment across Europe, its role and its perspectives. Both EU-level stakeholders (CER, EIM, UNIFE, European Commission, Commission's ERTMS Coordinator, ERA) and workers from different affected professions (driver, traffic controller, engineering) were included as speakers: they therefore provided to all participants a complete picture of the issues at stake, and of the possible links amongst them, in order to discuss about the demands, the uncertainties, the needs of each stakeholder.

An agenda of open issues for social partners was drawn. It included:

- the technological issue, in particular its nature of change of paradigm, which requires a different cultural approach amongst all stakeholders;
- the opportunities in order to compete with other transport modalities,

- its impact on the workforce in terms of changes in skills content, staff levels, staff composition, and health and safety;
- misalignments and misfits between ERTMS organizational demands and existing organization, which calls for comparative analysis across countries and with network-based industries relying on similar technological environments (telecom, electricity, civil aviation, DCS-based manufacturing)
- the scope for social dialogue in terms of *professional requalification*, by including training, recruitment, and professional paths; *restructuring* policies and personnel relocation; changes in motivations and new professional identities.

National workshops

Workshop design ERTMS deployment display wide differences across participating countries, according to two different approaches:

- ***Analytical-focused approach*** in those countries (IT, ES) where the timing and the extent of ERTMS deployment allow employees to gain some experience about the technology: a short informative section summarizing the Brussels conference outcomes preceded a focus group aimed to investigate the impact of ERTMS over participants' working conditions;
- ***Informative-focused approach*** in the other countries (FR, DE, BE, UK, HU) with more participants, with the objective to present the ERTMS technology and the possible effects: they were very appreciated by the workers. In this case the Brussels "Understanding ERTMS" conference programme was adapted to national perspectives by including a discussion within trade unions to decide on their way forward.

In the former case, a small group of workers and trade unionists participate to the workshop elaborating the impact of ERTMS through their concrete experience. The aim was to integrate information collected in the exploratory questionnaire, especially questions 8-11[1], by means of 4 main frames in order to guide individuals' and collective reflexion over changes introduced by ERTMS and for then figuring out how to re-compose the "new mirror" of professional identities broken by such technological changes. It was therefore an additional action with respect to the initial project.

The frames investigated:

1. extent of change
2. Anxiety/feelings of uncertainty
3. What change is due to new technology and what to the implementation process with multi-technology environment?
4. How would we redesign our job profiles?

The Italian workshop was very successful: it stimulated workers' participation, although only two professional profiles were investigated in depth. For this reason, we decided to start a new action (AIMESC community), not indicated in the programme, by inviting workers and trade unionist to an "online workshop" in order to

[1] See the complete questionnaire in the annexes.

continue the investigation. Three further contributions were then collected one of them integrating the workshop contribution.

The Spanish workshop, on it own, successfully collected information amongst a wider range of professional profiles, by searching more for the unifying factors rather than the specific differences, as a consequence of a management of the workshop by only trade union officers.

Both models (Analytical-focused and informative approach) of workshops can be used in future activities of the ETF rail section members to update information about ERTMS and to verify and anticipate the impact of the working conditions. Our experience highlights that while this latter can be successfully managed by trade unions' officers, the former requires that conductors hold two specific skills, which is expertise in work organization and working conditions and in group dynamics, such as tutors. Both profiles may be either external (researcher, consultant) or internal to trade unions.

Visits

The visits were not foreseen in the project programme: they were added in order to allow the steering group to gain direct experience about the directions of change coming from ERTMS implementation.

The visit to the Italian training centre of Ferrovie dello Stato in Milano gave the possibility to see the simulator, thus following a suggestion from both the questionnaire's answers, the EU conference and the analytical workshops, and allowing to anticipate in theory what the group would have checked in practice in the following visits at workplace.

Visits played an important role in increasing perception about the extent work changes, especially by comparing different operating context, by highlighting both organizational differences (e.g. the Spanish traffic control command, located in Zaragoza, exclusively dedicated to ERTMS lines versus the small Belgian one, located in Verviers, where just one position was monitoring the 40 km ERTMS line and the operational structure was the same as the traditional one) and the transition issue (the relaxed Spanish train driver with only initial and final transition from ERTMS and national traditional technology versus the German or Belgian driver facing 5 signalling systems and 6 voltage changes, which requires higher attention level and mental workload). However, some limitations were evident because of limitations in ethnographic observations: the visiting group was quite numerous in relation with a single workplace (the train driver's cockpit) and the span of time in observing management of anomalies quite limited.

Aimesc Final Conference

The Final conference, held in Rome on 27 January 2011, was the opportunity to exchange within a wider community of trade unionists from different European countries how the **project elaboration** can support our future activity in developing a new strategy to deal with ERTMS (or other technologies) impact on work and to share the content of the **guidelines**.

The day was organised in 3 Session:

1. the activities of the AIMESC project and its findings
2. the impact of ERTMS and trade union strategies – exemplary country cases:
   - working with ERTMS: experiences from countries where the technology is already implemented
   - anticipating the future with ERTMS technology: experiences from other countries
3. presentation of the trade union guidelines: How to anticipate and tackle the impact of ERTMS technology.

An overall assessment

The whole project highlights that trade unions' need to develop competences beyond the usual profile – that is organizational, information collection, and negotiating skills - in order to face radical changes of whatever kind. They also need to develop analytical skills in order to:

1) realize what information are appropriate to properly face change;
2) elicit, collect and compare employees' cognitive maps about their work in order to better represent their demands;
3) act as a "social architect" (Wilthagen and van Wenzel, 2004)[2], able to promote, manage and, when necessary, carry out some preliminary planning activity on work organization on the one hand, and thus to device and negotiate solutions to urgent issues by achieving satisfactory compromises which not only meet both employees demands and employers' performance needs, but also envisage more advanced solutions along the "high road flexibility" pattern, supported by

[2] Wilthagen T. and van Velzen M. (2004) *The road towards adaptability, flexibility and security,* Brussels, European Commission/DG Employment. Thematic Review Seminar on "Increasing adaptability for workers and enterprises".

both the 1997 Green Paper on Partnership for a new organisation of work and 2002 Commission reports on Work Organization.

Such process is not straightforward and needs also the construction of higher levels of shared information with employers and a participatory social dialogue framework.

In the case of railways industry we can list both enabling and hampering factors.

Amongst the former, we can include:

- high unionization level;
- good human capital both in terms of qualification and job-related experience;
- widespread professional identity;
- the feeling of carrying out a service of public interest;
- a strong attention to the safety issues.

On the other hand, several factors concur in hamper such cultural change:

- the feeling of working in a "protected" industry favoured both sectionalist union representation and prevalence of redistributive aspects rather than to solve organizational issues by increasing organizational performance;
- the persistence of authoritarian management style as an heritage of their importance for military strategies and as a way to coordinate a complex system;
- the negative feedback with a liberalization process without the necessary degree of technological and regulatory standardization amongst EU countries which would favour a race to bottom competition.

METHODOLOGY

Evidence about ERTMS implementation and its effect on employment and working conditions is collected by means of:

- submission of a semi-structured questionnaire to 5 to 10 employees per country by covering all involved professional profiles, collected in the first 2010 quarter;
- visits to traffic controller centres, driving cabs, and training centres;
- presentations at the introductory conferences and national workshops on ERTMS implementation progress;
- employees' witnesses at conference and national workshops, according to an analytical summarizing main changes in tasks and job content and their impact over health and safety, with a special focus on psychosocial issues, aiming to go more in depth about ERTMS impact;
- review of the existing literature on railways and other network industries' technological change, their impact on working conditions and social dialogue.

The questionnaire (see Appendix 2) investigates the extent of ERTMS deployment and its current state, by collecting information, if any, on rolling stocks and tracks, and outsourcing; the second section investigates both the actual and the expected impact on employment levels, changes in tasks and workloads, skills and competences, responsibilities, working times, and their workplaces' design, while the third section investigated on its impact on work organization and productivity; finally, the fourth section investigates whether the impact of ERTMS entered in collective bargaining, including pay.

Kick-off conference and national workshops were further steps in collecting information from employees: while in the former "free narration" was the basic pattern, in this latter reconstruction of the impact of ERTMS on the quality of work, organizational design, and on health and safety at work were based on a grid (see Annex B).

The contribution to trade unions' action

The present report cannot aim to fulfil with methodological requirements making outcomes from the collected body of evidence as "scientific", but rather provides a methodology in order to investigate more extensively and systematically the impact of ERTMS according to the "action research" strategy. In order to achieve more consolidated outcomes the collected evidence must be integrated by contributions from further workers.

Such a preliminary reconstruction attributes a central role to employees' cognitive maps (or "**raw maps**", according to the definition proposed by Oddone et al., 1981), that is how employees perceive their job with a specific focus on a specific goal (health outcomes, skills requirements and training, work organization, work performance, working times, etc.) which is the issue at stake in subsequent bargaining amongst social partners.

Such maps are the reference basis for any analysis aimed to support trade unions' actions aimed to redesign any aspect of work organization, as only workers' representatives – and thus those acting on their behalf - are entitled to have a full access to employees' private knowledge.

Under such a perspective, collective bargaining can be seen as designing a new "social architecture" of the affected organizations. In order to provide a credible and sustainable proposal, trade unions and workers' representative have to combine such information with other shared and accessible ones, such as company performance, repertoire of available analytical framework, analysis of the firms' actual mission and market positioning, according to the bargaining issue at stake.

CHAPTER 1
ERTMS, INSTITUTIONAL AND MARKET CHANGES IN THE RAILWAYS INDUSTRY

1.1 The goal of the unique market: do ERMTS and the process of liberalisation actually converge?

The EU "double track" strategy

The ERA "Biennial report on the Progress with Railway Interoperability in the European Union 2009" states that interoperability is "an essential part of the railways liberalization" by both fostering unique market in the railways sector and "improving the competitive position of the railways vis-à-vis other transport modes". Interoperability goals are set for the first time by the Council Directive 96/48/EC, which considers high speed trains, and then extended to conventional lines by Directive 2001/16/EC.

Simultaneously to the development and establishment of ERTMS and similarly to other 'network' public services – such as electricity, gas, post, telecoms, rail, air, and urban transport, employment services - the European Union launched a liberalization process aimed to create a unique EU market[1]. In the railways sector, three "liberalization packages" were launched in 2001, 2004 and 2007, by implicitly assuming a positive feedback between the

deployment of interoperability and liberalization in promoting the unique market for the railways services by guaranteeing a non-discriminatory access to newcomers in railways markets at national level.

Unique market is designed according a common structure to most services of general interests, which require heavy investments (see also Eurofound, 2006; SERVRAIL study, 2006), namely:

1) distinction between infrastructure owners and service providers to both individual and business customers, and between different service providing business, and by segmenting different businesses as passengers and freights in the case of railways, in order to prevent cross-subsidies (package 1);
2) when such a distinction is not possible, submit such services to regular competitions amongst those companies having an adequate know-how according to the Baumol et al. (1988)[2] contestable market model (package 3, and recast of the package 1, under discussion);
3) whenever possible, allowing more companies to operate in infrastructure supply by limiting their monopolistic power;
4) when infrastructure constitutes a "natural" monopoly (railways, electricity), several rules protecting both service providers and final customers in price setting by allowing access on a non-discriminatory basis (package 1);
5) establishment of regulatory authorities tackling monopolistic and collusive tendencies amongst operators, especially in price setting, aimed to protect final users (package 2, after that package 1 established the principle);
6) establishment of common standards in skills requirements for key professional profiles, such as train drivers, and of safety standards by means of both European (ERA)[5] and national level safety independent agencies.

According to the 2006 Eurofound EMCC report on railways sector, the separation of passenger and freight transport service provision from infrastructure management is the key transformation. It also resulted "in a greater focus on core activities, with outsourcing of non-core activities either through the creation of independent companies still under the state control, or usually through outsourcing of smaller activities to private sector companies". Some of these newly created companies – typically those focused on real estate - have been transformed into joint-stock companies with mixed ownership structures. On the other hand, new players entered, mostly restricted to regional activities, while few European-wide players have emerged serving national and regional markets in several Member States.

According to the SERVRAIL study looking into the current and likely future conditions of providing rail related services and at the legislation put in place in Member States as well as Norway and Switzerland, open access to rail related services is far from being achieved in most Member States.

[3] Hall D. Evaluating network services in Europe PSIRU March 2006 http://www.psiru.org/reports/2006-03-EUEPNIcrit.doc; Hall D. Evaluating the impact of liberalisation on public services PSIRU March 2005 http://www.psiru.org/reports/2005-03-EU-U-horizeval.doc.

[4] Baumol W.J., Panzar J.C., Willig R.D. (1988), Contestable markets and the thoery of industry structure. Harcourt, Brace, and Jovanovich, San Diego.

[5] European Rail Agency

Many stakeholders recognise that many of the difficulties encountered are introductory or transitional problems due to the fact that the opening of the rail market and competitive market entry are still relatively new processes; they consider that the problems should be solved as more experience is gained, and as the procedures and safeguard clauses are revised reflecting lessons learned. However, the categorisation of the remaining services varies between networks: certain elements are included within the minimum access package; some are included as services that must be provided on a non-discriminatory basis; whilst others are defined as discretionary, and hence are implicitly considered to be of less significance to market entrants. The consequence of these variations is that some national regimes are non-compliant with Directive 2001/14 in terms of their obligation to separate infrastructure from service provider to ensure non-discriminatory access to rail-related services.

Casting some doubts

Recently, several contributions criticize the apparent "double track" approach towards a unique railways market as quite an optimistic vision, based on a "mechanicistic" view of the liberalization impact. Their core argument is that liberalization without the previous implementation of a shared technological platform allowing an extensive interoperability will jeopardize both the establishment of a unique market in railways industry and therefore the expected benefits in terms of attracting both freight and passengers transport flows. Such an argument seems also shared, although in a reversed way, by the 2009 ERA annual report, when stating that "interoperability greatly favours liberalization processes, otherwise there hidden barriers would arise by limiting transport services offered". The most important atouts are, however, the immense increase of trains ERTMS should allow to travel, by achieving one train every eight minutes (level 1) and one minute and a half (level 2) on a double-track line: it would therefore overcome in large part the "shortage of rail transport capacity"[6] by minimizing investments in extremely expensive new tracks (around 20 ml €/km for High Speed) and therefore the impact on environment of heavy infrastructures.

Such argument is more extensively developed by several authors.

Mariaud. Two types of barriers: differences in signalling and institutional heterogeneity

Mariaud (2010)[7] singles out two types of barriers: *differences in signalling systems* and *institutional heterogeneity*, reinforcing each others.

Differences in signalling "are physical barriers for the entry of competitors on national markets" on the one hand and have economic consequences on the other in terms of disruptions, under-utilization of carrying capacity of the existing network, and therefore leaves "railways inefficient in the European competition between transport modes". Heterogeneous institutions are the effect of the national interests in railways, because of the strategic importance of railways for military authorities (Stopp and Dekker, 2008), thus hindering cooperation amongst actors which often "do not know how to proceed". While only this latter can be considered as "hidden", they both interact in slowing the implementation of the unique railways market.

Laperrouza and de Tilière. Two contradictory objectives: liberalisation and interoperable network

According to Laperrouza and de Tilière (2009)[8], integration of the European railway market is "far from achieved", as "*the European Union has been pushing two major but contradictory objectives at the same time*: the liberalization of the national markets and the creation of an interoperable network" which need different regulatory governance structure in order to be achieved, thus "potentially conflicting". They stress that "*the sequencing of reforms matters*", like in other network industries such as telecoms and electricity: "achieving technical harmonization of the European railway network matters would have probably eased the re-organization of markets and the introduction of competition, as within technical standardization it would have probably been more efficient to harmonize operational rules before technical rules".

[6] Noreland J., Modal split in the inland transport of the EU Freight and passenger transport up to 2006, Statistics in focus, Eurostat 35/2008

[7] Mariaud C. (2010), "Technical and institutional changes in European railway signaling systems" Paris School of Economics, http://laep.univ-paris1.fr/SEPIO/SEPIO100622Mariaud.pdf

[8] De Tilière, G. and Laperrouzza M. (2009) "Developing and deploying innovative technologies in a liberalized European railway system", European Transport Conference. Leeuwenhorst Conference Centre, The Netherlands, 5-7 October.

Why ERTMS must be prioritized in the unique market strategy

Fragmentation

The EU liberalization packages, by atomizing roles and responsibilities, go in an opposite direction of what ERTMS implementation calls for, that is "a deep cooperation in order to ensure the technical compatibility and interdependency between the equipments", thus raising "a contradiction between the technical and institutional recommended degrees of coordination" (Laperrouza and De Tilière, 2009). Fragmentation spread from the *technical* and *administrative and legal aspects*, due respectively to the technical complexity of the sector and the size of the network and different implementory processes of EU packages, to the *financial* and *organizational* aspects. Many railways operators, in fact, do not enjoy a good financial situation, although improving, and infrastructure managers are in an "even worse situation" (Laperrouza and de Tillière, 2009). Further unbundling strategies of the former vertically integrated monopolies vary across MSs with different public/private arrangements.

Thus, although ERTMS aims to remove the technological heterogeneity, implementation rules in national systems does not get rid of institutional and organizational heterogeneities, and "the higher the technical and institutional heterogeneity, the less likely the interoperable systems" (Mariaud, 2010) because of the higher difficulties in achieving the consensus amongst the involved stakeholders.

Institutional coordination

For these reasons, Mariaud (2010) emphasizes "that the need for institutional coordination is at least as important as the technical one" as "the technical interoperability has to be supported by a coherent and "interoperable" institutional framework". She therefore calls for ERTMS implementation according to a rather hierarchical structure, which "should encompass both the scope of the project in terms of organizational and technical responsibilities and decision rights so as to guarantee sufficient coordination between the actors".

Laperouza and de Tilliere (2009) outline the complexity of the European railway networks' governance as Member-States are often reluctant to give up control of their domestic railway sector. Thus, ERA "is not a regulatory agency *per se*" playing "a strong regulatory role but only to a certain point", its position is "weak (...) with a limited set of powers and strong oversight, although it successfully put in place a number of measures at the European level in order to achieve interoperability between national railway markets, in particular in the field of technical standardisation".

Such arguments provide a robust ground for the very severe ITF[9] (2010) conclusions: "there is insufficient co-ordination of transport policy on the one hand, and transport innovation and promotion policy on the other. The long-term orientation of innovation policy following the innovation cycle is difficult to bring in line with short- and medium term-oriented transport policy aims and measures. Moreover, there is an insufficient level of awareness about the importance of innovation among both public and private transport stakeholders. There is poor synergy between transport policy and industrial policy – numerous stakeholders and competing priorities from different sectors of the economy make convergence on innovation initiatives difficult".

CER-ETF report

The 2009 report of the CER/ETF joint group "Freight business restructuring and its impact on employment", clearly states the perspectives by stressing the importance of achieving a "critical mass", as the expansion of future rail infrastructure is therefore closely linked with the improvement in interoperability. Liberalization with poor interoperability and poor coverage of foreseen investments for the 6 ERTMS corridors, would thus not allow to achieve profitability for freight rail transport and making them followers of the road transport. This latter, in fact displays by far lower prices because of limited internalization of external costs[10]: in that case price reduction would be therefore at the expenses of the main variable cost (i.e. workforce) in order to achieve limited increase in their businesses.

The report highlights that the rescue of rail freight in the USA is favoured by a unique technological platform: thus, *it is interoperability the key driver for re-launch of rail transport and thus the establishment of a unique market*

[9] ITF (International Transport Workers' Federation). ITF (2010) Summary Analysis of Responses to a Country Survey on Innovation in Transport. International Transport Forum. Leipzig, 26-28 May 2010.

