Building Blocks for a New Skills Ecosystem in the Rail Sector:

Assessment of the state of play in employment in the railway sector

Human Capital Report Series

TNO innovation for life

Shift2Rail
Moving European Railway Forward

About this publication

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Summary

Goal of the report D3b

The Shift2Rail Joint Undertaking (hereinafter "the S2R JU", "the Joint Undertaking" or "the Contracting Authority"), is a public-private partnership in the rail sector, established under Horizon 2020, to provide a platform for coordinating research activities with a view to driving innovation in the rail sector in the years to come. S2R JU has assigned the consortium TNO and NewRail a contract three studies in the "Human capital" working area of the S2R cross-cutting activities (CCA) of its' research programme:

› *To study the socio-economic context of the rail sector:* this study analyses the socio-economic aspects of human capital, notably the skills that will be needed in the future for the different categories of railway staff - from workers to engineers, railway managers and researchers. This study is included in the report Deliverable 1a (see Dhondt e.a., 2018a, b; D1a);

› *To develop a preliminary prognosis* on the impact of the market introduction of the S2R research and innovation programme and its technologies on human capital. This study is included in the report Deliverable 2 (see Dhondt e.a., 2019a; D2);

› *To develop strategies and trainings* based on the above analyses to bridge the skill gaps, with a special attention to ensuring increased flexibility of railway staff. Best practices from other sectors, transfer of knowledge and of workforce (mobility, etc.) are also studied for this goal.

For the 'strategies and trainings', two reports are delivered. The first report is Deliverable 3a (D3a) in which six measures to deal with the future skills gap in the sector have been analysed and recommendations have been formulated and discussed (see Dhondt e.a., 2019b). This second report (D3b) is the fifth and final publication with as main focus the right human capital conditions to sustain the future skill development in the rail sector. These future changes, in technology and in skill gaps have been documented in reports D2 and D3a. This final report offers two overviews of what rail organisations and their stakeholders can do to create the right conditions for these future changes:

› What are the right conditions to create sustainable health and safety conditions in the future rail?

› What is helpful for the development of supportive skills ecosystems that offer the right conditions to develop future skills in the rail sector?

The results as laid down in this report have been discussed during the final workshop of S2R JU in November 2018. The conclusions of this workshop are also added to the report.

Future health and safety practices for rail companies

Technological change not only brings challenges for employment levels and skills gaps, but also for health and safety for employees working in the rail sector. The rail sector has a long tradition in taking great care of health and safety of its employees. Railways and trains are only operable if risk management, also for its' personnel, is fully ingrained in the operations. Future workplaces are capital-intensive, IT-intensive and customer-centered workplaces. The following questions are important to deal with these future workplaces:

› What is the current health and safety situation of employees in the rail sector and how do health and safety practices among employers match up with these results?

› What are the core components for more sustainable employment conditions in the rail sector to support the required skill and employment changes? On what should the sector start working to improve health and safety?

Current policies in rail companies have been dominated by compliance-to-regulation. With the technological changes under way, this compliance-driven approach will come under pressure. There are two reasons for this:

› Work in the current rail sector is still in an unfavourable ambient working environment. A lot of effort is S2R innovation programmes to make future trains less noisy, more comfortable and easier to work with. Such new environment is particularly necessary if the working situation requires more communication, dealing with data and making more informed decisions on these data and signals. The sector is not there yet.

› Railway organisations have been in a process of continuous rationalization over the past decade. Continued rationalization and in particular downsizing is very detrimental to employee health and well-being (Westgaard & Winkel, 2011), also of remaining personnel. The challenge for rail companies is to speed up the improvement of the ambient working environment and create some sort of working environment in which rationalization is channelled in a specific way. Rationalization strategies in the sector need to become strategic, more conscious of the impact of measures and more in line with goals of individuals working for the company. Strategically run rationalization allows to channel detrimental impacts in a strong way.

Given this starting point - if rail companies want to achieve health and safety situations that are supportive conditions for the future work situations - **what kind of interventions should rail companies look at**? Four recommendations have been formulated:

› Investing in health and safety can go hand in hand with better operations and better company performance. It has been shown time-and-time again that **both elements can be complementary in helping better performance of companies**. However, it also means that management will need to develop good labour employment relations, good planning and preparation of operations and the right supervision and leadership.