[10] An even worse scenario would be its complete failure: in that case liberalization impacts just at national level.

in rail, by making it profitable due to high sunk costs related to the high complexity in managing extensive networks, thus exploiting decreasing marginal costs and thus lower prices, and therefore by getting it attractive for new competitors.

The EC "double track" therefore contains conflicting internal goals which could seriously jeopardise not only the "unique market" goal. Unless interoperability, and therefore ERTMS, is prioritized, such a goal could leave the floor to a by far less ambitious liberalization at national level, with by far higher social costs. This perspective would seriously undermine the ambitious 2020 environmental goals.

1.1 Changes in the relationships between railways companies and their suppliers

According to the 2004 Eurofound report on railways equipment industry, the "development of new areas of competencies previously provided by railway operators" is seen as a major change coupled with a strengthening of technical and commercial innovation since the second half of 1990s. Such changes are accurately described by DeTiliere and Hulten (2003)[11] as the transition from a "national rail innovation model" to a European one.

The turning point was the EC directive 1991/440 imposing the separation between operations and infrastructure, the progressive opening of national markets for operation, and breaking the former equilibrium based on the tandem structure at national level between the national railways operator and one (or more) reference partners in developing technological innovation. Concentration processes amongst manufacturers (in general diversified groups operating in engineering and electromechanical manufacturing) started at mid-80s in view of the unique market and achieved in late 1990s.

The National rail innovation model was based on the partnership between the national railways operator and the manufacturer(s) at a very early stage of the innovation process: the former financed most (or all) of research and development (R&D) expenses through study contracts, with a complete validation of the technology. Manufacturer's pricing did not include R&D expenses, thus allowing it to export a validated technology at a lower price. The advantage for the manufacturer was a protected market up the full maturation of the technology, poor risks related to technology development and the benefits from a long-term cooperation with the operator, but at the price of export opportunities limited by similar partnerships in other countries. The main advantage for the operator was the full control of the technology, as innovation came from its functional and specifications while the manufacturer proposed technological specifications according to the degree of innovative solutions required, but at a higher price, as a combined effect of bearing most of R&D costs and of the search of specific solutions (the "not invented here" syndrome, de Tilière and Hulten, 2003).

By establishing open market, the European Rail Innovation Model does not allow the pursuit of long-term partnership between the operator and the manufacturers: these latter

[11] DeTiliere, G. and Hulten S. (2003), "A decade of change in the European Rail market; Influence on Innovation and R&D: Toward a new equilibrium in the railway sector". Paper presented at the First conference on Railroad industry structure, competition & investment. http://idei.fr/doc/conf/rai/papers_2003/detiliere.pdf

perceive "good opportunities to win new market shares, while still keeping for some time their national advantages to due remaining captive markets". Manufacturers financed R&D on their own, and operators were playing the role of the customer mainly involved in the process to test the operability of the system: the complete validation of the technology is done by manufacturers under the first commercial contracts where operators (customers) expected an implementation of "on the-shelves products".

The new situation exposes both manufacturers and operators to higher risks: the former have to bear all the risks, as R&D expenses are no more funded by the latter, although their market opportunities greatly increase and gain the full control over the technology, while the latter do not control anymore the technology they are buying, although they may benefit of lower costs due to increased standardization.

Operators do not provide anymore study contract for generic technologies but rather look for fully proven technologies by maintaining a role in identifying functional specifications. The increased competition amongst manufacturers increased standardization, by creating a subcontracting market: both the market and R&D risks shifted over the manufacturers, as open market favours "one shot" contracts. Operators may therefore maximize their short-run savings, but this prevent long-term cooperation opportunities: this implies that manufacturers redesign contracts by maximizing information asymmetries in order to prevent information transfer to their competitors, such as including their intervention in maintenance, especially in diagnostics. As we will see below (chapter 3) this change has a great impact on maintenance staff.

According to de Tilière and Laperrouza (2009), the main advantages of this model are higher standardization and lower prices because of increased competition between manufacturers and economies of scale; more efficient R&D efforts with increased value for operators. These advantages are counterbalanced by several disadvantages, such as higher financial risks for R&D investments for manufacturers, as none of them has the guarantee to have sales behind, and higher technical risks are higher as the operator has less role in the validation process; and higher commercial risks.

The operator and infrastructure managers can further incur in higher costs associated with lack of experience in contract design, evaluation and management: for instance, manufacturers can offer a lower price while providing equipments counterbalanced by a higher price in maintenance intervention.

ERTMS is a first systemic innovation developed according to this new European market configuration. After 10 years of maturation, it provides a key example to understand the new "European Rail Innovation Model": according to de Tilière and Hulten (2003), opportunities for manufacturers seems to increase, but "also increase commercial risks, as they have no guarantee for implementation even on their own former national networks", while operators have to shift from technical to functional specificators as "they now are not anymore shareholder in the technology development as before, letting manufacturers doing their role in technological specifications". However, this shift leads to a new challenge which now resides in the system integration: the number of partners and decision-makers is significantly increasing and therefore the implementation of systemic innovations such as ERTMS, is now more complex."

This change is viewed in dramatic terms by trade unions in most countries, as they fear maintenance staff losing their acquired professional levels and, the most worrying, being exposed to outsourcing risks. This point was widely debated both at the EU conference and at national workshops.

Main findings

While EC documents stress the role of liberalization process in order to achieve a unique market in railways services, several academic contributions stress the technological factor (that is interoperability and ERTMS) as the main driver in achieving such a goal. According to such contributions, ERTMS provides the common technological infrastructure that would boost railways modality with respect to air (especially passengers) and road (mainly freight) ones.
ERTMS is the new technological framework breaking the previous "national" model of innovation: technology development does not start anymore from rail operators in cooperation with equipment constructors, but it is these latter that take the initiative, and therefore hold the "property rights" over the technology.
However, ERTMS is still a non-mature technology: as rail operators still play some role as developers, they can apply for some property right over the technology.

Indications for training

A careful and updated information plan about technological evolution and regulatory implementation of ERTMS is necessary for trade union officers and workers representatives.

Indications for trade union bargaining policies

More information about contractual relationships between railways companies and infrastructure managers on the one hand and constructors on the other must be required.
Trade unions have to manage in order to gain wider scope in regulatory agencies both at national and European levels in order to promote regulatory uniformity.

CHAPTER 2
THE IMPACT OF ERTMS ON EMPLOYMENT: ARE THERE RELIABLE FIGURES?

2.1 The Eurostat source

The railways industry experienced over the last 20 years a severe restructuring with wide job losses. This is due to both the decline of railways modality, especially for freight transportation, and restructuring due to states' budget constraints, and the need to meet with the liberalization packages. For these reasons, we expect that the workforce is quite old because of lack of hirings.

The case of Austria is a good example of statistical problems: while according to Eurostat there are just 14,167 employees, according to CER OBB, the national railways operator, reported over 43,069 employees (47,009 in 2002), thus displaying a much more moderate reduction over time (-8.1%).

Further problems and inconsistencies arise when we consider disaggregation by operations, as the case of Spain shows. While 2000 statistics fit with those by gender (tab.2), this is no more the case for 2008 ones: for instance, total employment reported in tab. 1 (28159 employees) do not include employees in "other operations" functions, which amount to over 14,287 employees. Needless to say, figures show by far greater blanks that those by gender.

However, as stressed by the Eurofound 2006 report, "there are several problems about such statistics. First, the data available at European level are incomplete and do not provide statistics on rail transport for all Member States. Second, these figures do not illustrate the development of employment in railway services accurately, taking into account the extensive restructuring of the sector, which has led to a more heterogeneous market structure, in which large rail companies have created separate divisions for different types of services and/or outsourced services to companies operating in other sectors.

Another discrepancy that is apparent is between data from official statistical offices and those provided by the operating companies themselves and by other sources close to the company level, like industry associations. This makes it difficult to attain a clear and unambiguous picture of the development of employment in the past and of current employment levels".

Given these caveats, table 1 summarizes available trends in employment in the industry by gender, by considering 3 reference years, namely 2000, 2004 and 2008. No figure at all is available for Luxembourg, only 2000 figures are available for Germany (engendered), Bulgaria, Denmark, France, Ireland, Hungary, and the Netherlands (not

Tab. 1 Employment trends by gender and country.

	2008			2004			2000			2000-2008 variation		
	Total	Men	Women	Total	Men	Women	Total	Men	Women	Total	Men	Women
Belgium	38587	35045	3542	39289	36262	3027	41663	38831	2832	-7,4	-9,7	25,1
Bulgaria	:	:	:	:	:	:	19435	:	:			
Czech Rep.	56054	30498	25556	74993	51406	22609	87215	59978	27237	-35,7	-49,2	-6,2
Denmark	:	:	:	:	:	:	9705	:	:			
Germany	:	:	:	:	:	:	230615	185415	45200			
Estonia	3100	:	:	3570	:	:	6448	:	:	-51,9		
Ireland	:	:	:	:	:	:	5358	:	:			
Greece	6801	6082	719	8394	:	:	9973	9252	721	-31,8	-34,3	-0,3
Spain	28159	25064	2495	29752	27003	2749	33747	30837	2910	-16,6	-18,7	-14,3
France	:	:	:		:	:	174787	:	:			
Italy	83335	:	:	93380	82931	10449	106180	96336	9844	-21,5		
Latvia	5112	2433	2679	15401	9456	5945	15563	10061	5502	-67,2	-75,8	-51,3
Lithuania	10717	6739	3978	11818	7654	4164	15618	:	:	-31,4		
Luxembourg	:	:	:	:	:	:	:	:	:			
Hungary	:	:	:	:	:	:	57242	:	:			
Netherlands	:	:	:	:	:	:	11300	:	:			
Austria*	14167	13113	1054	46931	44117	2814	52554	49271	3283	-73,0	-73,4	-67,9
Poland	117077	84531	32546	133329	:	:	169488	121698	47488	-30,9	-30,5	-31,5
Portugal	:	:	:	:	:	:	12417	10469	1948			
Romania	:	:	:	65568	51728	13840	104795	81295	23500			
Slovenia	7984	6862	1122	8073	6941	1132	9026	7753	1273	-11,5	-11,5	-11,9
Slovakia	33468	24902	8566	39151	28737	10414	46813	34109	12704	-28,5	-27,0	-32,6
Finland	9922	8632	1290	10531	9004	1527	12236	10506	1730	-18,9	-17,8	-25,4
Sweden	16604	12230	4374	15291	11829	3462	14499	:	:	14,5		
U Kingdom*	52000	43000	9000	:	:	:	:	:	:			

Source: Eurostat, 2010

engendered). Only 2008 rough statistics are available for United Kingdom, while 2000 and 2004 figures are available for Romania.

All countries displaying figures for the 3 reference years display a noticeable reduction in employment levels, ranging from -7.4% in Belgium to -7.3% in Austria, with the noticeable exception of Sweden (+11.5%).

Because of the extent of such problems, no further analysis is carried. This poses huge problems in monitoring the impact of both ERTMS and liberalization packages: thus, any claim about the impact of any policy on employment is purely derived on a merely theoretical basis. Unless both Eurostat and social partners deploy a serious effort in building up reliable statistics, any impact assessment including employment is not well ground and meaningless.

2.2 The Eurofound EMCC observatory

The Eurofound EMCC (European Monitoring Centre of Change) monitors employment variations (increase or decrease) reported by main newspapers in each EU member state (+ Norway). Only those hiring or workforce reductions over 100 employees are reported, by including a short description of the underlying process (unilateral or negotiated, internal restructuring, merger/acquisition, outsourcing, delocation, closure, bankruptcy, business expansion, other). The 100 employees' threshold restricts to medium and large enterprises restructuring processes.

As figures are based on companies' (or social partners) announcements, they may not reflect the actual change in employment levels: there may be further redundancy (or hiring) processes which are managed individually, while the replacement rates of retired workers are not taken into account. Further, some announcements may overlap with previous ones from the same company as a consequence of further negotiations or change in business perspectives.

Notwithstanding such limitations, the EMCC database provides a good flavour of employment trends with a non-ordinary reason in medium and large companies.

Tab. 4 summarizes employment variations by scrolling the "transport and communication" industry and then including only those announcements in the railways sector. Poland, Austria, and Czech Republic report the most relevant employment reductions while only Norway reports a positive non-ordinary variation due to investments in the railways industry. Poland shows most contrasting trend: while in 2008 PKP intercity announced 5,000 recruitments after a merger, 2009-2010 restructuring generate almost 20,000 redundancy announcements.

France, Spain and Belgium announced restructuring with both early retirements and hirings in order to favour generational change, while in Italy, after massive

Tab. 2. Employment in the railways sector by activity. 2000.

ACTIVITY	General administration	Railway operations - total	Railway operations - operating and traffic	Railway operations - traction and rolling stock	Railway operations - ways and works	Employment in other operations	Total
Belgium	:	:	:	:	:	:	41663
Bulgaria	:	:	:	:	:	:	19435
Czech Republic	3823	81650	40571	23456	17623	1742	87215
Denmark	:	:	:	:	:	:	9705
Germany	:	:	:	:	:	:	230615
Estonia	334	5340	2404	1715	1221	0	6448
Ireland	:	:	:	:	:	:	5358
Greece	612	9361	3145	3480	2484	252	9973
Spain	2024	31723	14306	11562	5855	:	33747
France	10459	163422	53480	49933	60010	906	174787
Italy	:	:	:	:	:	:	106180
Latvia	1140	12490	4711	2699	4590	1933	15563
Lithuania	276	13550	4991	3854	4705	1792	15618
Luxembourg	:	:	:	:	:	:	:
Hungary	901	48579	24272	12547	11760	7762	57242
Netherlands	:	:	:	:	:	:	11300
Austria	:	:	:	:	:	:	52554
Poland	4988	161110	44070	38225	78815	3390	169488
Portugal	3007	9410	5880	1964	1564	2	12417
Romania	9063	95732	43504	21211	27805	3212	104795
Slovenia	486	8427	2817	2071	3539	113	9026
Slovakia	:	:	:	:	:	:	46813
Finland	887	11248	4607	3993	2648	101	12236
Sweden	:	:	:	:	5731	:	14499
United Kingdom	:	:	:	:	:	:	:

Source: Eurostat, 2010

redundancies announced in 2002, 1,900 new recruitments were announced as a consequence of new High Speed lines, equipped with ERTMS, including the new entrant Ntv (a partnership amongst Italian entrepreneurs and the French SNCF).

In general, Eu-15 countries achieved their restructuring in 2006, with the noticeable exceptions of France and United Kingdom, while National Member States report massive redundancies especially in 2009-2010.

2003, 2005 and 2009 report the strongest employment reductions' announcement at European level, while only in 2007 hiring announcements prevail over those foreseeing redundancies.

2.1 Employment perspectives: forecasts ….

The analysis of employment perspectives in the railways sector has been included in the transport and logistics sectoral study of the Commission project "Sectoral level analysis: Investing in the future of jobs and skills" aimed to identify emerging competences and future skills needs in 19 sectors at EU level, as a part of the "New skills for new jobs" strategy. By applying a common foresight scenario-based approach, these studies provide options both for anticipating and adapting to change and draw qualitative trends for the main professional profiles.

In the transport and logistics sector the overall demand is strongly dependent on macroeconomic performance, while the mix of different transport modalities is strongly affected by the technological innovation and the regulatory framework. Skills needs are therefore affected by economic, technological and organizational drivers (Rodrigues, 2007)[12].

The report acknowledges that a*dvances in IT impacting on organizational structures & new business models* are perhaps the most important driver, which influences development of the sector and will have large impacts on the transport sector: ICT development will affect the technology for both vehicles, the infrastructure and at the home base of transporters, that we can easily identify with ERTMS. "If and how fast these potentials materialise into products also depends on the overall economic situation (e.g. in regard to R&D investments) and the financial situation of firms that develop the products, research policy and the possibility of transport firms to purchase new and innovative products". Since science and technology are likely to progress independently of the macroeconomic performance, the investment in and demand of eco-technology is expected to remain rather stable "even in times of the financial crisis".

Tab. 3. Employment in the railways sector by activity . 2008

ACTIVITY	General administration	Railway operations - total	Railway operations - operating and traffic	Railway operations - traction and rolling stock	Railway operations - ways and works	Employment in other operations	Total
Belgium	:	:	:	:	:	:	38587
Bulgaria	:	:	:	:	:	:	:
Czech Republic	6268	43441	22475	12602	8364	6345	56054
Denmark	:	:	:	:	:	:	:
Germany	:	:	:	:	:	:	:
Estonia	:	:	:	:	:	:	3100
Ireland	:	:	:	:	:	:	:
Greece	:	:	:	:	:	:	6801
Spain	2480	25679	10202	4658	10819	14287	28159
France	:	:	:	:	:	:	:
Italy	:	:	:	:	:	:	83335
Latvia	388	3816	1754	407	1655	908	5112
Lithuania	230	9840	3520	2848	3472	647	10717
Luxembourg	:	:	:	:	:	:	:
Hungary	:	:	:	:	:	:	:
Netherlands	:	:	:	:	:	:	:
Austria	:	:	:	:	:	:	:
Poland	:	95140	26809	25991	42340	21937	117077
Portugal	:	:	:	:	:	:	:
Romania	:	:	:	:	:	:	:
Slovenia	450	7534	2606	1876	3052	0	7984
Slovakia	:	:	:	:	:	:	33468
Finland	926	8895	3502	3171	2222	101	9922
Sweden	:	16604	10788	:	5816	:	16604
United Kingdom	:	:	:	:	:	:	:

Source: Eurostat, 2010

[12] Rodrigues, M.J. (2007) "Innovation, Skills and Jobs. Pilot Project to Develop a European Foresight Methodology to Identify Emergent Jobs and Their Skills Needs". Working Document 2007.03.29

Employment perspectives are singled out for eight professional profiles in the railways sector (tab. 5) according to four alternative scenarios on the basis of macroeconomic trends, based on both trends:

- **exogenous** (such as macroeconomic, demographic, and technological trends)
- **endogenous**, or sector specific, drivers (mainly regulations concerning transport, competitiveness, labour markets and environmental impact, tolls).

The four alternative scenarios are:

1. ***no-limits***, that is fast recovery from the current crisis, and therefore *high transport demands*, and *loose regulatory levels* about all endogenous drivers;
2. ***off-roading***, that is a global scenario characterized by *economic stagnation*, with low performance in transports demand, and *low regulatory levels* as the dominant policies are aimed to cost reduction;
3. ***shifting gears***, that is "*regulated modernisation* of the transport sector within favourable economic settings" having environmental and socially sustainable growth as reference criteria, and therefore with a shift towards low-carbon transport modes (rail, navigation) , thus combining good macroeconomic performance and increasing regulation;
4. ***slow down***, which implies *low economic performance* with *increasing regulation* and while poor macroeconomic performances would not allow performing adequate investments.

The discussion in the previous chapter highlights the role of the sectoral regulatory framework in devising the competitive outlook of the railways modality: scenarios 1 and 2 look at first sight as associated with the prevalence of the liberalization process over the construction of the shared technological platform (ERTMS + interoperability), both in institutional and physical terms, while scenarios 3 and 4 look more associated with the prevalence of the regulatory process implementing ERTMS and interoperability.

Professionals in both business and logistics show the best perspectives, as a consequence of both liberalization with increasing needs in marketing: customized transport offers, often according to an intermodal pattern, will play an increasing role. Conversely, managerial and administrative profiles show more static perspectives since companies "formerly state-owned ... are still quite overstaffed with administrative and back-office workers": their move from the "natural monopoly" into a competitive market requires a less "bureaucratic" approach.

Consistently with this view, the 2009 CER-ETF report further outlines that combined road-rail transport, using large-scale rail transport to cover the principal distance and small-scale road transport for the further distribution

Tab. 4. Employment reductions in the railways industry. 2002-2010 announcements

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2002-2010
Belgium		**4177**						***900***		**5077**
Bulgaria										0
Czech Republic				6000		4000	320	2200	2200	14720
Denmark		100		100				200		400
Germany			480	9000						9480
Estonia						200	200	110		510
Ireland										0
Greece										0
Spain		1500		*1333*	2500					5333
France			3905	*3440*	-500			2600		9445
Italy	10000						(1000)	(900)		8100
Latvia								580		580
Lithuania										0
Luxembourg										0
Hungary								460		460
Netherlands	940			200	300				200	1640
Austria		15000								15000
Poland				1500			(5000)	9850	9700	16050
Portugal										0
Romania								3720	6380	10100
Slovenia			1136	2105					754	3995
Slovakia										0
Finland										0
Sweden		700						200		900
United Kingdom		2000	280	*(100)*		*140*	930	2920	(130)	6040
Norway							(1000)			(1000)
Total	10940	23477	5801	23578	2300	4340	(5550)	22840	19104	106830

Notes: in brackets employment increases; figures in italics are the algebraic sum of employment reductions and hirings announcements. Source: EMCC

and collection of goods, still accounts for a marginal portion of the total freight traffic within the European Community. However, they display wide opportunities, such as the transport flow between Germany and its southern neighbours.

Professional profiles related to operations (train drivers, stewards, mechanics and freight handlers) show different perspectives according to the market scenarios: favourable when growth is framed into a socially and environmentally sustainable scenario, unfavourable when increasing competition in a stagnant economy is based on cost reduction (off-roading scenario), static otherwise. However, workforce allocation is not investigated, since it pertains to the evolution of market organization.

In the case of the "No Limits" scenario with high growth and less regulation, this trend is expected to change into a more stable one, because of the strong increase in the overall demand for transport. For the business and logistics professionals even an increase in employment is foreseen, because of privatisation, business restructuring, more need for marketing and service concepts, the necessity for improving efficiency and the implementation of new technologies.

Under the "Shifting Gears" scenario high growth and more regulations, even higher growth then previous one in train transport is foreseen as environmental policies will favour rail transport over road and air transport because of lower pollution per ton/km transported. In this case, an increase in most job functions is foreseen, except for managerial and administrative functions, which will maintain. Here also the number of stewards, mechanics and rail drivers will increase due to the converging factors of growing demand for rail transport and the call for safety improvement.

Stewards, for example will not only add to on-board comfort but will also provide safety. Only in the "Off Roading" scenario where regulations are less strict and demand for transport declines, the number of stewards, mechanics and rail drivers will decline. In the other scenario with a decrease in overall transport demand but a much higher in regulations, rail transport will belong to the winners, thus maintaining the amount of mechanics and on-board train personnel due to counter balancing effects.

2.1 .....and employees' perspectives

An important issue is whether employees' perceptions about their employment perspectives fit with general forecast on sectoral labour markets. In general they fit, provided that they perceive as viable alternatives only those employment opportunities which imply at worst marginal losses in their earnings and by allow them to employ their skills. When market configuration changes, employees' perceptions do not fit anymore as they still refer to the previous scenario: in our case, this is consistent with the rent reductions caused by a transition from a monopolistic situation to a competitive one. In order to make them fitting, this would require strongly positive market perspectives, thus opening some career opportunities incumbents' employees.

In our case, employees' perspectives on employment discount both market and technological discontinuities: as discussed above, their temporal sequence is not neutral on both sectoral performances, thus affecting employment levels.

Employees in Italy and Spain, the two countries displaying the most extensive ERTMS deployment, share the main trends but with some difference. In Italy ERTMS tracks are additive, thus the impact on employment is initially positive:

"there would not be any occupational reduction if new technologies will coexist with traditional ones, although this does not occur in the junctions. There has been some increase (in employment) because of the new high-speed line" (TCTRL_IT)[13]

However, they fear that the trend will be reversed when it will be deployed on old tracks:

"no (reduction in employment) unless traditional technologies disappear. In that case there will be a strong migration with difficulties in adapting since new technologies are as you drive a bike or a plane" (TCTRL_IT)

"The change in technology in the safety system does not imply tasks' elimination. Those employed in signals' maintenance migrated towards new tasks, unless qualified" (TMAN_IT)[14].

Such answers, drawn from exploratory questionnaires,

Tab. 5 Train transport: employment perspectives by occupational group. 2020 forecasts

	1. no-limits	2. off-roading	3. shifting gears	4. slow down
Expected growth	**High**	**Low**	**High**	**Low**
Regulatory option	**Low**	**Low**	**High**	**High**
Managers	Stable	decrease	Stable	decrease
Business professionals	Increase	Stable	increase	increase
Logistics professionals	Increase	Stable	increase	increase
Administrative workers	Stable	decrease	Stable	decrease
stewards	Stable	decrease	increase	Stable
Mechanics	Stable	decrease	increase	Stable
Rail drivers	Stable	decrease	increase	Stable
Freight handlers	Stable	decrease	increase	Stable

Source: "Investing in the Future of Jobs and Skills. Transport and logistics"

[13] TCTRL_IT (quotation from questionnaire answer of a Traffic Controller in Italy. The suffix refers to the country, e.g.: ES in Spain)

[14] TMAN_IT (Train Maintenance in Italy)

show two implicit assumptions:

1. the **technological change** will increase labour productivity more than the business increase: rail modality will crowd other transport modalities (air and road) only marginally, without any significant reversal of the long-run decline of rail modality;
2. the **sectoral boundaries** coincide with the incumbent company, thus new entrants will belong to different labour market segments: employment opportunities in these latter are not perceived as viable alternatives as employment rights and/or wage are lower.

Such views summarize first of all the incremental way ERTMS has been introduced hereto, with a moderate deviation from the long-run trend: creation of a unique market is perceived as a synomim of liberalization and "deregulation" in the sector and thus in the employment status. Positive performance of high speed lines (HSLs)[15] are seen as just a short-term anomaly rather than the anticipation of the long-run trend reversal. Reduction in employment levels is as worrying as changes of the technological environment.

In Spain ERTMS is deployed more extensively by combining both new lines and switching old ones. A traffic controller summarizes as follows its impact:

"employment being generated by ERTMS/ETCS deployment is diverted towards those companies providing maintenance services for the infrastructure, ICT systems, rolling stock construction, R&D, testing, etc. The workforce (...) is being concentrated in large premises, without implying any increase in the staff but rather a re-classification or changes, transfers from less productive premises to others with more workload". (TCTRL_ES)

His views fit with those of an employee for maintenance provider:

"I believe that in general there could be an increase in employees, since there is an increase of components to be maintained (balises along the tracks), provided that there will be a regular maintenance" (EXTman_I_ES)

Although the argument might be too semplicistic, he catches the main organizational change in the sector: **the transition towards the market is not limited to the railways transport services** per se, **it introduces in any phase the managerial choice between "make" or "buy", including maintenance activities, while in the previous monopolistic national markets the "natural" choice was "make"**. The sector no more coincides with those firms supplying transport services (including infrastructure): the boundary between them and technology providers is being blurred for several reasons, first of all the speed of innovation in ICT.

Because of the wider deployment of ERTMS, including non-high speed tracks, the Spanish employees outline the already systemic impact of ERTMS, well beyond passengers' high speed trains as in Italy: restructuring of both the railways sector and incumbent goes much more in depth, as we will discuss in the next chapter.

Denmark is probably the only EU country having announced hereto an operative transition plan to the ERTMS: 300 redundancies are foreseen amongst traffic controllers, which will be concentrated in less traffic control commands. Such redundancies will be jointly managed with trade unions according a redeployment plan.

[15] As Ponti (2010) points out from FS statistics, the High-speed track Milano-Bologna-Firenze is a great success, with over 72 trains per day and 55% of the total passengers' traffic between Rome and Milano after just one year functioning.

Main findings

European figures on employment in railways sector do not allow for a reliable monitoring of trends: while Eurostat statistics show lots of missing figures, the EMCC observatory reports only major announcements concerning redundancies and hirings, providing just a flavour of actual trends. At the present state, they do not provide any ground to the claim "liberalization = lower costs = more employment".

2020 employment forecasts heavily rely on economic performance and regulatory policies, both at general (green economy) and sectoral (ERTMS standards and liberalization) levels, thus affecting all profiles in operations. More regulation would advantage railways industry: however, EU reports under-estimate the role of technological regulation in promoting the railways mode of transport.

Business and logistic professional show the best perspectives: they are quite new for the industry.

However, employees' perceptions highlight that breaking integrated railways companies increase managerial "make or buy" choice, thus favouring outsourcing and contracting-out processes.

Indications for training (for workers)

ERTMS deployment implies a wide employees' internal mobility, both in terms of changing work premises within the same professional profile and changing professional profiles. Both cases require extensive workforce re-training, having different complexity according to the ERTMS impact on their tasks.

Training activities must be based on national protocols having as reference EU certification requirements and national standards. Such activities are to be summarized in a *Training plan*, which must take into account the socio-demographic profile of the affected workers, especially age and professional profile.

Indications for trade unions

1. ERTMS is a technology reducing the need for new great infrastructure with high environmental impact since it allows a strong increase in trains' frequency, and employment perspectives in the industry strongly rely on its success: there is therefore a clear convergence of interests between sectoral social partners with those actors calling for a "green economy". This opens room for wider coalition building.
2. Social partners have to seek for a reliable monitoring tool both by lobbying over the Commission and Eurostat by improving their quality and timeliness, and by promoting a network of Observatories monitoring employment levels in the industry as a whole.
3. Internal mobility processes have to be negotiated amongst social partners and coupled with some training activities, having a different extent according to whether it implies a professional change or not, according to a negotiated training plan.
4. A negotiated training plan foresees training activities by professional profiles, modularized as much as possible in order to meet different competence levels of affected employees.
5. These latter must be granted the right to a competence balance, the definition of a training path in order to achieve skills required by her/his new professional profile as a consequence of ERTMS implementation: such a training path must include specialistic skills, transversal skills, with a particular attention to occupational health and safety (OHS) information, communication and linguistic skills.

CHAPTER 3
THE IMPACT ON WORKING CONDITIONS: ERTMS AS A RATIONALIZATION DEVICE

ERTMS has a wide impact on the way employees' perform their tasks, learn their job and the relations they have with their colleagues and superiors. Such changes affect the skills they need on the one hand, and have a deep impact on their health, due to both the different technological environment and the uncertainties related to the switch phase, amplified by the expected length of the transition phase.

"The practical ERTMS stake is to suppose a continuous transformation in the quantity and the quality of tasks to fulfil" (TCTRL_ES)[16]

Employees directly dealing with ERTMS, such as train drivers, traffic controllers, infrastructure and rolling stock maintenance staff, report an extensive redesign in their task and some times in their premises as well, while those not dealing directly with such technology, such as guards and stewards, seem at first sight marginally affected. In this report we focus over just three professional profiles, where evidence from both our sources of evidence (questionnaires, conference, workshops, and visits) and literature is richer: *train drivers* (DRI), *rolling stock maintenance* (TMAN) and *traffic controllers* (TCTRL). These profiles are amongst the most directly affected by the implementation of ERTMS,

Most of the studies about "human factors" in ERTMS design and implementation focused on train drivers and, to a minor extent, traffic controllers (RSSB, 2004; Porter, 2002; Wilson et al., 2007; Young et al., 2006)[17], by paying particular attention on more frequent errors affecting train safety, mental workload, and ergonomic design. Such studies played an important role while devising risk assessment (RSSB, 2004).

Further, the way ERTMS is being implemented calls for significant selection bias: employees involved in a new technological environment, requiring a "fine tuning" regulation, are usually selected amongst those enjoying the reputation of "best" workers within their profile, holding above average competences, as they play the role of technology developers when the new technology requires new skills. In that case, they therefore benefit of a sort of "élite" status: their supervisors take in great consideration their comments and grant them more opportunities and autonomy while performing their tasks with respect to the hypothetical "consolidated" state of the technology.

The professional profiles investigated are mainly focused in the operation area, where the largest part of the workforce is concentrated (in brackets the acronym used): train drivers (Dri), on-board stewards (st), train and infrastructure maintenance (Tman and I_man), which could be technology providers' employees (Ext), traffic control (tctrl), project (PRO), while his/her nationality is identified by the country abbreviation: (IT, ES, DE, UK, HU, FR, BE).

3.1 Train drivers

The overall impact

The main change train drivers experience while working with ERTMS, is their focus on information displayed by the monitor, or DMI ("head down", Porter, 2002), instead by external signalling ("head up"). This introduces great changes in their cognitive workload and was topping ex ante studies' worries: signalling from the DMI is more accurate and detailed (up to 147 different symbols, Porter, 2002) and provides detailed information for forward route planning.

After several years, most experienced train drivers draw a right positive balance of ERTMS:

"(information available on monitor) greatly improved train drivers' job, as it is easier to pay attention to internal than to external signalling" (DRI_ES)

"it is a good system, very stable, easy to drive". (DRI_DE2)

They further appreciate its higher safety levels:

"it is much safer than ASFA (the Spanish signalling system, installed on the Madrid-Sevilla High Speed Line) since in normal conditions .... it is impossible to exceed maximum speed". (DRI_ES)

Train drivers carry out regulatory activities while driving, as degrade concern both mechanical, electric and configuration systems: some software are being developed.

"I used pliers and screwdriver, now I don't leave my armchair" (DRI-IT)

However, the need of on-board maintenance remains: apart traditional electro-mechanical intervention on locomotives, which is no more possible as in most countries trains have one driver, it is the guard which provides some support, although he does not have any specific knowledge about the technology and "has to trust the train driver".

Trains equipped with ERTMS show a further shift towards a digital control of electro-mechanical parameters with a totally different regulation when the train is on march: maintenance activity is mainly carried out by means of centralized signalling apparatus governed by the on-board PC, and – when needed – still with the support of the guard.

[16] TCTRL_ES (Traffic control in Spain)

[17] Porter D. Implementing ERTMS in the UK: Human Factors implications for TRain Drivers. http://www.intlrailsafety.com/Tokyo/3-2Tokyo_FullPaper.doc.. Young, Mark S., Stanton, N.A. and Walker, Guy H. (2006), "In loco intellegentia: human factors for the future European train driver". *International Journal of Industrial and Systems Engineering*, 1, (4), 485-501. available also online at: http://dspace.brunel.ac.uk/bitstream/2438/656/1/2006%20Young%20et%20al%20IJISE%20(preprint).pdf. RSSB (2004). Impact of the European Rail Traffic Management System (ERTMS) on driver workload. London: Rail Safety and Standards Board.

The drawbacks of a technology in a continuous evolution...

It seems therefore that the transition to the new environment does not generate additional mental workload, unless two factors concur in modifying such feeling:

1) ERTMS is technology in evolution

2) it is deployed over a small part of the railways network, thus requiring transitions from different systems.

As an Italian train driver states "there are almost daily software updates", which implies some conflict between the available instructions and the system: this would require drivers to be pre-alerted, but this is not often the case.

Further, standardization is limited to operative rules, letting differences amongst constructors:

"unfortunately each constructor deploys its own ETCS which, although they fit for the main characteristics, always show differences both in the functioning and train drivers' operability" (DRI_ES)

"DMI are different between Alstolm and Ansaldo: this generates confusion" (DRI_IT)

such as diversity in labelling functional buttons, different ways for data entry, different location of external acknowledgment on the desk, presence of automatic driving modality, functioning tests, etc..

"for what concerns GSM-R there is a total madness, each constructor has its own type of monitor: some are touch screen, others are not, some are large, others small .... instead of easing workers' task performance thanks to vehicles' interoperability, they generate wide difficulties at the same time" (DRI_ES)

External signalling contributes to such confusion:

"over the same track Madrid-Barcelona the same message for balises inconsistencies sound, and the way to drive the train as well, differs from Madrid to Lerida (constructed by Ansaldo-Cobra) to from Lerida to Barcelona (constructed by Dimetronic)". (DRI_ES)

Further problems reported are lowering in the signals, unreal braking curves as the rolling stock occurs in an unnecessary warning out, inconsistencies amongst balises, or failures in meeting balises, or unplugged ones with adverse weather (frost, snow), thus generating systems disconnections.

Thus, train drivers' mental workload increases with the number of equipments, providers, as he has to "reset" his mind according to the train he is driving. This gets troublesome in the Spanish case, where rolling stocks is supplied by 5 constructors (Alstom, Ansaldo, Caf, Bombardier, and Siemens). This explains why train drivers advocate for further standardization beyond the technological rules by affecting operational aspects, such as the establishment of a standard layout in order to minimize operational uncertainties to train drivers.

.... and of the transition phase

Limited deployment of ERTMS raises the second critical area, as train have to combine "new" and "traditional" technologies and train drivers must be keen on both:

"the new technology did not substitute the old modus operandi, rather it added to" (DRI_IT)

"There have been an increase in application of on board installed equipments". (DRI_DE)

The Koln-Brussels track is the extreme situation, described by a German train driver:

"I start with the German traditional system, then after few kilometres, I switch to the UCP (the German hi-speed system similar to ERTMS) after almost 20 minutes, while approaching to Aachen, I switch back to the German traditional system. After Aachen we cross the frontier with Belgium with Belgian system TBL-1, few kilometres with ETCS-1 then level 2. Further 20 minutes, while approaching Liege we change back to TBL until Brussels." (DRI_DE1)

Such systems switches overlap with switches in voltage from 3KV to 25KV of High-speed lines, including 60 Km between Liege and Brussels with the Belgian TBL-2.

In order to guarantee higher safety standards, train's signalling systems setups minimizes "missed failures": unfortunately their minimizing inevitably increases the probability that the systems detect some "false errors", and then signalled by both the on-board screen and an acoustic warning message. As such checks are automatically performed every time there is a transition amongst signalling systems, they are quite frequent on such a line: although train drivers are aware of such occurrence, it anyway generates some apprehensions:

"continuous switches sum up with attention to signals, thus generating functioning irregularities … This is stressful" (DRI_DE1)

"This way of working has great dangers of mistakes and wrong reactions when the systems have failures. And it is stressing the drivers..... four drivers stopped driving cross border, because of health (stress)" (SG_DE)

"driving at 3KV is different than at 25KV, degrades are different for instance." (DRI_IT)

Transition will be a long-standing state, well beyond the time ERTMS will achieve its maturity. Such coexistence of old national systems not only generates considerable additional costs for train equipments, but also additional cognitive workload, as we will discuss below.

Changes in the learning process: towards a specialization

An Italian train driver describes how he got train driver

"After the initial flanking, I was for about one year second driver, then I had the full entitlement of the train, for about 2 years (of training)" (DRI-IT)

Such a short description summarizes that train drivers' training was basically on-the-job and relying on socialization patterns. Migration towards the new environment deeply changes the learning pattern, which is by far shorter and more proceduralized:

"5 months (off-the job training) for learning procedures and regulations, 6 months in flanking as a second driver, written and oral exam and 10 days driving for the high-speed trains: at most one year for gaining the certification for train driving" (DRI_IT)

Socialization is no more the key learning modality but it just plays a complementary role, as the "practicing" phase of procedures studied and tested on the train simulator: training is no more governed by the "senior" driver's informal knowledge transfer, but follows more tight and optimized steps. The six-months on board period plays the

role of "validating" experience in order to get accustomed to the actual pace of train driving, such as the switch phases from ETCS to traditional systems, and managing with system degrading.

Thus, the migration towards the ETCS/ERTMS technological environment implies a **rationalization of the training process**, by formalizing it according to well-defined steps patterns.

On the other hand,

"once the train driver could drive a variety of engines over a variety of tracks, now his scope is delimited over a limited typology and he gets more specialized." (DRI_IT)

thus generating "a knowledge loss about engines and tracks" (DRI_IT). Differences in training paths will drive to "two distinct train drivers' profile, similarly to aircrafts" (DRI_IT): ERTMS will be the discriminating factor.