› Focusing on the content of OSH- and HR-policies, it is also important to focus **on the following organisational aspects:** worker participation (employee engagement), active management style, information, support, group autonomy and procedural justice. These can help to further influence better workings situations and outcomes for employees.

› Reorganisations that are strategic do not necessarily have a negative impact for employees. Rail organisations are big organisations and have more abilities to offer employees more options in dealing with change. Examples of strategic reorganisation are non-lay-off policies, investments in skills development, attracting new employee groups, and offering the existing employee base equal future opportunities.

› Rail organisations should learn about **new work organisation approaches** such as High Performance Work System (HPWS) and workplace innovation. These are associated with positive outcomes for employees, together with positive outcomes for companies. These HPWS offer sustainable environments for upskilling and continuous improvement.

Strengthening the skills ecosystem of the rail sector

The concept of skills ecosystems has been launched as a concept to deliver better insight in factors that explain skill disbalances in sectors and therefore help in formulating better recommendations to improve skilling and training in sectors. Skills ecosystems are made up of four areas:

› the demand for skills (recruiting function of companies);
› the supply of skills (labour market: from schools, from competitors, from other sectors);
› the development of skills;
› and the deployment of skills (or use of skills) (quality of work).

The dynamic skills ecosystem approach allows to make us understand that the possible skills gap in the future requires much more than a static equilibrium perspective in which supply and demand are in balance. Next to supply and demand, attention is needed for use of skills and deployment of skills in the rail sector. Important in all these areas is to build more resilience into the rail skills system. Younger (and older) workers need to have the ability to change jobs if needed, or at least be able to adapt to new tasks in the future. The discussion with the partners in the rail organisations has given the perspective that to achieve technological change in the future, a broad set of old and new skills will be required at the same time, and possibly for longer periods of time. This may require that young workers need to get acquainted to old technologies too.

Preparing for this future of technology and skills means that for the companies it is better to work on a set of solutions for different levels of workers. More room for academic technologists seems necessary, which also allows for graduates and maybe even professional specialists to upskill their knowledge over time.

Learning from the reports D2, D3a and chapter 2 of this report, the following four recommendations are formulated:

Building the skills ecosystems

The main issues for the short future for the sector are then the following:

›   There is need for a broader discussion within sectors on the significance of the skills ecosystem in the rail sector. In some countries, such discussions have started at the regional or at the national level. For example, the TechniekPact (see report D2 for more details) in The Netherlands shows an example at the national level. The national skill alliances and National Skills approaches (as shown in the UK) are good settings for this. Also, it is good to remind ourselves that the net-effectivity of certain actions needs to be assessed.

›   The current reports have produced a list of issues of what is working well and what needs to improve in the ecosystems. A separate analysis may be needed to make the recommendations specific.

›   The countries in this study, but in Europe in general, show institutional and competitive differences. The main difference seems to be between the Netherlands and the UK on the one side, with both a strongly privatized and decentralized market, versus France and Germany with one major company dominating the market, is important to understand the impacts on the skills ecosystems. If decentralization of the markets continues in France and Germany, then maybe the skills ecosystems in the Netherlands and the UK can shed some light on the major future changes in countries that have not yet liberalised their rail market.

›   The six measures to deal with skill gaps are good step forward, but more needs to be done. Report D3a shows a broader set of measures rail companies need to use to improve the skills ecosystems in their countries all over Europe.

Understanding the changing role of the different stakeholders

The different stakeholders in the rail sector (rail organisations, educational partners, social partners, research partners) can help create an environment in which the matching and development of skills can be vastly improved. The ecosystem approach shows what the playing field(s) are for these stakeholders but also that most stakeholders will need to change their mindsets and positions:

›   The future of the rail system will be one of more openness and more clear relations between companies, but also more competition as is the case in the UK and Netherlands.

Clearly, the stakeholders in such open and clear competitive systems need to change their mindset on the factors they can influence.

› The stakeholders in the whole ecosystem need to develop new roles to be able to cooperate with one another. Stakeholders need to operate in a networking approach, and act on a broader set of priorities. They also need to understand the 'interconnection' between the different segments of the skills ecosystem.