On the other hand, such "specialization" is required by the change in the market configuration allowing one-shot contracts, as reported by a Spanish train driver:

"the ERTMS system is on Alstom trains (104 and 114), Caf (120 and 121), Bombardier-Talgo (102, 112 and 130) and Siemens (103, ICE 3) and on Civia units by Caf."[1] (DRI-ES)

That is "just" 9 trains from 4 constructors, with the variety of equipments and desk design discussed above: in that case specialization of train drivers on just ERTMS is somewhat obliged, as they must also detain enough experience over traditional technology because of switches amongst technology.

However, railways operators show some tendency in separating High Speed Lines (HSLs) from the "traditional" ones: while in Spain they are a separate RENFE division, in Italy there are recurrent whispers about FS will launch an IPO (*Initial Public Offering)* for High Speed Lines as they are profitable.

Control and communications: new conflict stances

GSM-R introduced considerable changes in communications with both colleagues and superiors. The issue of communication by mobile phone was strongly debated amongst practitioners because of the possible risks for safety, by extending per analogy findings about road drivers, although no indication emerged that these results were transferable to train drivers as rail is a completely different context. The use of a hands-free kit does not seem to relieve the situation.

Train drivers favourably perceived its introduction (Young et al., 2006). Good communication with colleagues, especially guards and traffic controllers, is very important in order to solve unforeseen problems: while the former provide an important support in facing with local trains degrading and regulation, communication with these latter are essential in order to ensure safety and punctuality:

"good cooperation and developing synergies with guards and traffic controllers generate a mutual learning process" (DRI_IT).

Of course, it is a different communication style with respect to the two-drivers situation, where they achieve such a strict partnership and, when one-man driving was introduced in Italy in 2009, it generated a widespread "widowship " feeling: horizontal communications are now less "emotional" and quite concise, especially those through DMI.

By making the whole process more formalized, it gets also more transparent and monitorable: management thus has more control opportunities and can exert some pressure over train drivers, especially in terms of punctuality, safety and reliability needs, with the withdrawal (or non-renewal) of the ERTMS licence as a last resource threat, which implies in the Italian case the loss of a ERTMS driving indemnity on the one hand and a loss of status on the other.

However, as a train driver points out,

"the whole HSL-ERTMS stuff is new for hierarchy as well: they need cooperation. The relationships with hierarchy increases" (DRI_IT)

ERTMS is a technology still in evolution: driving, traffic control and maintenance diagnostics are the key activities carrying out its development. For this reason the keenest

on train drivers were selected and gain a "special" treatment: those selected for the experimental phase often propose the reformulation of operative, making them more friendly and manageable. Management is well aware of their contribution, which will persist as software updates, new releases and new trains need an optimization phase, thus making their pressures more subtle.

"Conflicts with hierarchy increase. It is the way to manage that changed." (DRI_IT)

It is therefore the train driver's individual reputation and ability in managing conflicts that decides the balance:

"I never undergo in conflict with my supervisor, I manage to avoid it." (DRI_IT)

This is the case of senior ERTMS train drivers: what about a new licensed ones, enjoying a by far lower room to manoeuvre? They are not (deliberately?) trained in conflict management and can be easily pressured by management. Thus, the flanking phase, its previous experience on "traditional" engines, and unionization are the main socialization ways in order to achieve the necessary self-confidence.

3.2 Traffic controller

How work changes

In the electromechanical technological framework, traffic controllers were largely dispersed along the lines in order to ensure a fast intervention. Further, as the size of the control unit increases the command chain would greatly increase by achieving to a decision slower. Automatic systems greatly reduced the size of traffic control units and therefore the complexity of the decision chain.

A Spanish traffic controller summarizes the goal these activities and the changes induced by ERTMS implementation: man intervenes when safety is at risk as

"A high degree of workforce responsibility is maintained: we know that safety is guaranteed by the system, but in case of degrade the responsibility passes from the machine to man, traffic controller or train driver." (TCTRL_ES)

Thus, it's a just-in-case intervention. Circulation management is, of course, more focused on supervision rather than on intervention. The new terms of reference are well resumed in the Spanish case as follows:

"one train every 5'30" with 300 km/h as maximum speed with ETCS level 1, reduced to 2'30" with 350Km/h as maximum speed with level 2, while on ASFA the interval is 8 minutes with 200km/h as maximum speed." (TCTRL_ES)

Such changes call on traffic controller higher reactivity, with shorter lead times from the emergence of a circulation anomaly to its solution: while the speed is lower in a non-HSL environment, the train interval may decrease. Higher reactivity is favoured by changes in both operational routines:

"simplification in protocols and messaging with train drivers; more safety and simpler interventions in maintenance, as they are managed and supervised by the central maintenance head." (TCTRL_IT)

It seems therefore that a strongly decentralized system has been put in place, with an apparently flat work organization, while supervision and main decisions (including maintenance) are centralized, according to the following tasks' redesign:

"actions once assigned to several profiles are concentrating (to one person), ... these systems require timely interventions and decisional points have to be upgraded at the top of their intervention's potential" (TCRTL_IT)

As already observed since late 70s in manufacturing, digitalization induces task recomposition and a de-taylorization of control activities: it therefore greatly increases work discretion, especially by allowing the operator to choose solutions which cannot be anticipated by the hierarchic line, according to the Ohno (1988) "autonomation" principle ("automation with a human touch": attributing employees the power to autonomously intervene when an anomaly arises). While in Toyota, and then more in general in manufacturing, this means to empower the employees to stop the machine or the production line, in traffic controlling this means to choose amongst alternative solutions: not only in order to prevent a negative occurrence (pars destruens) but also to find a solution (pars construens) in order to allow circulation to go on, if possible, that is something definitively more complex. This would have not been possible in the previous tasks' division amongst a plurality of traffic controllers, where a supervisor was needed: the organizational change is impressive.

"There is a noticeable change in responsibility, the commercial speed is a relevant factor, changes in the way of working and type of employment with a stronger involvement in the company system, with larger competences but more regulated and controlled." (TCTRL_ES)

In order to achieve empowerment, our traffic controller outlines that empowerment requires involvement, a shift of employees' focus "from task to mission". This impact on professional profile:

"working with HSL requires an extension in traffic control abilitation with a specific protocol, thus knowledge must be implemented." (TCRTL_IT)

A new work organization

Finding a solution in managing a railways line is no more a "local" problem of a specific machine or an assembly line: it requires a higher professional content, more formalized procedures and work routines in order to make his/her decisional process fully traceable, similarly to air traffic controllers. However, multitasking and collapsing of multiple competences once split amongst several workers into just one person make small traffic control centres unbearable for objective reasons: variability in circulation along the day, both in number of trains and their timetables, requires a variable number of traffic controllers. The mental workload would become unbearable when there is a one-man workplace because of the extent of the responsibility related to the "take in charge", both in circulation problems and safety implications, as traffic controller as well would need advice, at least peer-to-peer; finally, dispersed premises would be so small that a foreman would be useless. The complex organization of a traffic control unit is well highlighted here:

"Although this supposes a team working, lines are

divided in section of regulation and management which is something else then responsibility division: it is a line subdivision in area of jurisdiction under a unique head." (TCTRL_ES)

There is at the same time an individual responsibility in supervising the assigned track section, an horizontal cooperation amongst traffic controllers for both take in charge transfers at a formal level and share suggestions and advice in order to share the psychological burden when an anomaly arises. And however the presence of a local supervisor which heads the unit (or the shift) which takes the main decisions as he holds both an overall view of the supervised lines and keep the contacts with the central unit, which may play the role of the Likert's "linking pin" (Likert, 1961). It is therefore a spurious team working as information sharing is the key feature while there are not necessarily rotating tasks, a key characteristic of non-autonomous teams, and the head could act as a team leader, but his/her role is not just as a last-resource decision-maker as his/her interventions are quite extensive and play a purely supervisory role. The military-like heritage, shared to different extent by all railways companies and particularly strong in traffic controlling, reinforces spurious characters also with respect to "lean" non-autonomous teams.

Concentration in large traffic control units is a further consequence of task recomposition at a higher technological level, and short feedback in reactions:

"an increase in technological knowledge, a personnel concentration in fewer centres with lower presence over the line, increase in the interface with the central units' heads" (TCTRL_IT)

"personnel charged of traffic control are being concentrating in large premises, without any workforce increase but rather a re-classification or transformations by moving from low-productivity premises to other concentrating more activities ... we observe a workers' redeployment without any employment creation in strict terms." (TCTRL_ES)

Remote control allowed by ICT is the key issue which allows concentration in even larger traffic control. Such feature is shared with both telecoms and electricity networks, whose supervision is guaranteed by the opportunity to continuously "ping" (send control messages with automatic feedback, when the receiving point is working) balises and the lines. In principle, this would allow a full centralization in traffic control, as envisaged in German and Danish infrastructure management companies. Centralisation will favour "scale economy" but is less appropriate in order to manage anomalies and disruptions: "a remote situation awareness of such a centralised system under pressure of the need for more detailed and actual traffic information and communication increases the workload of the controllers in case of traffic flow disruptions and incident handling."(Stop and Dekker, 2009)[19]

The way control is performed is a further point increasing team working's spuriousness amongst traffic controllers: ICT makes front-end activities more transparent,

"We feel observed and controlled not only how we achieve our tasks but also the way and the time we employ" (TCTRL_ES)

This does not mean that rationalization could be pushed up to assign times for each tasks, routinary activities alternate with non-routinary ones, but could aim to reduce job porosity:

"the management structure is endowed with necessary technical means in order to observe from remote all processes and intervene when they consider it necessary throughout the command line when required." (TCTRL_ES)

This means that supervisory structures may intervene in handling anomalies, such as disruptions, accidents, or just conflicts between infrastructure companies and rail providers, as last resort controllers or a sort of emergency task force. There could be a scope for an organizational choice between peripherical (although in larger units) versus centralized organizational redundancies: while in the former case supervisory structures prefer to do not interphere as much as possible in front-end operations, in the latter case non-standard contracts (part-time, on call workers) or working times' (on-call working time) may be introduced in order to keep the workforce at its minimal stock. Safety reasons and dynamics in the technology would play against this latter perspective while lower human involvement in innovative train control system, based on modern technology and a new generation of signalling systems would favour it. However, as conflicts resolution is a key skill for traffic controllers and its importance is increasing as competition amongst train providers is expected to rise, as a consequence of Liberalization they need to be both well trained and experienced. Further, the rapid decline of the early 1980s myth of the unmanned factory in favour of "frugal innovation" since human experience is a less complex resource and allows decentralized problem solving makes peripherical redundancy by far more desirable by the companies.

[19] Stop J., Dekker S. (2009), The ERTMS railway signalling system; deals on wheels? An inquiry into the safety architecture of high speed train safety. http://repository.tudelft.nl/assets/uuid:433a0dd7-c2fd-4b14-a2eb-f02e5862bf13/MTS_123973590776790665.doc

"We are observing a new working methodology, a new way of communication between traffic and trains' heads: a new language, very technical, adapted to each own system defining ERTMS. New concepts and new definitions shaping the daily language after the system implementation." (TCTRL_ES)

3.3 Train maintenance staff

How work changes: a reduced room to manoeuvre?

According to the transport and logistics sectoral report "New skills for new jobs", the introduction of a European system will ease cross border operations and evolve competition across borders in the sector in the longer run. Standardization of components implies that maintenance workers will have to be trained in replacing rather than repairing.

The maintenance process is almost unchanged, by distinguishing amongst ordinary maintenance, carried out when train driver signals an anomaly, and planned maintenance. In both case the sequence is almost stable in the two environments (diagnostic - intervention – running simulation and loop – and system functioning final check) but lots of things change, especially the way to proceed.

First of all, with "traditional" technology, diagnostics was the first step carried out by the team: intense communication was the distinctive feature as it was performed by all team members and then jointly discussed in order to plan interventions. As actions required analysis, communication exchanges, planning, implying the full deployment of maintenance staff experience, they consider this phase as:

"the most stimulating and professionalizing task" (TMAN_IT)

Under ERTMS, it is the construction company performing these tasks:

"now (diagnostics) is all by PC, there is a responsibility left to the external enterprise" (TMAN_IT)

"data are downloaded and sent to the engineering department, who decides the intervention to be done and what's to substitute ... we depend from the system's supplier and maintenance software." (TMAN_IT)

Such a dependency from the constructor generates a deprivation feeling amongst maintenance staff. From workers' point of view, this is the most important consequence of directive 440/91 defending long-term cooperation between constructors and operators. This has also great importance in clarifying the relationship between railways companies and technology suppliers (see the box below).

Thus, while train drivers act as "technology developers", the maintenance staff – the knowledge reservoir applied to railways' equipments under the "traditional" technological paradigm – is now confined to an ancillary role as mere executor of what decided by the constructor's engineering: a full separation between "thinking" and "doing" is apparently achieved.

The intervention phase experience noticeable changes. Once inspected the train, in the traditional technology the maintenance team decides how to distribute the tasks according to the different interventions to be take: piece repairing was the prior alternative, while parts were substituted only when necessary, with an extensive use of machine-tools for mechanic parts.

Under the ERTMS technology, the train is a priori decomposed in modules assigned to smaller teams (usually "the old, the transferred and the apprentice") performing the task as soon as possible

"it is like the F-1 pit-stop." (TMAN_IT)

The assessment parameters in evaluation of "good" interventions change:

"once a good intervention was the adjustment of the piece without incurring in high costs although it required more time. Now speed is the key parameter in assessing both a good intervention and professional level." (TMAN-IT)

There are several reasons for it. First of all, ERTMS requires a perfect fit between the train and the line, as the case of an ovalized wheel summarizes. Under the traditional technology, giving it a turn was fair enough to remedy the problem, while under ERTMS the wheel must be substituted, as turning it would reduce the diameter, although very slightly: as the on-board PC calculates the speed and the distance between balises on the basis of its standard size, it would not match the balise when expected, thus generating system errors.

Further, the "traditional" maintenance staff may not consider time as a binding constraint, thus considering spare parts and consumables as the only cost, and workforce time as a fixed cost. Such a view cannot fit with both managerial views' and general economic sustainability considerations[20]. The following scheme summarizes the main apparent changes.

Tab. 6 changes in maintenance staff working process

	traditional	ERTMS	Optimized variable
Diagnosis	internal	Constructor: data download sent to engineering	From integration to know-how preservation
Intervention	Internal: take in charge the whole train and repair it	Internal – unbundled in small groups and substitute	from cost minimization to time minimization
Running simulation and loop	Internal	Internal	
Final check	Internal	Internal	

[20] This point needs further investigation as this picture clearly relies on too few organizational context: for instance managerial control over costs may vary across railways companies.

When we move our attention from the process to the content of work, changes are even more substantial. ICTs massively enters in maintenance processes

"with respect to tasks I performed previously, maintenance and control of the new system require a wider use of PC and related technologies, especially Wi-Fi" (TMAN_IT)

ICT intervention impacts first of all on the linguistic codes used:

"maintenance programs are based on codes and symbols. Most of them are in English" (TMAN-IT)

Transition from manual, experienced-based linguistic codes, shared in their native language (unless dialect is used) to formalized language in a non-native one raises huge difficulties over several aspects[21]: first it raises the feeling of uselessness of their work experience, and in particular of inadequateness and inferiority with respect those handling the new language:

"As we "depend" on the PC, the autonomy declines as if the task is done by the machine which must just be fed and red" (TMAN-IT)

The loss of any role for their independent judgment basis about trains' functioning upsets in depth the whole individual and collective construction of work, their identity and professional pride. PC is felt as "too invasive at the expense of tradition" and coupled with "excessive influence of external firms" (TMAN-IT): the underlying view seems therefore too defensive and nostalgic, an instinctive reaction to an earthquake which destroyed their practice community. It affects the relations, which lose their original meaningful content:

"The opportunity of PC-based breakdowns search implies lower human cooperation in favour of a "cool" PC collaboration ... the software "suggests" the solution to the problem, by optimizing times, reducing operator's both intellectual and manual intervention" (TMAN_IT)

thus impacting on both positive and negative aspects of relationships at work:

"the PC doing our work isolates us from the human context surrounding us .... as "human" contacts decline, there are actually few events for confrontation, consequently of conflict with colleagues" (TMAN_IT)

Such feelings are well known in industrial sociology, as automation incorporates into the machinery part of human competences, especially those related to the product. As a consequence, also satisfaction declines:

"as manual intervention is reduced, consequently declines the feeling of having a good job done." (TMAN_IT)

What remains is responsibility, which requires high concentration while performing their tasks

"as we deal with a safety system, responsibilities related to maintenance and system's perfect functioning increases especially over time" (TMAN_IT)

but deprived of the creative part they enjoyed previously. There is something paradoxical when

"we control the work done by the external enterprise without knowing data this latter inserted ... lots of people put their hands in and the subject, still owning the train, does not know intervention parameters." (TMAN_IT)

The need to ensure high quality standards for both service and safety reasons is the main reason why outsourcing policies are unsuccessful, as shown by the British case (Dadashi, 2009) [22]. This fact, jointly with an increased repetitiveness of their work, raise the feeling of meaningless work: they control the outcome but not the process behind it, the surface but not the inner structure which is no more material but embodied into a third party's owned software. In turn, they are more controlled and put

BOX 1. MAINTENANCE AS THE KNOWLEDGE RESERVOIR

We saw above (chapter 1) that property rights over the ERTMS technology are retained by constructors, while under the traditional national technologies they were shared with railways companies.

By retaining diagnostics and interventions dispatching, constructors actually monitor and command over both rolling stock and infrastructures equipments. This changes the nature of the contract between the two parts.

What is tendered is no more just a purchase-and-sale contract, but a multi-face contract: the sale is integrated by a constructor engagement in providing assistance and substitutions in order to keep in full efficiency their equipments. Collecting information on systems degrading is strategic information for constructors as ERTMS is an un-mature technology.

We can therefore suppose that constructors' offers have different returns: while profits from the equipments' sale are poor unless negative, the profitability is ensured by the assistance part of the contract, designed in order to maximise the share on Railways Company's cash-flow. Railways companies are very sensitive to the financial design of such contracts as they do not enjoy a good financial situation and, as ERTMS is deployed mainly on HSL which are their most profitable business. Such contracts provide a strong incentive in favour to transform them into mere service providers.

However, the need for internal control over effectiveness, timeliness and quality of maintenance intervention prevent both railways operators and infrastructure maintenance from outsourcing the whole maintenance activities

[21] The importance of shared languages in maintenance is stressed by a maintenance staff head in a large plant to the author of the report "When we hire or someone or outsource any tasks, we search for local ones in either case: sharing the dialect implies sharing the exact meaning of the words we use"

[22] Dadashi Y (2009), "Fundamental Understanding and Future Guidance for Handheld Computers in the Rail Industry". University of Nottingham, PhD dissertation. http://etheses.nottingham.ac.uk/988/1/Thesis_-_Yassi_-_Final.pdf

under pressure as they have to respond not only for the outcomes but also for deadlines respect. The only positive aspect is the opportunity to learn new work techniques: a new equilibrium must be achieved, as it is supposed that such a task repartition will persist in the long run.

3.4 Mapping the rationalization process: radar charts as preliminary diagnostic tool for training needs

In order to summarize and compare different impact of ERTMS over different professional profiles, we map the main features by means of radar charts, by taking into account 8 dimensions:

1) the technological complexity;
2) the "vertical" relationships, that is the extent of the interface with hierarchy;
3) relationships with colleagues and third parties;
4) the complexity of performed tasks;
5) the variety of performed tasks;
6) the autonomy and discretion in performing the task, including learning opportunities, which jointly define the room to manoeuvre;
7) repetitiveness of tasks;
8) the psychosocial pressures while performing the task.