Building a European initiative

There is need and space for a dynamic *European* skills ecosystem approach. There is need for learning at the EU-level. For developing a European skills ecosystem, this learning about skill gaps needs to be used in a broad European discussion. There are already well organised European partnerships and stakeholders (for example: UIC, ETF). The building blocks for a skill ecosystem are there. The topic of skill gaps and employment risks are sufficiently important to discuss within this ecosystem. For the further development of a European skills ecosystem, it is necessary to define in a collaboration a common perspective on the challenges defined.

The following table summarizes on which topics this European partnership could have its focus to help improve the supply, demand, use and development of skills in the sector. The actions are also linked to the six main measures from S2R.

Table i. Action plan for the EU rail sector to prepare for the future of skills

	Action plan to prepare rail for the future
Supply of skills	1. Understand the institutional difference between one party vs multi-party dominant country eco-systems for rail for demand. (FR/GE vs. UK/NL). The UK and Netherlands have open rail systems, still very much the exception in Europe. Other countries can learn from these experiences with education, schooling and training. 2. Create more engagement from the companies in the education system to secure a realistic profile of the sector in schools and to secure right-sizing of educational programmes to need of companies. *[access to education]* 3. Continue to improve the quality of education: connect training situations of VET (and other levels of schooling) to real world practice. Develop the in-house training systems to the educational system. 4. Engage in national partnerships for aligning interests in four areas of skills and not over-focus on supply-demand nexus. 5. Support further development of (multi-party) simulation tools, also into the education system. Work on EU-level projects for this. *[virtual tooling]*
Demand for skills	*Broaden supply base of talent* 6. Broaden supply base with new talent from other sectors, but also internal in companies. 7. New entrants may be more receptive to new technical requirements (new recruits). 8. Attract IT-talent from other sectors. 9. Focus on higher apprenticeships and access to academics to channel new talent to rail companies. 10. Use diversity as an asset. *Understand impact technological change* 11. Engage technologists in discussion with innovation, HR, social partners and education systems to get a better understanding of future skill demands. Proactively engage workers when scanning new technological applications. 12. Develop **more access** to knowledge areas in schools and innovation systems.
Use, deployment of skills	*Quality of work* 13. Improve quality of work ahead of development of new trainings and systems. 14. Align messages in campaigns etc. with actual work in the sector (or with planned changes) *[access to new groups]*. 15. Connect better working conditions to the needs of the under-represented groups in rail. *[access to under-represented groups]* 16. Take account of future of mix skills: engage in sustainable employability to secure re-engagement of specialists in the future (ex. from maintenance to other fields). *Better Occupational Safety and Health policies* 17. Understand and develop concepts of strategic OSH and HR to help make human capital fit for the future and resilient for disruptive changes. *[re-integration]* 18. Make prevention policies more active. *Organise work otherwise* 19. Engage in better understanding of new operational concepts with split-up or integrated occupational profiles of drivers. 20. Prepare for managing more unknown technical capabilities (e.g. with suppliers, ageing groups). 21. Integrate quality expectations of network on innovations, technologies. 22. Prepare for rising (technological) risk situations that need managing.

	Action plan to prepare rail for the future
	23. Develop methodologies to use prospective thinking about possible future risks (learning in the future).
	24. Use virtual tools purposeful, with intent to manage risks.
	25. Develop cooperative relations in networks to understand unknown technological capabilities.
	Organise more flexibility
	26. Organise for unpredictable growth and decline of tasks in organisations.
	27. Organise to deal with faster changing personnel composition.
	28. Consider impacts of contracting-out of work in rail sector and impacts of skill.
	29. Assess impacts of new contract systems: negotiate security and flexibility engagement of personnel
Development of skills	30. Develop practices within the rail systems of learning with virtual tools and adapt HR-practices to incentivize this. *[virtual tooling]*
	31. Develop methodologies for faster and more specific learning, use Next Generation /Virtual Learning.
	32. Develop methodologies to faster assess changes in occupations and translation into training.
	33. Adapt learning-systems from compliance-focus to fit-for-the-future.
	34. Make human capital more resilient for change. Engage in systematic retraining; 'broad' functions. Challenge workers to try new tasks in safe contexts.
	35. Develop advanced IT-skills among current personnel, recruit new talent.

A separate research programme

S2R JU has developed the Cross Cutting Activity on Human Capital to support the innovation projects. The focus of research by S2R JU has been on the following topics:

› Change of job profiles – Effects of digitalization & automation on the job profiles;
› Skills and qualifications – Change of qualifications & skills due to new technologies and specific training programmes;
› Flexible organizations - Identification of sources of disturbances, and solutions on how to build resilient organizations in a rapidly changing business environment;
› Costumer-oriented design of mobility - Simplification of specific aspects of railway system and whole journey from door to door based on the customer´s needs and requirements (user-centered design).