Train drivers

Train drivers and train maintenance staff display wide differences in the impact of ERTMS on somewhat complementary tasks. The technology greatly increases in complexity for both profiles, from a quite complex electro-mechanical environment into a mechatronic[23] systems with remote interface, definitively more complex: guards and on-board stewards do not experience the change with a comparable intensity. Their previous professional map, under the "traditional" electro-mechanic paradigm, was quite similar: low hierarchical and psychosocial pressures, thanks to strict cooperation with their colleagues, and high levels in autonomy, varieties and complexity of tasks, thus outlining "artisanal" professional profiles, as stressed by their on-the-job knowledge accumulation.

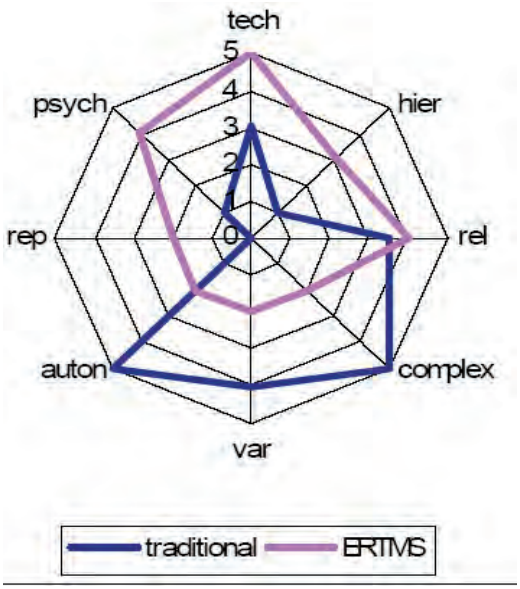


Fig.1 the train driver

The technological discontinuity shows quite similar impact: the extent of social interaction and social pressures is on the increase while the "craft" aspects decline. Rather, it is the intensity of change which greatly differs, thus giving room to widely different balance from employees' point of view.

Train drivers report a *moderate increase in psychosocial pressures*, due to several factors: system transitions (except when they are too frequent), frequent updates in software and procedures, differences amongst different constructors' train, while improved safety devices play a mitigating role. Working with an ICT interface allows for wider communication flows both horizontally, such as with guards and traffic controllers, with more intense communication flows (especially in ERTMS-2, where it is bi-directional) and vertically with supervisors. In turn, these latter increase their control opportunities, thus affecting the ways and the forms of conflicts.

On the other hand, while the complexity of tasks and their autonomy tend to increase, since their regulatory activity includes also the ICT dimension, especially in the too long transition phase, and lower variety because of their specialization on a certain typology of trains. Their radar chart thus displays an "adapting" profile, consistent with their previous experience, reporting the increase in supervision as the main discontinuity. Irrelevance of repetitiveness, high levels in autonomy and regulatory intervention are the pivotal factors preserving their professional identity. Rationalization is somewhat negotiated by the seniors who developed the national standards and mainly affects the initial training.

We cannot forget that this perception is mainly reconstructed from senior drivers, who are still playing – to some extent - the role of developers of ERTMS operational rules: their balance is positive as supervisors show certain deference in their regard and they feel the new technology as a further evolution in their work experience. The picture may therefore be different for those recruited more recently operating in a - at least partially – consolidated body of procedures they did not concur to define, with stronger pressures, especially from hierarchy, and lower autonomy.

Train maintenance staff

On the other hand, **train maintenance staff** shows a more radical shift in the reference performance target, from a "well-done" approach, where time is not the crucial target, towards a time-based assessment, according a "pit-stop" pattern: psychosocial factors boosted and consequently the hierarchical control. Operative tasks show a strong decrease in complexity (diagnostic tasks are eliminated because of both on-board diagnostic and equipments' providers retain of such actions; components

[23] Mechatronics is the synergistic combination of mechanical engineering, Electronic engineering, computer engineering, control engineering, and systems design engineering in design and manufacturing.

substitution instead of repair), variability (modularization of trains allows unbundling of maintenance intervention in smaller units working simultaneously on the same train), and therefore in autonomy (diagnostics is performed by external maintenance, that is by constructors' employees which download the parameters sets and communicate actions to do). As the radar chart below shows, their professional content is totally upset, from a "neo-artisanal" profile (which extent could vary across companies according to their managerial policies) to a fully "rationalized" profile. Contrarily to train drivers, specialization of train maintenance operators enters in depth in their operations by separating diagnostic from operative skills, similarly to what occurred in early 20th century with taylorism.

Such a rationalization is accentuated by contractual arrangements between railways companies and equipments' constructors: more precisely, such arrangements seem rather imposed by these latter in order to preserve their know-how, protect and improve their technologies. In the short run, such arrangements are a datum: however, private know-how can be affected by authorities' intervention, such as ERA, which could widen the standard in order to improve train drivers' operability.

The traffic controllers

The **traffic controllers** experience an ever more complex transformation in their professional content. The role of hierarchy greatly changes: from direct supervision and appropriation of decisional margins to more indirect, mediated by the ICT frame. Performance is getting even more transparent and this is clearly perceived.

Social relationships greatly increase when fulfilling with the assigned tasks, which are definitively more complex: at workplace there is a more balanced role of horizontal and vertical from previous primacy of vertical ones, the new technological environment discloses the wide world of horizontal communications, especially with train drivers, by combining formal (trough DMI) and informal flows (through GSM-R).

Tasks increase in complexity and go hand in hand with both variety and autonomy: monitoring is no more passive, just a human appendix of a lightning bundle which promptly refers to the head of the control centre, but he/she gains an active role, by interacting with train drivers, as tasks recomposition allows to the front-line operator a wider view of what's going on. However, while it is the technology that mainly induces higher complexity and variety, it is the organizational design that establishes the degree of discretion and the room to manoeuvre for front-line controllers: they are empowered at least for minor gravity decisions, although well below the technology potentials. We cannot forget in fact that its transparency easily allows supervisors to intervene and rectify decisions taken, while workplace leadership based on high involvement would increase bi-directional consultation before taking a decision.

Empowerment implies a stronger organizational social pressure on the performance, as there is no clear-cut balance between discretion and subordination: as discussed above, front-line traffic controllers perceive a pervasive control of their performance which implicitly puts pressure towards "appropriate" behaviour, specially in large control centres.

Similarly to logistic operators and plant drivers in manufacturing, traffic controllers and train drivers are those benefitting the most from the change of technological paradigm, while on-board personnel and maintenance show a definitively more "fungible" status, although there are strategic considerations both of economic and safety nature against outsourcing of maintenance activities (Dadashi, 2009). Consequences on the social cohesion are huge as this paves the ground to deverticalization of the sector, and increasing divergences in pay and working conditions within companies. Further, the separation between infrastructure and providers would deprive professional profiles at risk of marginalization of a cohesive profile as logistic operators, when unionized, are in manufacturing. Logistic operators are in fact a brand new profile in railways sectors and, as they are usually recruited from outside companies or

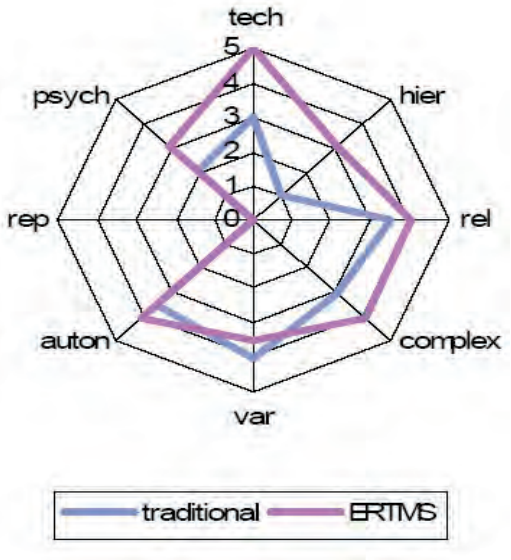


Fig.2 the rolling stock maintenance

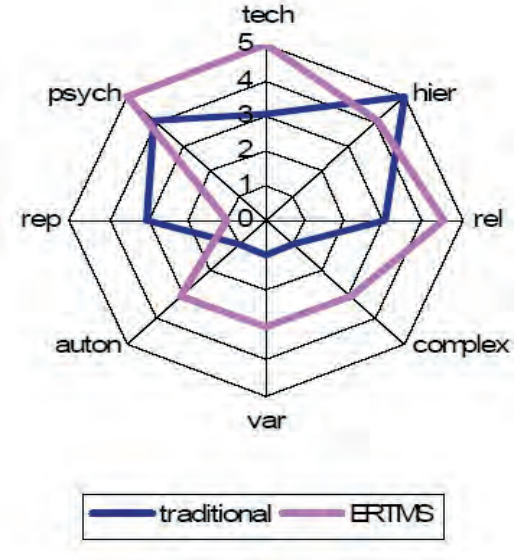


Fig. 3 - the traffic controller

directly after their qualification, they consider themselves as just professionals according an individualistic style, which is far from the collective identity combining industry and professional pride.

3.5 Organizational challenges: the need of high performance work practices

Although there is a wide variety across countries managerial styles, we cannot forget the railways history as Stoop et al. (2009) stress, in the 19th century railways gain a key role in military strategies, as they allow a fast and massive redeployment of troops, arms and provisions along the states' frontiers. This strategic reason, combined with the fact that the early signalling system was exclusively performed trackside by men, thus calling for a strong stress on punctuality as conformity to rules and procedures, were the key drivers towards an authoritarian managerial style and management of the workforce.

On the other hand, railways were seen as the flag of modernization and therefore the symbol of economic, social and technological progress: professional pride, need for well-functioning rolling stock and infrastructure and, last but not least, a considerable bargaining power, reinforced by their public status are the ingredients of the railways' "social compromise". The primacy of Railways Company over constructors in "national innovation model" is consistent with such national and strategic needs.

Safety and "well functioning" reasons call for a strong attention on maintenance, in order to maintain rolling stock's efficiency, both on board (thus concurring to the need of two-man driving until 1980s in most countries), while in maintenance ateliers the whole work organization was outcome-oriented rather than performance-oriented. These priorities thus elicited a "craft" work style aiming to achieve workers an extensive knowledge about rolling stocks' electric and mechanical equipments.

The underlying "social compromise" was therefore centred on train drivers and maintenance workers: the exchange was between an *authoritarian managerial style* and the acknowledgement of a *craft-like status to the key professional profiles* as they were the knowledge reservoirs. Traffic controllers, dispersed in small units covering the whole territory, did not benefit of such status and were therefore exposed to supervisors' pressures, which detained the decisional prerogatives for any operational deviance.

ERTMS reverses such an approach. Technological redundancies and modular design of rolling stock deprive maintenance activities of any craft-like status, while front-line traffic controllers gain the role of train drivers' direct interface operating in separate companies, similarly to the civil aviation long-standing pattern.

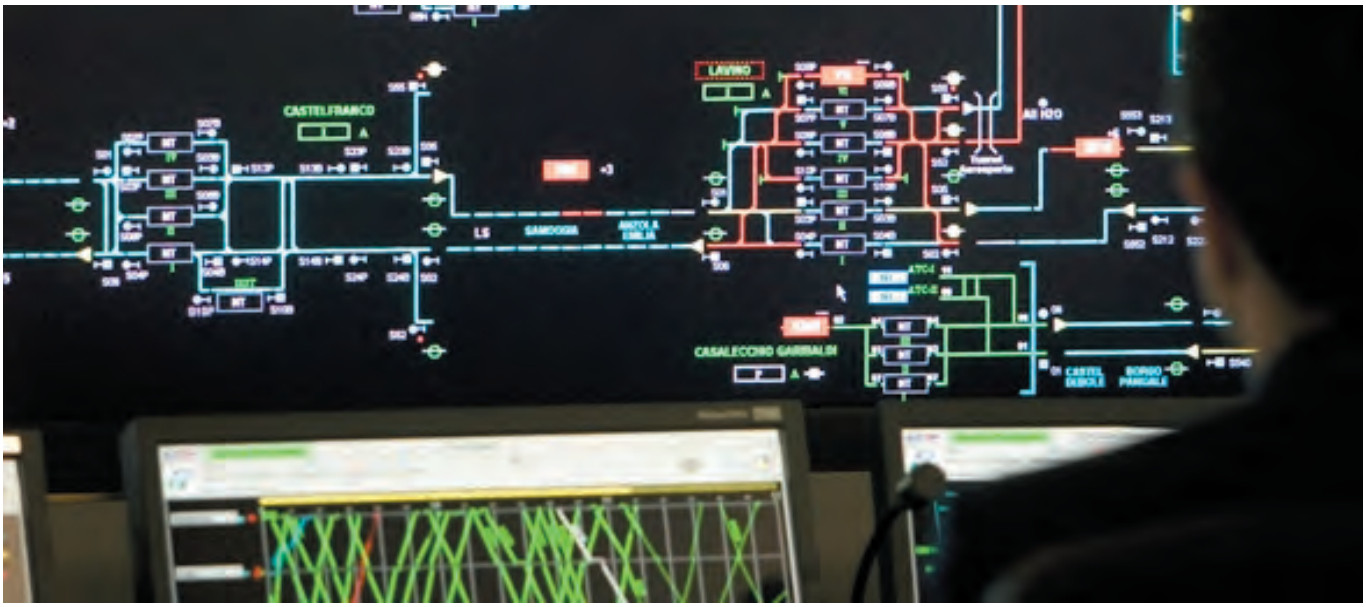
Digitalization enables remote activities in operations' control and remote diagnosis. At the same time, it allows front-line operators to gain a wider vision of the whole process, thus empowering them to take relevant decisions when anomalies rise: this change requires a different managerial style, which should retire from direct decision-making – unless for most complicated issues – to planning and supervisory tasks and personnel management (balancing amongst shifts etc.). Thus, traffic controllers replace maintenance staff as the strategic partner of the forthcoming "social compromise" in the ERTMS environment.

The Spanish case, where ERTMS have been deployed most extensively in Europe, is very interesting about the ongoing managerial strategies

"a new direction has been created devoted exclusively to put in service new HSL with ERTMS (....). Command centres depend from the HSL management, which in turn depends from the Traffic Operations' direction. There is an Information Technology direction. Eventually ERTMS and its set up required a new great infrastructure in order to put into service and future exploitment. There is a continuous enlargement of competences and functions included in the HSL creation. There are new competences and personnel to develop." (TCTRL_ES)

However, the challenge goes well beyond.

"The establishment of ERTMS presupposes a new concept and a new organization which tries to get rid of previous systems. We cannot turn back ..." (TCTRL_ES)



3.6 Why health and psychosocial issues are important

Employees working with ERTMS are well aware it greatly improves safety standards, thus strongly reducing the risk of train accidents.

However, as shown by a wide literature, an automated job position shows a strong reduction of hygienic and physical work factors on the one hand, such as physical fatigue, awkward postures, force exertion, exposure to dust and chemical substances, while on the other it displays higher cognitive demands and concentration levels, which generate increased mental workload, hypo-elicitation of the whole body leading to higher risks of both musculoskeletal disorders and stress levels.

This is just a "comparative static" exercise amongst two consolidated states: actually, as ERTMS deployment is at an early stage, we have to consider two types of mental transitions:

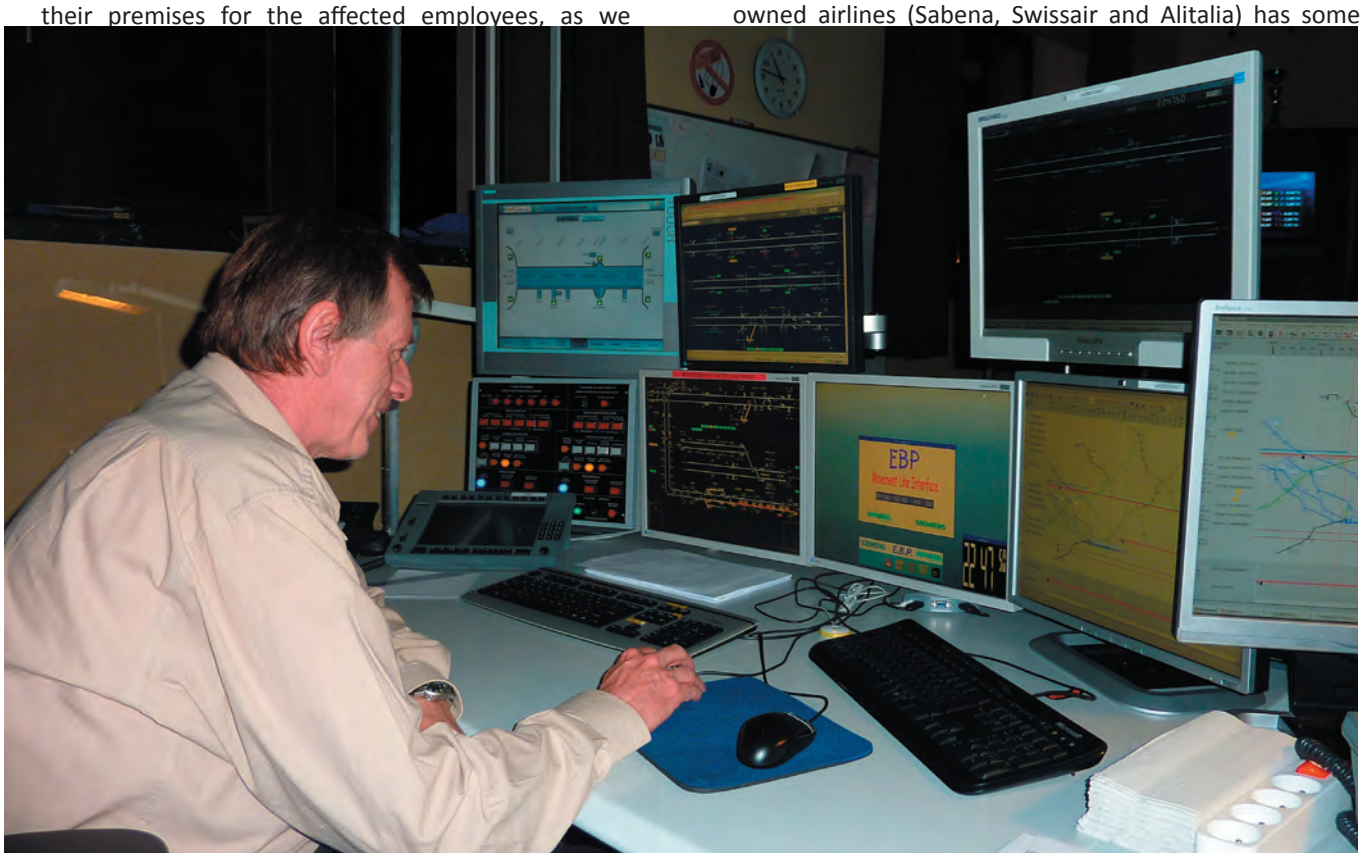
- the technological switch, and
- transitions amongst old and new technologies.

The first type of transition affects train drivers, traffic controllers and maintenance staff (both infrastructure and rolling stock) amongst direct professional profiles, and several technical figures (planning, engineering): while train drivers move across different technological paradigms, the other profiles leave behind them the "traditional" technology – unless for internal mobility reasons - once they embraced the new one. Factors affecting risks for health in the transition phase are:

- internal mobility processes often imply changes in their premises for the affected employees, as we have seen in the case of front-line traffic controllers, thus generating increasing uncertainties both at work, related to the re-insertion phase and the change of scale of the new premise, and for their private life, as they have either to move with their families or facing longer commuting times, thus affecting the previous work life balance;
- the feeling of uncertainty due to a lack of confidence in the system, which increases with affected people's age;
- the higher risks of systems' failures and system degrading, at least in its early implementation stage, which generate a widespread wondering "why had we to move from a well consolidated technology to a new unreliable one?" need the acquisition of both a technical and organizational know-how.

However, we expect an increase of the uncertainty feelings also for those not directly affected by the technological change, with a direct impact on risks for their health. While the affected employees consider themselves as more "protected" from their company uncertainties as they enjoy a skills advantage, the non-affected ones fear their work at risks in case of poor performance of their company, as ERTMS – as most ICT-based technologies – is strongly labour saving.

The overlapping of technological and regulatory changes can generate a widespread feeling of anxiety, due to takeovers, mergers and acquisition processes, and the appearance of the bankruptcy risks, which can generate a "race to the bottom" in working conditions, as outlined by CER-ETF (2009). What occurred to some formerly state-owned airlines (Sabena, Swissair and Alitalia) has some



[24]HSE (2003), Train Protection - Review of economic aspects of the work of the ERTMS Programme Team. http://www.hse.gov.uk/research/rrpdf/rr066.pdf

impact on railways employees.

The impact of ERTMS on health has been extensively investigated ex ante for train drivers in the UK (Porter, 2002; HSE, 2003; RSSB, 2004)[24], especially changes in cognitive workload, while traffic controllers are considered as converging to air traffic controllers, thus sharing similar problems.

According to Porter (2002), switches from traditional to ERTMS technology imply both a change in the level of supervision and a change in the driving philosophy, by generating a "very high" cognitive workload, as a consequence of continuous changes in driver philosophy. "The cognitive workload demands associated with use of the new DMI will need to be carefully assessed to ensure that drivers can cope with the increased demands on their attention, memory and decision-making abilities. (.....) Any task activity that has to be performed by the driver will have an associated impact on his or her workload, both physical (e.g. number of buttons to be pressed or displays to be scanned in a given time) and cognitive (e.g. interpretation of data and decision-making requirements). (.....) In order to ensure effective performance under ERTMS and minimise the risk of safety critical errors and/ or adverse health effects for the drivers themselves, it will be essential that the cognitive workload on the driver is kept within optimal and manageable levels."

This is not the case of train drivers on the Cologne – Bruxelles line, as summarize a member of the steering committee:

"There are on a distance of about 250 km 5 different signalisation systems with each own rules and 6 changing of the catenary voltage systems to be handled by the driver! (.....) the driver is always busy changing from one system to another."

This greatly increases safety risks

"This way of working has great dangers of mistakes and wrong reactions when the systems have failures."

And therefore, as responsibilities train drivers feel is very high:

"four drivers stopped driving cross border, because of health".

This occurs after just one year! The train driver may perceive exit as a personal failure, thus severely affecting his/her personal feeling of pride[25].

As counterfactual, long High Speed Lines tracks in Spain and Italy favour a different feeling of confidence:

"The driver in Spain can do quite relaxed his job, because the ERTMS journey is nearly the whole shift."

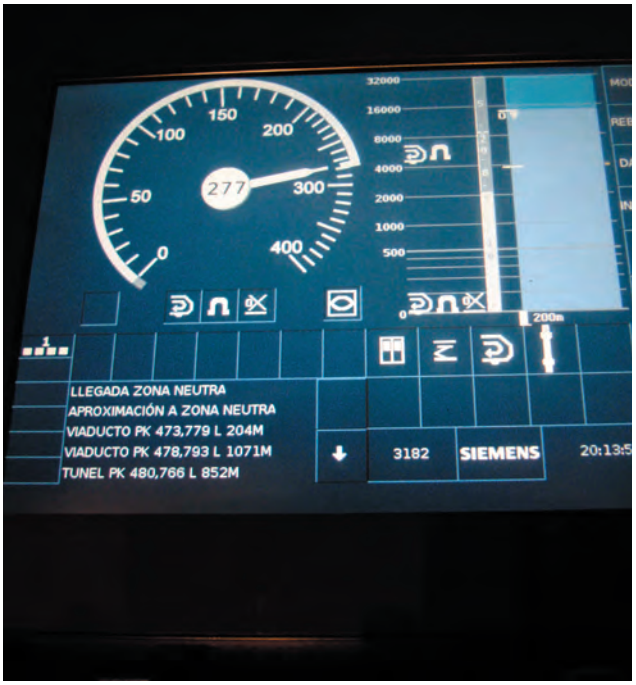
"If it may happened that I fell asleep, the train would drive me until the end of the ERTMS and none would realize it, in normal conditions." (DRI_IT)

On the other hand, maintenance staff feeling of deprivation is equally negative for their health, raising at the same time a risks of depressive states and anxiety feelings for over-pressured.

Lessons from other sectors

From this short overview, it is important for the social partners to understand the impact of restructuring, upon both the mental and physical health of individual workers affected, as well as upon the organisation as a whole. Restructuring can uncover and highlight existing health conditions amongst the workforce, but also trigger new problems. In addition, the social partners will need to be aware of the impact of restructuring on the health of those workers who maintain their employment following the restructuring exercise, so-called 'survivor syndrome'.

Several good practices may be useful in facing technological change and related restructuring processes. The MIRE project in manufacturing points out that health promotion at the workplace prior to restructuring can create a culture of health awareness among employees, which in turn enables employees and their employer to adapt and to cope with change. Yet, despite the potential



benefits, Occupational Health Services are not universally accessible and do not always include preventive health promotion initiatives.

In the UK former telecom monopolist BT, management and trade unions introduced a tool, labelled STREAM, aimed to identify and address stress throughout its workforce in the context of ongoing restructuring and concerns with health and safety issues in the form of an on-line assessment on the company's intranet which is widely advertised. The questions concern areas such as work demands, control over the labour process, managerial support, relationships in the workplace, roles and, significantly, change. The completed form identifies those who suffer from or are potentially at risk from stress. The worker is then offered guidance about how to address any arising issues, and further help if necessary through the company's Employee Assistance Programme. Whilst the tool was not specifically

[25] It worth to stress that the employer suffers in that case a serious economic loss, as train dirvers' training for ERTMS is very long (about one year) and expensive.

introduced because of restructuring, the company with the trade unions has been able to collate the anonymous results as so monitor stress in the workplace, especially in relation to organisational change.

3.7 Training needs and organizational change

The 2007 report "Rail training 2020 Training needs and offers in the European railway area the next 10 - 15 years", carried out by the Danish Institute of Technology, CAS and Lloyds Register Rail Europe (then DIT et al., 2007), and the transport and logistics sectoral study of the Commission project "Sectoral level analysis: Investing in the future of jobs and skills" identify three exogenous factors of change (technological, legal, and market). The former report also identifies two further factors - demographic and organizational change - with considerable endogenous dimension. We are to compare the key results from these reports due mainly to the technological and the organizational dimensions with results from our analysis of professional profiles.

According to these reports, the technological and regulatory changes will overlap with serious shortages due to the imbalance in the age pyramid: since late 80s staff reductions have been based on massive early retirements and a generalized absence of recruitments, especially in the 90s, leading today to a "generation gap". Demographic imbalances cause not only include "transfer experience from one generation to another", as the ETF-CER (2009) states, but also increases the difficulties in re-training professional profiles more affected by the technological change, as they are in general less confident with ICTs than younger. Training and continuous vocational training (CVT) policies are further challenged by poor attractiveness of railways employment amongst youngest generation, as too "technical" and not enough "creative" (DIT et al., 2007), aggravated by poor attractiveness of both shift work and mobile place of work. Thus, the end-of-career management becomes an even more important issue than the ETF-CER (2009) report poses in order to face the risk of workforce shortage in some key professional profiles, especially train drivers.

According to DIT et al. (2007) report, rail operators consider market changes (liberalisation and entering in other countries' rail markets), recruiting new and well-qualified staff, increased legislative requirement on safety and new skills needed due to the internationalisation, such as knowledge of foreign technical systems, languages and culture, as the most relevant future challenges for training activities. The ERTMS-related technological bundle will mainly affect train drivers, calling for "a lot of extra-training capacity", staff responsible for rolling stock inspection, which will need updated knowledge of the different modules (interacting between old systems and ETCS) and related software and, to a minor extent staff responsible for dispatching and control-command.

The report outlines that the establishment of high-speed lines – most of them, as discussed above, equipped with ERTMS - accentuates the need to facilitate cross-border operations between Member States, thus ensuring that technical as well as staff related issues are addressed appropriately (see section on cross-border operations). This requires railway undertakings to ensure that their staff is sufficiently qualified for high-speed operations (e.g. additional courses in safety requirements, special technical equipment, etc.).

As pointed out by a Spanish traffic controller

"Workforce's specialization is a necessary guarantee (for safety), together with CVT and compulsory learning processes we achieve system integration along the whole line." (TCTRL_ES)

"we are seeking for a common language, as in air traffic control." (TCTRL_ES)

Training cannot be limited to just a transition from traditional to ERTMS and, within this latter, from one release to a more advanced or updated one: it must be systematic, with regular recalls for specialistic skills and their impact on health and safety, and complemented and timely prepared with both communication and linguistic skills.

Train drivers

According to the sectoral report "Investing in the Future of Jobs and Skills", train drivers will experience some differences due to different technology evolution between trams, subways, normal trains and high-speed trains. Intercultural and language skills will be more relevant on international / trans-European train routes, especially in case of good economic growth. The general trend towards more ICT-use will continue in every scenario, even the less economically favourable one, thus requiring according skills and increasing use of train simulators for training purposes, especially on HSLs. The same applies for flexibility, due to an increasing workload for train drivers, which will become dramatic in the high growth scenarios because of their high specialisation, long initial training and poor attractiveness. Stronger adjustment of vocational training to European demands and a European-wide recognition will be necessary in the future, at least for train drivers crossing borders.

Radar chart (fig.1) summarizes our main findings points out as priority areas the need to increase their confidence with the new technology and communication skills, especially conflict management, and linguistic competences when corridors will be actually equipped with ERTMS, thus allowing international trains well beyond the Paris-Bruxelles-Koln/Amsterdam lines.

Regular sessions on simulators are seen as the key main tool in order to increase train drivers' confidence with the technology for several reasons: ERTMS implies a change in driving pattern (from "head up", by paying attention to external signals, to "head down", by focussing on DMI, Porter, 2002); a further issue is gaining practice with continuously updated instructions, to which is not easy to deserve the due attention:

"there are almost daily updates" (DRI_IT)

while some constructors still provide hard-copy manuals, which are quite difficult to consult in emergency situations

"the Alstom manual is about 500 pages!!!" (DRI_IT)

Finally, and most important, there is the safety issue: ERTMS greatly reduces the probability of incurring in risky

circumstances, thus causing to train drivers to lose their confidence about the necessary procedures. Simulator thus allows to maintain the necessary practice. This issue is widely agreed by CER:

"it is not enough a simulator session every six months: we need not only deal with dynamic simulator (which reproduce on-march conditions) but also static simulator as it increases both our confidence with the technology and therefore our safety feelings." (DRI_IT)

Further, simulators' sessions cannot stand alone, as train drivers still play the strategic role of technology developers: this is not acknowledged by both railways companies and constructors, but it should be elicited as it would reduce the achievement of technological maturity.

Because of the intrinsic asymmetry of the supplying contracts, we can suppose it is in railways companies' interest to accelerate such process for commercial reasons (a stabilized technology is less expensive to buy than an evolving one, with lower maintenance and assistance costs): simulators' sessions should therefore be integrated with some brainstorming activities in order to reinforce and elicit workers' skills developing – a sort of "quality circles".

They would further favour horizontal relations amongst train drivers, too often confined to the informal level in the waiting time from one train to another.

Training on communication skills must focus over two key inter-related areas: conflict management and psychosocial risks. All activities mediated by a ICT device while ease the performance of lots of tasks raise stress levels because of their man-machine interface: it plays a mediating role on the one hand by increasing conductor's powers of intervention while hides the actual functioning of the underlying system, thus preventing the operator to intervene directly on the "black box" but just performing checks and restoring procedures in order to remedy system's degrading. When the train driver says

"I was used to get on the train with my toolkit" (DRI_IT)

and when describing his regulatory intervention

"I used to operate with pliers and screwdriver, now I don't move from my armchair" (DRI_IT)

he summarizes both the gain in comfort and the loss on engine's mastery, thus generating an impotence feeling when degrading cannot be restored.

Two factors tend to amplify anxiety and stress generated by the technological change: transitions amongst technologies and increased pressures from hierarchy, both explicit and implicit, thanks to the increased transparency ICT allows and performance accountability. Separation between infrastructure and railways companies is a further source of conflicts and anxiety, as their goals are even more distinct, perhaps responding to demands outside the operation domain, and procedures more formalized.

Conflict management is therefore necessary in order to preserve train driver's psychological integrity and reactivity when problems falling outside their control arise.

Train maintenance

According to the sectoral report "Investing in the Future of Jobs and Skills", both technical knowledge requirements and e-skills requirements for rail mechanics will greatly increase in every scenario, by emphasising interdisciplinary abilities, since new technologies will be more convergent. The report outlines that good economic performance will put more pressure on such requirements, while low regulation will require from rail mechanics more flexibility and creativity, while outsourcing "may become an option with emerging liberalisation and internationalisation". Finally, off-shoring of technical services and maintenance is limited due to the predominant national-wide operation areas and standards which all have to be met.

The radar chart (fig. 2) summarizes that ERTMS would lead to a rationalization in tayloristic sense: the lead times from the maintenance tasks assignment from constructor's engineering to its delivery fully functioning is the key around which redesign their professional content and therefore their training. Specialistic competences about equipments' design and technological content, and coordination skills will be the drivers for their training: the former require an appropriate and timely training when new equipments are delivered, while the latter require a careful and extensive development of teamwork related skills, such as communication skills, working by objectives and team working skills.

They would also contribute to mitigate increased psychosocial factors, mainly the organizational pressures, although training role should not be overestimated.

Traffic controllers

Traffic controllers' changes show a great extension in their relational dimensions. They require great training efforts in both cognitive and communication skills, both for the technological and the socio-relational aspects, especially when mobility from small control-commands to larger premises occurs simultaneously with transition from traditional signalling systems to ERTMS.

They further need great efforts both in managing operative procedures. The most critical skills are those favouring autonomy: they are required in order to take decisions.

Tab. 7 cognitive workload and transitions

Cognitive Workload	Transition	Example
Very high	Change in level of supervision and in driving philosophy ('Head Up' vs 'Head Down')	Level 0 to Level 2 (no lineside signals), and vice versa
High	Change in level of supervision	Level 0 to Level 2, and vice versa
Medium	Change in driving philosophy only	Level 2 (no lineside signals) to Level 2, and vice versa
Low	Transition between supervised states	Level 2 to Level 1

Source: Porter, 2002

Ability in problem solving, calling for support in the fastest and targeted way must be promoted, as traffic control's path dependency tends to concentrate on supervisors decisions at the expense of timeliness. They can be identified more in detail by training needs analysis.

3.8 A training methodology

In this section we generalize the scheme that Porter (2002) devised for train drivers in the feasibility phase in the UK to the whole ERTMS deployment and post-deployment phases:

- develop i*nternal competences on ERTMS and a shared awareness of changes* "It will be necessary for all industry stakeholders to 'buy in' to ERTMS and therefore resources will need to be allocated to informing and educating the industry of the changes in the driving philosophy in a structured and controlled manner. Therefore, as a precursor to any training, a national briefing programme will need to be considered".
- the role of a *detailed and comprehensive Training Needs Analysis* in order to define:
  a) the optimal duration, content and delivery methods for the training programme in the designing phase,
  b) a comprehensive evaluation and re-definition of different professional profiles' competencies to support ERTMS operation;
- *transnational transfer programs* for those countries where ERTMS is not yet implemented for the initial validation and certification, complemented by a 'train the trainer' course developed by these experts.
- *Simulator training* as "the most efficient method of familiarising the driver with the system. The use of simulators will be crucial to enable practise in a full range of potential driving conditions, including degraded and emergency scenarios, and will help drivers to develop a consistent and accurate mental model of how the system works. Simulators will also enable assessment of driver workload and provide valuable input into the development of the full Training Needs Analysis."
- A *combination of classroom, simulator, and on-the-job practical training*: it will be essential that sufficient time is allowed in order to teach drivers the philosophy of ERTMS and to provide a suitable level of detailed information and practice;
- *A Workload Analysis* , including both *mental and physical workload*, in order to ensure optimal workload levels for all professional profiles and to enable the effective management of signalling transitions in particular for train drivers and front-line traffic controllers.

Main findings

The impact of ERTMS greatly differs amongst professional profiles: while train drivers and traffic controllers show an "adaptation" of their skills portfolio to the new technological environment, maintenance staff shows a dramatic rationalization from a craft-like outcome-oriented profile to a time-oriented approach, by loosing intervention in diagnostics in favour of constructors' technicians. They all report an increase in psychological risks due to ICT and increased managerial pressures due to technology transparency.

A qualitative methodology for investigate change in quality of work is devised: it allows mapping the changes in a synthetic way. Such a mapping tool allows identification of training needs in connection to technological and organizational changes, while more individualized tools in order to map changes in competence levels and training needs are part of the training and HR specialists' repertoire.

Indications for training

Each professional profile requires specific training intervention. They mainly focus on technological aspects in order to increase confidence with non-standard situation (such as driving simulators) and communication skills, with different design according to professional profiles.

The cycle "analysis-regulation-implementation-monitoring" must be assumed as the reference approach in ERTMS implementation, both at EU and at national level: trade unions officers and workers' representatives must be properly equipped in terms of masterizing ICT implementation at workplace level. Both anthropocentric production systems (APS) and sustainable production systems (SPS), mainly developed in manufacturing automation, are good be take as reference in developing analytical skills.

Training for trade union officers and workers' representatives must be differentiated according to their specific roles. ERTMS technology, market dynamics and identification of competitive drivers, understanding work organization and their impact on quality of work and health must be considered as shared knowledge then giving room to specific stress according to their role (national level union officers; local level officers and workers' representatives, OSH representatives).

Indications for bargaining

A careful analysis of contractual relations between railways companies and equipments' suppliers is necessary in order to manage maintenance staff exposure to both professional deprivation and their risks of being outsourced.

When ERTMS is implemented, changes in organization design of most affected workplaces (traffic control centres, maintenance ateliers) must be bargained in advance with prior consultation. The cycle "analysis-regulation-implementation-monitoring" must be assumed as the reference approach while implementing ERTMS at any level.

Quantitative methodologies (such as employees surveys) focusing on mental and physical workload, work discretion, impact on health, especially psychosocial aspects (such as the Karasek's "job content questionnaire" or the "Copenhagen psychosocial questionnaire" COPSOQ), are necessary for trade unions in order to monitor in detail working conditions changes, legitimate their demands and their proposal in the organizational design as a whole.

CONCLUSIONS

ERTMS is probably amongst the biggest challenges the European Union ever posed until now: not only for its huge deployment costs, but especially because it aims to overcome operational barriers amongst Member States. Railways played a central role in the 19th century in effectively achieving national markets and, in some cases, national identities: difficulties in setting common operational rules cannot surprise us as such task goes beyond mere technical regulation. However, when ERTMS will be deployed on a significant portion of EU rail network, European Union will be operatively achieved.

The AIMESC project considers apparently minor aspects - from both a political and budgetary perspective -of such immense effort: however, such aspects are crucial as they focus on the need to renew under a European perspective, according a new technological paradigm, the rail men pride of being modernization agents. Thus, the workforce perspective is a strategic issue indeed: employees collective identities are deeply changing, while the national "social compromise", based on the exchange between tight hierarchical line command and craft-like patterns of work and social reproduction, is seriously challenged. Key professional profiles are changing: while train drivers maintain their central role, maintenance staff craft-like proficiency is losing ground in favour of traffic controllers and traffic managers on the one hand, as they ensure an efficient performance under the full safety constraint, and and logistic operators on the other, which act as gatekeepers with the other transport modalities and the markets' demands. These new central professional profiles are those introducing market's breath into a strongly institutionalized sector.