Three projects have been commissioned to deliver insight for these topics. The work on Human Capital has only started with these projects. The following further development is recommended:

› Further research into the assumptions used in the analysis of skills and employment development (see conclusions Report D3a).
› The current research has had a focus on Germany, France, the UK and the Netherlands. More work is needed to understand if the results are equal for the New Member States and the South of Europe.
› In report D3a, over 45 measures have been identified to help improve rail organisations. Rail organisations need to have the opportunity to come together to discuss these measures and learn from each other. A series of workshops could be hosted by S2R JU.
› More understanding is needed of the use of new organisational concepts to improve working conditions and performance in the rail sector.

At this moment, not all recommendations can be made more specific. These recommendations should be the result of discussion and negotiation between all stakeholders involved.

Learning from the final workshop

The discussions in the final workshop were focused on five questions:

› How realistic are the calculations?
› Which shift in skills are most likely?
› Which priority ranking in the six measures do you think necessary?
› Which other measures are needed to deal with the future skills gaps?
› Which priority in measures for flexible provision of personnel?

The main result of the discussion was an understanding of how the results were developed during the project. To develop the recommendations, participants in the discussion stressed the following points: (1) the need for collaboration between social partners in the development of these recommendations; (2) an understanding among all stakeholders in the railway sector of the necessity to prepare for the future changes.

Abbreviations

- ATO = automatic train operation
- COMM = communication competences
- DB = Deutsche Bahn (German Railways)
- ECS = European Company Survey (Eurofound)
- ESENER = European Survey of Enterprises on New and Emerging Risks (EU-OSHA)
- HR = Human Resources
- IPs = Innovation Programmes
- ICT = competences and knowledge to use and develop information and communication technologies
- ISCO = International Standard Classification of Occupations
- ISCED = International Standard Classification of Education
- NR = Network Rail
- NS = Nederlandse Spoorwegen (Dutch Railways)
- ORG = organisational competences
- OSH = Occupational Safety and Health
- S2R = Shift2Rail
- SOC = social competences
- STEM = science technology engineering and mathematical competences
- T = technical skills (see report for list)
- VET = vocational education and training

Contents

1 Introduction

The Shift2Rail Joint Undertaking (hereinafter "the S2R JU", "the Joint Undertaking" or "the Contracting Authority"), is a public-private partnership in the rail sector, established under Horizon 2020, to provide a platform for coordinating research activities with a view to driving innovation in the rail sector in the years to come. S2R JU has assigned the consortium TNO and NewRail a contract three studies in the "Human capital" working area of the S2R cross-cutting activities (CCA) of its' research programme:

› *To study the socio-economic context of the rail sector:* this study analyses the socio-economic aspects of human capital, notably the skills that will be needed in the future for the different categories of railway staff - from workers to engineers, railway managers and researchers. This study is included in the report Deliverable 1a (see Dhondt e.a., 2018a; D1a);

› *To develop a preliminary prognosis* on the impact of the market introduction of the S2R research and innovation programme and its technologies on human capital. This study is included in the report Deliverable 2 (see Dhondt e.a., 2019a; D2);

› *To develop strategies and trainings* based on the above analyses to bridge the skill gaps, with a special attention to ensuring increased flexibility of railway staff. Best practices from other sectors, transfer of knowledge and of workforce (mobility, etc.) are also studied for this goal.

For the 'strategies and trainings', two reports are delivered. The first report is Deliverable 3a (D3a) in which six measures to deal with the future skills gap in the sector have been analysed and recommendations have been formulated and discussed. This second report (D3b) is the fifth and final publication with as main focus the right human capital conditions to sustain the future skill development in the rail sector. These future changes, in technology and in skill gaps have been documented in reports D2 and D3a. This final report offers two overviews of what rail organisations and their stakeholders can do to create the right conditions for these future changes:

› What are the right conditions to create sustainable health and safety conditions in the future rail?

› What is helpful for the development of supportive skills ecosystems that offer the right conditions to develop future skills in the rail sector?

This report is a summary of several separate research tasks that have been conducted over the past year that offer insights into these two questions. This report is not so much a new research activity, but rather an overview on the basis of the past research about what the best conditions are for the sector to prepare for this future. The report holds recommendations how the different stakeholders can cooperate to prepare in time for these future changes on the rail. Human Capital is as important for the future of rail as the newest technologies are in which the sector is investing. The report ends with some remaining questions for future work that hopefully S2R JU will be able to conduct.

The report is centred around the two research questions formulated above. For the health and safety research, the main materials have been collected for reports D1a and D3a, at both the employee and employer level. The chapter in this report builds on these analyses. The next chapter is about the skills ecosystems required for a sufficient support of future skills and employment in the sector. It builds on the observation in report D3a that networked approaches, if designed well, can support the development of these skills and employment.

The results as laid down in this report have been discussed during the final workshop of S2R JU in November 2018. The conclusions of this workshop is added to the final chapter of this report.

2 Future Health and Safety Practices in Rail Companies

2.1 Introduction

This chapter looks at the technological challenge and skills gaps from the health and safety perspective for employees working in the rail sector. **Report D3a** has shown that the rail companies (i.e. railway undertakings, manufacturing, infrastructure management, system integrators) have great difficulties in identifying measures specifically focused on reintegration of employees (return-to-work). This is not specifically a challenge for the rail sector, but is the case in all sectors. All companies abide by their (national) laws for return-to-work. For as far as for companies health and safety are an issue, this is mainly a topic for preventative policies. No company in the rail sector (or other sector) wants to design unsafe and unhealthy workplaces from the start. This does not mean that working in the rail sector is without its challenges and risks: many jobs in the rail sector are still confronted with high physical and mental job demands. Several of these demands have already been illustrated in **report D1a**. For developing future skills, all companies also understand the need to create working conditions that are nurturing for future jobs. Future workplaces are capital-intensive, IT-intensive and customer-cantered workplaces. Creating workplaces that support the right skills development is a core strategy for all rail companies.

In this chapter, the following overview is given:
› What is the current health and safety situation of employees in the rail sector and how do health and safety practices among employers match up with these results?
› What are the core components for more sustainable employment conditions in the rail sector to support the required skill and employment changes? On what should the sector start working to improve health and safety?

Both topics require us to look at different HR-measures to support such conditions. The core elements of sustainable employment in relation to the future skills issue will be discussed with participants in the final workshop.

This section ends in four recommendations for rail organisations to balance changing personnel policies with future skills situations.

2.2 Current health and safety performance in the EU-rail sector

First, the general picture at the level of employee surveys is given. With these results in mind, current company policies are summarised.

Future innovation changes in the sector are focused on more customer contact, more distance working in all work settings, dealing with computerized working environments, more complexity and more unpredictable growth of and in work. However, current organisational policies (OSH, HR, operations) in EU-rail organisations are focused on compliance, structure and stability (see **report D3a**). Employees at rail organisations possess still predominantly low skill levels and enjoy good pay and benefits (health insurance, bonuses, etc.) in comparison to the general occupational population in Europe. Figure 2.1, calculated and based on the European Skills and Jobs Survey (CEDEFOP) outcomes, shows what the skills challenge is that current rail organisations (i.e. railway undertakings, manufacturing, infrastructure management, system integrators) are confronted with.
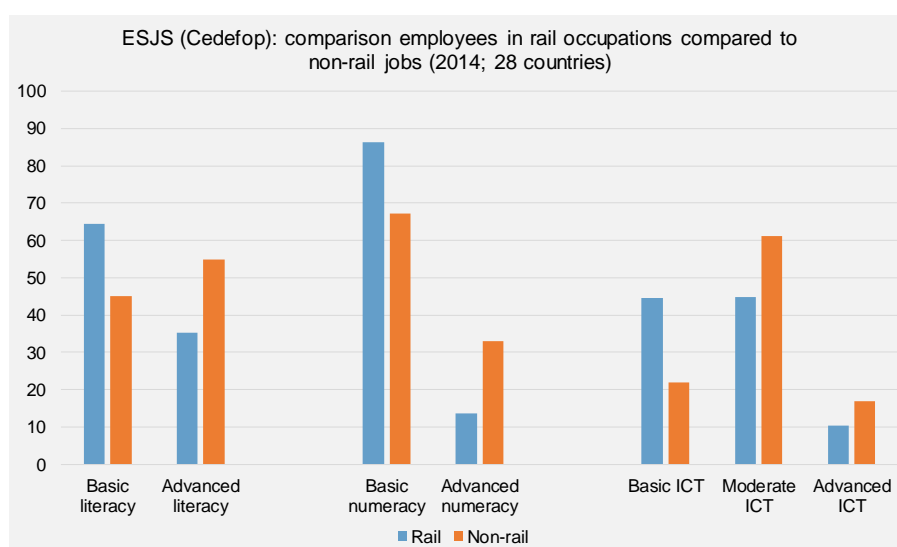
Figure 2.1 Differences in (average) skill profiles of rail personnel compared to the general non-rail personnel in the ESJS-survey 2014