In that sense, the AIMESC original general goal was widely achieved, as it envisages a new perspective to social partners. These latter plays an important role in such a challenge: they are called to settle a shared agenda in order to manage these issues by designing new sectoral governance:

- at EU-level, they have to settle a proper framework favouring both information flows, shared approaches and a general governance framework by decentralizing as much as possible the "fine regulation";
- at national level, such guidelines should be elaborated by making them fitting with other national system, such as industrial relations, labour market, and education and training, by letting local-level agreement to regulate the implementory issues in a more refined way.

AIMESC project thus draw several indication for trade unions' action in training: analytical skills play a central role in order face the change of technological paradigm and new opportunities ERTMS envisages for the railways industry, to be complemented with specialistic skills especially in training, ergonomics and workload analysis, and occupational health and safety at work, by paying specific attention to psychosocial risk factors.

Recommendations for future work or follow up

As ERTMS is an immature technology at its early stage of deployment, a large array of follow ups may be devised: some of them may fall within sectoral level social dialogue, while intersectoral issues may be of great interest not only for social dialogue.

At the kick-off conference in Brussels, CER-EIM representative settled a Wide range of social aspects to be considered that, for sake of simplicity, we can assume as the "acid test" for AIMESC project and the agenda for both follow-ups and social dialogue:

1. Impacts of the people working within the system on the system performance: reliability and error, intervention, effectiveness etc.;
2. System design issues impacting on the interaction of people and the technical and organisational systems: work organisation, job design, human-machine interface etc;
3. Training and competence needs to ensure that systems design and implementation meets human factors requirements;
4. Issues related to the employment effect of ERTMS: job skills required, grading and progression, labour mobility etc.;
5. The effects of working with ERTMS: health and safety, workload, ergonomic aspects, stress, fatigue etc, which are accentuated ;
6. He then mainly focused on train driver, which as we saw was the most investigated professional profile in the ex ante design and implementation of the technology:
7. Ergonomic aspects of the ERTMS Driver Machine Interface (DMI);
8. The impact of a change from lineside focus to in-cab focus in the case of level 2 without lateral signals;
9. Driver stress during transitions between ERTMS (as well as non-ERTMS) modes;
10. Implications for driver competency and training, including the use of simulators.

The AIMESC project provides the first insights about all these issues, by indicating the different directions of change across the main professional profiles directly affected by ERTMS implementation, according to a parsimonious combination of both qualitative and quantitative approaches.

Pathway1. ERTMS, liberalization and railways restructuring: devising a monitoring tool.

As pointed out in chapter 2, available information about employment in railways industry and changes in its configuration lack of timeliness and accurateness. This is due to the changes in the boundaries of the industry, thanks to the liberalization packages. As an effect, both employers and trade unions do not know the actual effect of the ongoing changes, while there is no validation of the Commission claim of the positive and mutually reinforcing

impact on both the business and the employment in the industry.

Social partners display an urgent need of timely information about these issues: however, they can manage to pool their information from their members, both at collective and individual levels (trade unions, workers representatives, and railways companies) by ensuring some cross validation methods. There are several highly sensitive issues, affecting the contractual sphere of railways companies (i.e. subcontracting) which have, on the other hand, a wide impact on workforce perspectives and professional profiles.

Although in its general design such a monitoring tool is quite similar to what envisaged in the electricity industry in order to monitor the impact of restructuring on employment, ERTMS implementation is a distinctive feature which deserve a regular information and update, by separating – whenever possible - its impact from the liberalization issue.

Thus, social partners are recommended to confront each other over this issue. Combining a joint discussion with a feasibility study, based on both employers and workers' representatives opinions, would allow shaping the most appropriate tool.

This pathway can be developed only within the framework of social dialogue budget line as well as the "Information and training measures for workers' organisations" one.

Pathway 2. Implementing ERTMS and training policies: impact on professional profiles and organizational change.

The present project provides a partial mapping of professional profiles in the railways industry, by investigating more in depth – although without any pretension of completeness – the impact of ERTMS over three of the most affected. Thus, AIMESC project just paves the ground to a more systematic and accurate analysis by providing several methodological hints.

In order to achieve this task successfully, cooperation amongst social partners is required. Social partners can in such a way build up a complete "competence platform" for training strategies related to ERTMS deployment and implementation. The social dialogue budget line, as well as well as the "Information and training measures for workers' organisations" one, may be also integrated by ESF (such as "workers and new skills" and "business undergoing change" budget lines seem the most appropriate).

Pathway 3. The impact of network technologies in services of general interests: an intersectoral approach.

Chapter about "Social dialogue and Socially responsible restructuring" (see annexe CD) overviewed the varieties of EU-level social dialogue sectoral committees' strategies while managing the effects of both network digitalization and sectoral liberalization. A more in-depth comparison may be achieved by means of intersectoral seminars and cross-fertilization actions aimed to exchange bargaining experiences both at EU and at national level would greatly improve social partners', and especially trade unions awareness in dealing with such issues. Both the "Information and training measures for workers' organisations" and the "Industrial relation and social dialogue" budget headings look as the most appropriate in dealing with.

AIMESC GUIDELINES - INDICATIONS FOR TRADE UNIONS

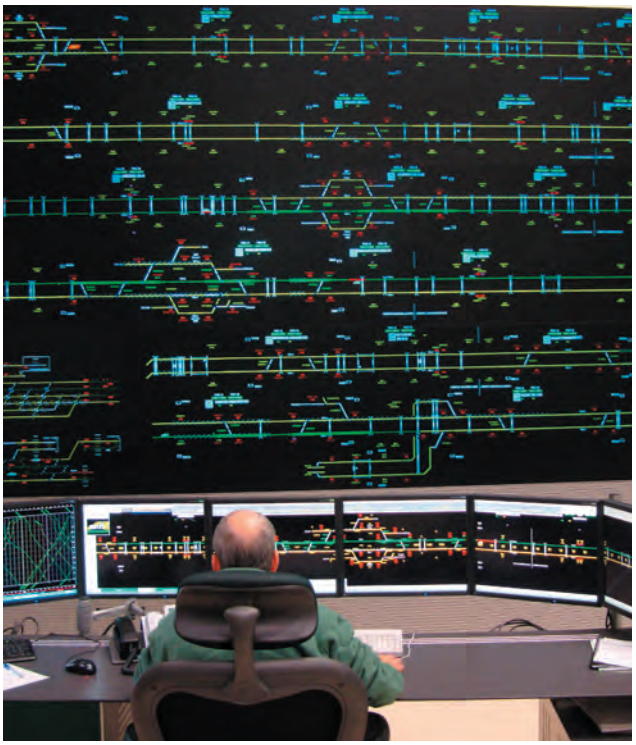
Guideline n. 1 **Target: Workers** **Iitem: information** **Favouring the widest knowledge on ERTMS implications as a premise for a socially responsible restructuring.** Its actual impact and perspectives are still unclear to both employees and to the external stakeholders.	**Page 48**
Guideline n. 2 **Target: Trade unionists** **Iitem: information** **Promoting new skills amongst trade unions, promoting quality of work and employment.** Promoting employees' quality of work under ERTMS technology requires new analytical skills amongst trade unions: extensive training activities, pilot projects and good practice exchanges would support learning processes. Exchange of good practices and local-level analyses will foster the social partners' action in favouring a social responsible restructuring	**Page 49**
Guideline n. 3 **Target: Workers** **Iitem: employment** 1. **Managing employment levels: redundancies and re-deployment.** Detailed shared information is a precondition. Gradual retirement schemes should be preferred to early retirements ones, re-deployment must be combined with appropriate retraining, by minimizing the impact on worklife balance. 2. **Monitoring the impact on employment in a more accurate and timely way:** available statistical information are quite poor, as they reflect the change in the market structure. Social partners are encouraged to launch a joint EU observatory on rail employment. 3. **The governance of employment implications of ERTMS: bargaining and social dialogue.** Social partners should settle at local level a training and deployment place, managing its impact on workforce according a holistic approach. EU-level social dialogue and national bargaining should define the appropriate supporting tools.	**Page 50**
Guideline n. 4 **Target: Workers** **Iitem: Social conditions** 1. **Old and new skills for new jobs: the training-and-redeployment plan and continuous vocational training.** ERTMS changes a consolidated learning process and continuous refresh on its updates. Use of both static and dynamic simulator is recommended. 2. **Rewarding new skills and increased productivity.** ERTMS generates new professional profiles, especially in train driving and in traffic management and control, to be rewarded in a negotiated way. 3. **Addressing health and safety at work to new risks.** ERTMS increases safety levels but also workers' exposure to psychosocial risks, as it affects mental workload, especially in the transition phases, and increases managerial room in exerting pressures over employees.	**Page 54**
Guideline n. 5 **Target: EU Stakeholders** **Iitem: Environment sustainable rail** **Acting beyond the sectoral boundaries:** ERTMS will strongly contribute to the EU "green economy" strategy: consensus building amongst all stakeholders is required	**Page 57**
Guideline n. 6 **Target: ERTMS suppliers** **Iitem: Contractual matter** **Outsourcing and relationships with construction companies.** ERTMS is a non-mature technology and contractual asymmetries are at constructors' advantage. For safety reason no maintenance must be outsourced and social dumping defended.	**Page 58**

1. FAVOURING THE WIDEST KNOWLEDGE ON ERTMS IMPLICATIONS AS A PREMISE FOR A SOCIALLY RESPONSIBLE RESTRUCTURING SOCIALMENTE RESPONSABILE

Restructuring, as a consequence of ERTMS implementation, has a strong impact on both the socio-technical system and health and safety at work. It implies workforce redeployment, a considerable change in work methods, organization design and managerial practices, that an extensive specialistic training may support.

ERTMS deployment overlaps the liberalization process: according sectoral experts and social partners, this would generate negative feedbacks, thus hindering the construction of a unique EU market in the railways sector. The length of the expected transition from an electromechanical towards a ICT-based paradigm is a further factor of uncertainties and stress, both in work perspectives and while performing tasks due to technology switches.

Both market and technological changes have a deep impact on employees: they will affect employment levels, workforce composition, and employees' working conditions, work expectation and well-being. As a consequence, the risk is that higher absence levels, wider use of drugs and addictive substances would affect the overall performance. Poor knowledge about change increases the feeling of uncertainty, adding further stressors to those employees affected by the technological change.



Railways employees display **strong commitment** to their work as they perform a public service by sharing a general feeling of contributing to economic and social modernization.

Social partners have to leverage on such commitment as a key resource in order to face the competitive challenges, the technological transitions and work opportunities, thus catching the largest opportunity in reversing a 30-years decline.

Widespread information sharing, extensive training and high levels of consensus according a deliberative bottom-up approach will favour the appropriate support employees need in order to tackle the negative effects associated with such transitions. Extensive information and the feeling of being involved in the decision making process will increase the perceived fairness of the process.

We can single out such information:

- **general information about the ERTMS technology** its deployment and implementation problems, consequences on work organisation addressed to all employees, trade union officers, middle management and workers representatives with annual updates, regardless to time horizon employees will be affected;
- **more detailed information** addressed to those affected in the medium term (1,5/3 years) as "paving-the-ground" training before they participate to specialistic training and/or to any personnel redeployment.

Middle management needs to be equipped with more information and more competences in order to favour the information flows, both top-down (mainstreaming) and bottom-up. Pilot projects and good practices on restructuring experiences, also in those industries implementing comparable digitalization (electricity, telecoms, etc.), are a very useful device.

Guideline n. 1
Target: Workers
Item: information

MAIN ISSUES:

- Poor knowledge about change increases the feeling of uncertainty, adding further stressors to those employees affected by the technological change.
- Professional pride is a key resource posed at risk when there are too many uncertainties.

ACTIONS:

- Extensive information about ERTMS deployment, its impact on the quality of work and employment in order to make employees aware of the direction of change according to a "realistic" approach, and to reduce a source of uncertainty (EU coordination).
- Regular information (+ updating) and training for workers' reps, trade union officers, middle management as mainstreaming agents.

2. PROMOTING NEW SKILLS AMONGST TRADE UNIONS, PROMOTING QUALITY OF WORK AND EMPLOYMENT.

ERTMS is a great challenge for all: enterprises, European Union, National Governments, social partners. Managing its deployment successfully requires new skills not only for employees, but also for the trade unions in order to promote not only the employment, but also employees' working conditions and well-being at work, career development, and innovative work practices and to minimize the negative impact on their health.

Trade unions are recommended to develop extensive training for both their officers and workers representatives in order to increase their general analytical skills first of all, by further focussing on specialistic competence according to the occupational health and safety representatives and the UK Unionlearning representatives. They must be able to act as "social architects" at local level, by attributing high value to employees' experience and cognitive maps.

Monitoring tools, pilot projects and good practice exchanges would support learning processes. Timely and accurate monitoring of employment trends, ERTMS progress in implementation and employees' working conditions affected by a new technological environment are key points in order to foster motivation and performance.

Social partners at EU-level are recommended to agree a protocol over shared guidelines, as the current ones as a background note on the employees' side, by setting out regular joint monitoring.

Social partners are recommended to launch transnational projects, jointly whenever possible, in order to provide a monitoring tool and achieve comparability across countries, coordinating regular surveys amongst both undertakings and employees on ERTMS impact on performance, regulatory advances and quality of work, collecting regulation and agreements, and promoting good practice exchange and pilot projects, thus favouring a social responsible approach to restructuring.

Similarly, cross-sectoral joint projects, such as the CEEP project "Anticipation of change in public sector", performed with the support of ETUC, greatly favour cross-fertilization, mutual learning and exchange of good practices amongst social partners at any level.

Guideline n. 2
Target: Trade unionists
Iitem: information

MAIN ISSUES:

- ERTMS require higher levels of expertise amongst all stakeholders: not only worker but also trade unions are required to develop new skills and be endured information.
- The transnational character of its deployment and the un-mature stage of the technology require extensive exchange of good practice and information exchange.

ACTIONS:

- Extensive Training for Workers Representatives and Trade Unions' officers is necessary in order to foster both analytic and specialistic skills.
- The health and safety representatives' pattern may be a reference model in order to promote specialized workers' representatives on training and work organization.
- Joint regular monitoring of ERTMS impact on employment and working conditions is necessary in order to prevent any related risks and support social partners' action.
- Transnational project aimed to promote good practice exchange are strongly recommended for both trade unions and social dialogue projects.

3. EMPLOYMENT

3.1. Managing employment levels: redundancies and re-deployment

Until now, ERTMS have been mainly implemented over new tracks, thus producing a positive impact in terms of personnel redeployment by avoiding redundancies or new hiring: next implementations will mainly imply transition from traditional technology to ERTMS, thus exposing employees committed on to redundancies' risk. The impact over the employment levels and their distribution by the main socio-demographic and professional variables is the first issue social partners should bargain and monitor.

Bargaining amongst the employer and social partners managing possible redundancies both at geographical, sectoral and professional levels is the first issue of both levels agreements. While the national-level framework agreement should contain general guidelines about employees selection, geographical and redeployment internal mobility, access to eventual retirement path, training activities by professional profiles and training areas, the training-and-redeployment plans will contain in detail (scoreboards, distribution of affected employees, etc.) the whole implementation process. *Detailed information over the affected workforce*, which must be carefully described by professional and demographic variables (age, gender, qualification), and work premises *is a pre-requisite for the plan*.

Workforce redeployment should follow some general principles:

1. ***older workers*** should be offered, when redundancies cannot managed by means of turnover management, early or gradual (part-time) retirement by maintaining them in the old technological environment if skill upgrade is agreed as too long and/or too expensive: current financial restrictions should favour part-time retirement schemes, in order to retain their competences, although related to the "traditional" technology;
2. ***redeployed workers*** because of concentration in fewer and larger workplaces, such as traffic controllers and maintaining their professional profile, should be offered a premise at a reasonable distance from their previous one and/or their residence;
3. ***redeployed workers changing professional profile*** *or at-risk of professional deprivation* must be *offered a re-training program* in order to re-deploy them in a workplace fitting as much as possible with their qualification, classificatory profile and competences and/or their work life balance needs;
4. ***Regular and timely information*** about ERTMS deployment, training activities and impact over the workforce must be provided to workers' representatives and trade unions, by allowing joint evaluation and decision in order to manage any deviation.

Guideline n. 3.1
Target: Workers
Iitem: employment

MAIN ISSUES:

- Currently ERTMS is mainly deployed on new lines, without generating redundancies but rather geographical and professional mobility processes. When ERTMS will substitute traditional national systems, mobility processes will be more extensive and redundancies may be generated.
- Need to discourage early retirements as too expensive for public finances but rather move them for corridors and ERTMS deployment.

ACTIONS:

- Detailed information and monitoring on employment by socio-demographic and professional characteristics will be the basis for any bargaining over the training and redeployment plan.
- Training and redeployment plan should first settle mobility and eventual redundancies processes in a consensual way. Such processes have to be negotiated amongst social partners and coupled with appropriate training activities.
- Focus on target groups: aged workers, disabled, women, redundant workers to be redeployed, at-risk of professional deprivation employees.

3.2. Monitoring the impact on employment in a more accurate and timely way

The report highlights, on Chapter 2, the lack of reliable and timely statistics at European level about the railways sector: such a lack is only partly filled by employers' associations when they provide information about their members, as liberalization and outsourcing allow further employers to enter in the industry, thus affecting the boundaries of the industry. Such lack of information prevents both public institutions and social partners to assess the **impact** of both the **liberalization process** and **ERTMS deployment** over employment.

The report shows that there is no general consensus amongst railways' experts about the Commission's claim "liberalization = lower costs = more employment", as it may conflict with ERTMS deployment.

Both the technological change and the liberalization packages are changing sectoral boundaries: some maintenance is being captured by the railways equipments' companies, while the new entrants could outsource some activities usually falling inside the sector (e.g. train maintenance, tickets selling, train cleaning) to companies outside the current railways sector boundaries with different labour contracts (e.g.: metalworking or engineering for maintenance, trade for tickets' selling and commercial activities).

A network of **national-level observatories** coordinated at EU-level is the most reliable way to provide on a regular basis appropriate monitoring of the sectoral dynamics. As "owner" of such figures, they can directly monitor sectoral trends.

Both social partners and public institutions need timely information about such conflicting effects in order to anticipate change, pave the ground to the appropriate policy measures to face both redundancies, skills shortages and skills reconversion. They have to lobby with EU institution, especially Eurostat, in order to improve both reliability and timeliness.

A network of **national-level observatories** coordinated at EU-level is the most reliable way to provide on a regular basis appropriate monitoring of the sectoral dynamics. As "owner" of such figures, they can directly monitor sectoral trends.

In the meanwhile, social partners should be able to devise an **EU-level observatory** collecting with a reasonable effort the relevant figures about employment levels and workforce composition by demographic structure and professional profiles. Involved employers' must be granted the due confidentiality.

They further need to combine figures about employment with information about company restructuring by operations' area, redundancies announcements, new licences, and their link with ERTMS advances and deployment, etc., thus devising a sectoral observatory about employment and structural changes.

Guideline n. 3.2
Target: Workers
Iitem: employment

MAIN ISSUES:

- The sector boundaries will ever less coincide with railways companies, as was the case when they were national monopolies. There is a need to map accurately companies operating in railways services and their employees profiles in order to manage change and properly prepare them to changes.

ACTIONS:

- Social partners have to pressure the Commission and Eurostat in order to improve statistics' quality and timeliness over railways industry, including the establishment of joint working groups
- Setting a network of national and EU-level joint observatories collecting figures and information over operating companies (restructuring processes), involved employees by socio-demographic and professional profiles (EU coordination + national).
- Devising mainstreaming actions, esp. in connection with liberalization, ERTMS deployment, by extensively involving also middle management workers' reps. (EU + national + local).

3.3. The governance of ERTMS employment implications: bargaining & social dialogue

The ERTMS deployment is a EU strategy, having a European coordination and ERA as a technical branch about operational and safety shared rules. Further, national governments devised national deployment plans while corridors implementation are governed by an European Economic Interest Grouping (EEIG) composed by Infrastructure managers of the involved countries, having a management committees and consultative working groups as coordinating institutions.

The governance of social partners' action should fit with such **double-track institutional framework** according to figure below, by taking into account that the national level is the main regulatory one as labour law is a matter of national sovereignty.

At EU-level, social partners are recommended to establish a working group on ERTMS within the sectoral Social Dialogue Committee focused on its implementation and deployment, according to a pattern similar to the ATM one in civil aviation. Such a working group will support social partners by promoting further analysis, by issuing opinions both on specific aspects of working conditions and technical implementory issues, thus exerting further lobbying over ERA working groups, and by issuing joint guidelines and toolkits. The establishment of an EU-level observatory will greatly favour the establishment of shared information.

EU-level sectoral social dialogue has a wide scope in both monitoring and regulating ERTMS implementation and its impact over working conditions. High union density and EU-level social partners' representativeness are key enabling factors.

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The cycle analysis-bargaining-implementation-monitoring must be assumed as the reference approach, to be implemented both at EU and at national level. Joint guidelines and toolkits will greatly ease local-level bargaining and favour social partners' commitment both at national and local level.

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Trade unions representatives are not included in any stance concerning corridors' implementation, neither in the stakeholders committees, thus preventing them to express their opinion. Trade unions should on their own launch a "Corridor Employees committee", having the European Work Councils as the reference model, claiming for autonomous consultative function with respect to the management committee, which coordinates corridor employees' committees in each country.

Collective bargaining is mainly concentrated at national level in those countries having a centralized bargaining and/or nationwide operator, or at company level elsewhere. The establishment of national joint observatories will support both EU-level social partners' actions and national level information sharing. Social partners should agree the framework in order to manage ERTMS deployment at local level according to a training-and-redeployment plan, namely at corridor national portion level or specific tracks or local systems, by settling

New Institutional framework

	Framework	Corridor/project
Transnational	Working group on ERTMS promoting analysis, issuing opinions and guidelines on its impact on employment EU-level joint observatory	Corridor Employees committee
National	National joint observatories Framework rules in managing the impact of ERTMS on workforce re-deployment, training plans and contents, reward policies, OHS	Project-related agreement on training and re-deployment plan, monitoring actions and OHS surveillance Joint project committees

the main criteria about managing redundancies, workforce redeployment, the training activities, the reward policies and the measures aimed to protect employees' health and safety while implementing ERTMS. This regulation may be either included in national collective bargaining or agreed in specific sectoral protocols: this latter solution will allow more flexibility to both social partners.

The introduction of a **local level bargaining** aimed to ERTMS deployment is the major innovation for a strongly centralized sector: this is the level where employees face the major risks of poor support in the transition phase.

The training-and-redeployment plan, which foresees involvement of workers' representative in the process and monitoring tools, **has to specify in detail:**

- ***The impact on employment levels*** and the way possible redundancies are managed, with specific details, geographical mobility and professional mobility, concerning those workers which have to change professional profiles;
- ***Training activities*** by professional profile and subject matter, according to the national framework, by specifying the scoreboards;
- ***Prevention plans and actions*** over health and safety at work;
- ***Regular information*** over the advance, by allowing discussion about deviations from the plan and to adapt to the changed conditions;

Monitoring activities *aimed to assess* their impact over both working conditions and service performance, by letting social partners to agree the most appropriate way.

Guideline n. 3.3
Target: Workers
Iitem: employment

MAIN ISSUES:

- ERTMS deployment is devised at EU and national levels and implemented at local-level, such as corridors' transnational partnership level;
- bargaining must fit with such governance, by taking into account that employment relations are mainly regulated at national level.

ACTIONS:

- establishment at EU-level of a ERTMS working group within the social dialogue committee, promoting analysis, issuing opinions and guidelines on its impact on employment, and of a joint Observatory on railways employment;
- establishment of transnational Employees committees for each corridor, in order to monitor their implementation from employees' point of view;
- each ERTMS project deployment must include an agreement amongst social partners on the *training-and-redeployment plan* at local level (TRP), on the basis of a national framework agreement settling the main principles about redundancies and mobility management, training contents for each professional profile, and health and safety prevention.

4. SOCIAL CONDITIONS

4.1. Old and new skills for new jobs: the training-and-redeployment plan and continuous vocational training

Key professional profiles in the railways industry, such as train drivers, traffic controllers, and traffic managers amongst those investigated in the present project, require long training and a continuous learning and updating processes. ERTMS implementation shortens the span of time required in achieving a full proficiency, by formalizing learning processes according to long training periods and by introducing frequent sessions on ICT devices, such as simulators in driving. Train drivers carrying out cross-border inter-operability services are required a European licence, as the 2004 EU agreement settled out.

Thus learning processes don't rely anymore on just on-the-job learning but require extensive training plans and well-equipped training centres. Continuous vocational training (CVT) is a necessity in order to keep workforce updated, as both ICT-based devices and regulation continuously evolve: such needs greatly increases when both the technological and the competitive environment change almost simultaneously.

Redundant employees must be offered *a re-training program* and be granted the right to a competence balance, the definition of a training path in order to achieve skills required by her/his new professional profile as a consequence of ERTMS implementation.

Employees affected by geographical mobility may face significant organizational difference with the previous workplace: for instance, moving from a "small" to a larger premise could imply more complex social interaction, with higher coordination needs and therefore communication skills to be promoted by adequate training, according to the organizational design.

Each training and redeployment plan should include:

- an ***initial training plan***, by specifying how many employees per professional profiles are affected, the foreseen mobility amongst professional profiles, the timing and the goals of each training path and the amount of training activities according clear and reliable scoreboard, by tailoring them on the employees as much as possible;
- a ***maintenance (continuous) vocational training plan*** after its implementation and achievement, by guaranteeing a minimum of training hours per year to each employee: for instance, train drivers must be provided at least twice a year training maintenance about static and dynamic train simulators;
- ***Regular monitoring of performed training*** and achievements, satisfaction and feeling of usefulness, ex ante and ex post must be regularly reported, by submitting reports to workers' representatives and trade unions to propose and implement suggestions.

The initial training plan should outlines on:

- **specialistic tasks**, such as driving licences, training over software and online diagnostics, use of both static and dynamic simulators for train drivers, etc.;
- **communication skills**, in order to ease communication between different professional profiles, use and meaning of different communication media, and how to establish support in emergency situations and cope with possible loneliness or inadequateness feelings;
- **linguistic skills**, these latter of special relevance when international trains regularly run over a given track;
- **training on new organization** and related performance indicators, as the case of train maintenance shows;

Guideline n. 4.1
Target: Workers
Iitem: Social conditions

MAIN ISSUES:

- ERTMS learning processes rely on formal complemented by informal learning: this requires rigorous and well designed training policies, with a wide spectrum of both specialistic and general competences.
- It requires massive training activities for those employees moving from the old to the new technological environment and for those redeployed in a different professional family.
- ERTMS deployment requires extensive and regular continuous vocational training activities for both specialistic and transversal skills.

ACTIONS:

- EU-level guidelines and agreements on licences for specific professional profiles.
- Design of the training packages according a modular approach at National level.
- Need of a detailed "initial" training plan, including all employees considering their "starting" and "ending" points.
- Specific targets: redeployed (both geographically and professionally) and at-risk of professional deprivation employees.
- Maintenance (continuous) vocational training plan including both specialistic and general/transversal skills.
- Specific training programs for middle management (especially in traffic control), workers' representatives and trade unions officers.

- **training over new physical and psychosocial risks**, health and safety at work, and primary and secondary prevention plans.

4.2. Addressing health and safety at work to new risks

ERTMS greatly improves safety standards, thus strongly reducing the risk of train accidents. On the other hand, it "automatize" a wide range of job position, by introducing a mediator (interface), or a more sophisticated one, between the equipment and the operator.

As shown by a wide literature, **automation** greatly reduces hygienic and physical work factors on the one hand, such as physical fatigue, awkward postures, force exertion, exposure to dust and chemical substances. On the other hand increased **proceduralization** *requires higher cognitive demands* and concentration levels, which generate mental workload, hypo-elicitation of the whole body leading to higher risks of both musculoskeletal disorders and stress levels. These **risks** are increased in the transition phase, where affected workers are strongly exposed to communication problems, feeling of uncertainty and lost of their professional identities (see chapter 3).

Further, ERTMS make the whole system more transparent to supervisor, by providing them more opportunities to intervene by putting employees under pressure, especially when management by stress approaches is implemented. Further, transitions amongst signalling systems generate high mental workload: when they are too frequent the exposure to stress is very high.

This requires wide **primary prevention plan** with extensive risk assessment in a participatory way, including health and safety issues in the training-and-deployment plans to both employees and their OHS (occupational health and safety) representatives, with a special attention to new physical and psychosocial risks, health and safety at work.

Regular monitoring of the impact of working conditions on workers' health must be established by means of regular surveys, which have to include recommended measures that social partners have to devise in the most appropriate and effective way.

4.3. Rewarding new skills and increased productivity

When a technological innovation is implemented, it is reasonable to expect that affected employees may achieve

Guideline n. 4.2
Target: Workers
Item: Social conditions

MAIN ISSUES:

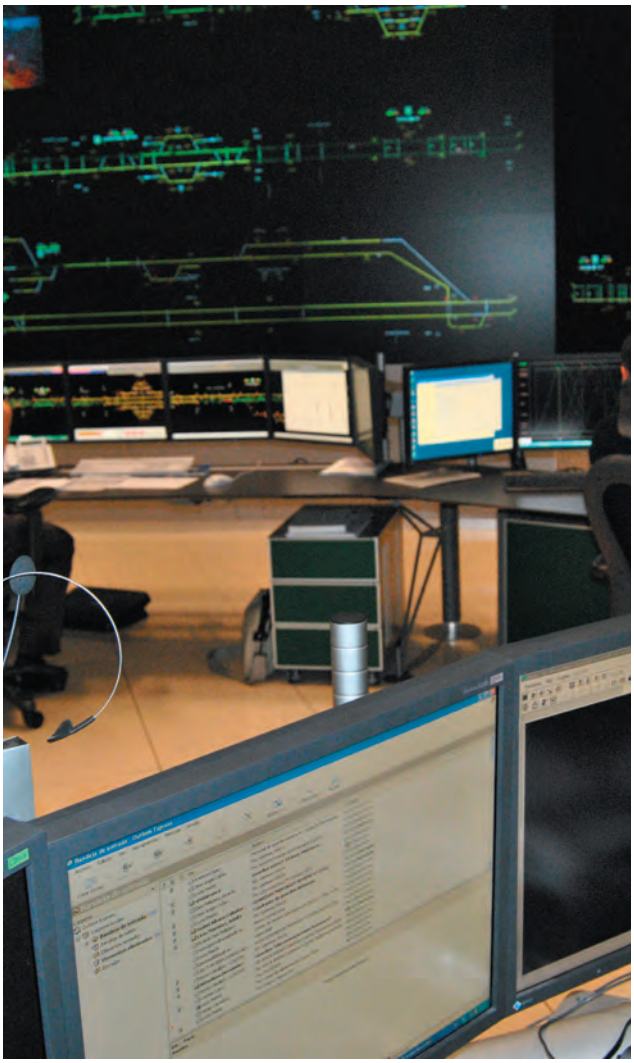
- Ertms increases safety standards and reduces physical fatigue, but increased proceduralization, hierarchical pressures, communication problems, feeling of uncertainty and lost professional identities raise strong risks of mental illnesses, MSDs and psychosomatic diseases.
- Management by stress will be very critical in train maintenance.
- "Stressed Orange" risks for those re-deployed or de-qualified (esp. maintenance).

ACTIONS:

- Promoting participatory primary prevention strategies and risk assessment, with special focus on including psychosocial risks.
- Extensive training on occupational health and safety for both employees and OHS representatives.
- Wide recourse to external expertise in mental health primary prevention (local).
- Regular monitoring over the impact on health and safety.

better compensation, provided that their skills increase because of its higher productivity. As any organization, we can expect as well that companies will seek performance improvement by either optimizing the organizational design, by setting the appropriate indicators (pay by results) and/or by improving individuals' and collective competences (competence-based pay). Trade unions must be prepared to such occurrence.

As railways industry is a newcomer amongst competitive markets, several tools about professional rewards, competence-based pay and pay-by-results are to be implemented by management:



- ***whereas ERTMS transition implies a skill upgrade***, a professional reward must be established through collective bargaining, by introducing new professional profiles (as in the case, according to the current approach of train drivers, guards and traffic controller).
- ***In any case, a tool monitoring competence progress is necessary, as it will allow settling in a transparent way required competence for "***senior" or "master" levels for each professional profile. It also allows defining competences-related reward scheme in order to link individual engagement and workplace performance. Employees' competence balance sheet should be drawn and discussed both at individual and collective levels, in any case with workers' representative supports. Joint committees and Union learning representatives at decentralized level with adequate training may ease such implementation and will carry out monitoring of competence failures, to be reported in the continuous vocational training (CVT) plan;
- ***whereas the National labour Contract (NLC) foresees pay-by-results*** in order to redistribute and foster productivity gains, collective bargaining should set specific performance targets for employees working in an ERTMS environment, which may differ from those applied to employees working in traditional technological environment. Targets should be set according to the reasonable achievement principles, while differences in compensation amongst the two technological environments should be moderate, by balancing fairness and redistributive reasons.

Joint committees at decentralized level with adequate training will ease the implementation of both rewarding schemes: they will also monitor of competence failures, to be reported in the continuous vocational training (CVT) plan, by proposing organizational improvement to social partners, according to the national industrial relations rules.

Guideline n. 4.3
Target: Workers
Item: Social conditions

MAIN ISSUES:

- ERTMS-generated productivity gains and new skills call for revising rewarding systems.
- Managing skills upgrade: new contractual professional profiles and competence-based employees evaluation (CBE).
- In competitive markets pay by results (PBRs) are standard practices: indicators must be bargained and related to competitive drivers (incentive) instead of financial indicators (profit and risk sharing).
- New professional profiles could be settled in train driving and traffic controlling under ERTMS environment.

ACTIONS:

- Specific Training for Workers Representatives and Trade Unions' officers on pay by results and competence-based evaluation.
- Developing professional tracks towards new professional profiles by means of competence-based evaluations.
- Joint monitoring performance and competence related wages.

5. ACTING BEYOND THE SECTORAL BOUNDARIES

According to all EU documents and transport plans, there are high expectations about ERTMS as a technological device allowing low-carbon freight and passengers transport by minimizing the need of new tracks: by insuring interoperability, it is expected to absorb some share from medium-long distance freight transports by road and from medium distance passengers travels by plane, as successful high speed lines show since early 80s. Thus, ERTMS plays a strategic role in order to ensure the new EU transport strategy and to achieve goals enjoying a wide consensus. Strategic projects generating high expectations require strong commitment amongst all stakeholders, both at collective (social partners, public institutions) and individual level (employees, employers, users and consumers). It therefore requires a wide sharing of their implications in a targeted way.

ERTMS is a technology reducing the need for new great infrastructures with high environmental impact to some high speed lines, most of them included in featured corridors. Since it allows a strong increase in trains' frequency over the existing tracks: employment perspectives in the industry strongly rely on its success. This is a clear advantage with respect to other modalities, while corridors deployment requires huge investments: the 2020 deadline is at high risk, thus affecting the shape of the unique market in favour of an unbalanced liberalization.

There are objective reasons favouring a convergence of interests between sectoral social partners: those actors calling for a "green economy" and wider citizens' interests in order to accelerate both ERTMS deployment and implementation of interoperability. A unique market relying more on liberalization than on ERTMS deployment will heavily affect workers' rights and working conditions by favouring social dumping: further, macro-economic measures in favour of green economy would be ineffective in the transport sector unless combined with more investments in low-impact modalities, such as an EU railways network.

Social partners should therefore consider coalition building in favour of ERTMS as a key issue of the economic, social and environmental sustainable Europe strategy, by means of joint lobbying initiatives, extensive communication campaigns at any level, and targeted actions, especially in those areas affected by great infrastructures.

Further, trade unions views' are poorly taken into account at EU level, as shown by the absence of any consequence to the 2009 joint letter addressed to ERA (European Rail Agency). At corridor level trade unions representatives are included neither in the corridor management committees nor in the consultative working groups: trade unions may promote a "social committee" at corridor level, including national sections, in order to stimulate other stakeholders' action.

Guideline n. 5
Target: EU Stakeholders
Iitem: Environment sustainable rail

MAIN ISSUES:

- Strategic role of ERTMS in low-carbon EU transport system.
- Need of wide consensus amongst stakeholders according a multi-partite approach (including consumers and environmentalist associations): ERTMS favours a unique market but does not imply deregulation.

ACTIONS:

- Coalition building with citizenship's associations.
- Joint communication campaigns at national and EU levels with citizenship's associations.
- Transnational "social committees" for each corridor in order to stimulate other stakeholders' actions.

6. OUTSOURCING AND RELATIONSHIPS WITH CONSTRUCTION COMPANIES

Unbundling of railways services, as required by the liberalizations packages, gives room to outsourcing: management gains room to manoeuvre when choosing between "make" or "buy", although seriously affected by shareholders' pressures.

As a general rule, a **social clause** about outsourcing must be negotiated, by safeguarding the "equal pay for equal work" principle, by defending the "National labour contracts' shopping", that is choosing the most advantageous for each professional profile. Also employees may be outsourced: in that case they must be granted at least previous employment conditions. Further, Trade Union representatives, including health and safety ones, must be established when more than one company is operating in any work premise.

ERTMS implementation shows a particular form of **outsourcing**, as the equipments' providers keep the most qualified part of the maintenance activities, in particular software updates and the diagnostics. Some operators outsource maintenance activities, thus raising the risk that required safety standards are not met, as the UK experience shows. In order to prevent such occurrence, a drastic solution may be that social partners agree at EU-level the ban of outsourcing in equipments' maintenance for safety reasons, with the reasonable exception of those firms which can demonstrate their competence as owners of the technology: in that case they share their responsibility with the railways operator.

Workers and Trade unions consider as unacceptable that the knowledge reservoir in the maintenance staff is thrown away, especially their diagnostic skills: these employees are usually highly qualified and are those most at-risk of professional deprivation, thus seriously affecting their health, and need adequate training and support in order to redesign their tasks and re-generating their motivations.

Guideline n. 6
Target: ERTMS suppliers
Item: Contractual matter

MAIN ISSUES:

- Contractual arrangements between railways companies and ERTMS equipments' constructors usually reserve diagnostics to these latter.
- New entrants may opt for a "shell model" by outsourcing most functions but one (e.g. traction for operators) and may perform a "contractual shopping" (that is choosing the most advantageous for each professional profile).
- Outsourcing may imply social dumping.

INDICATIONS FOR TRADE UNION BARGAINING POLICIES

- More information about contractual relationships between railways companies and infrastructure managers on the one hand and constructors on the other must be required.
- Trade unions have to gain wider scope in regulatory agencies both at national and European levels in order to promote regulatory uniformity.

ACTIONS:

- Promote increasing standardization at EU-level by lobbying on ERA in order to investigate whether it may reduce contractual asymmetry amongst railways operators and technology providers.
- EU-level protocol on outsourcing, by defending "contractual shopping" and outsourcing in maintenance for safety reasons.
- Tight rules guaranteeing contractual standards and prevent insider-outsider model.
- Site representatives when more than one company is operating in a given premise.

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APPENDIX
(See dedicated CD)

Appendix 1:

- ERTMS : System of European Railway Traffic Management

Appendix 2: Glossary

- Terms and abbreviations of ERTMS technology.

Appendix 3: Social dialogue and Socially responsible restructuring

- Social dialogue in the railways sector
- Liberalization and technological change: EU social dialogue in civil aviation, electricity and telecommunications.
- Indications from other sectors' social dialogue

Appendix 4: Questionnaire

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Appendix 5: Workshop

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