These figures show that current employees in rail companies have good basic literacy, basic numeracy and basic ICT skills. For the future, from the research that has been done for S2R JU, employees will need to move up the skills ladder toward advanced literacy, advanced numeracy and advanced ICT skills.

What are these Occupational Safety & Health (OSH) and Human Resources (HR) policies at **the company level** that allow to balance the new skill requirements with future working situations? The survey results (European Company Survey - Eurofound; ESENER - EU-OSHA) show that rail companies are currently heavily engaged in preventive OSH-policies. They spend a lot of time and effort in securing higher degree of risk assessments, safety measures, investments, preventive measures and training. Management and staff in rail organisations are also more than reasonably aware of what prevention means. A whole lot more rail companies put compliance to rules central to their strategy in comparison to non-rail companies. At the same time, HR is also a well-developed policy area. Rail companies require longer on-the-job training periods for new colleagues to become proficient in their tasks than other companies do. Training from a company perspective in rail organisations, is more focused on specialized task execution which mirrors the results at the individual level; task rotation is in less rail companies a central focus.. Rail companies also appraise and evaluate employees at the personal level, more so than companies in other sectors do. As reported in **report D3a**, these conditions provide possibilities for companies to develop Next Gen Learning. And again, survey results show that rail companies recruit at lower educational levels than other companies.

The current employment situation and dominant company policies in rail companies poses the sector with three major challenges if they want to deal with the skills challenges described in reports D2 and D3a:

› Most of the effort in 'access to education' by all companies, seems to be focused on further development of skills at the VET, apprentice-level and graduate-level (**report D3a**), which is a striking result. The objective is to attract rail professionals. Academic skills or higher apprenticeships seem not yet to receive large support from rail organisations. This may lead to an exacerbation of the skills situation that already exists. This will be **a first challenge for the European rail sector**: to change the recruiting perspective

to allow more graduates and academic level students. The advanced technical and ICT knowledge creates new jobs for which academic thinking is needed.

› Training of the current employed workers itself is an insufficient condition to achieve the major change for rail organisations, at least in this sense that the different surveys show that current rail personnel in the rail organisations is already well-trained. This training is, however, strongly focused on compliance ('how to abide by the rules'), and not so much on upgrading the skills towards changing skill needs. *For rail companies, it will be important to shift the training effort*. **This is the second challenge**.

› A **third challenge** is that organisational policies will need to firstly, console upgrading the workforce and maintaining a stable operational process; and secondly, *improve working conditions that are supportive for the new workplaces* while at the same reorganising processes and technologies.

2.3 Recommendations: Required changes in working conditions policies

Rail organisations seem perfectly positioned to deal with the future changes in skill and employment. However, current policies seem to stress just those elements that are precisely an obstacle for these future changes. The situation for rail companies gets even more complicated for the future. There are two reasons for this:

1. The first is the current dominant occupational safety and health situation in the rail companies that still seems to allow unfavourable ambient working conditions. A lot of effort is invested in IP1 of the S2R innovation programme to make future trains less noisy, more comfortable and easier to work with. Such new environment is particularly necessary if the working situation requires more communication, dealing with data and making more informed decisions on these data and signals. The sector is not there yet.

2. The second reason is that the railway organisations have been in a process of continuous rationalization over the past decade. From research it is clear that (continued) rationalization (in particular downsizing) is very detrimental to employee health and well-being (Westgaard & Winkel, 2011), also of remaining personnel. The challenge for rail companies is to speed up the improvement of the ambient working environment and create some sort of working environment in which rationalization is channelled in a specific way. Research shows that rationalization strategies can be either reactive or strategic. Strategic run rationalization allows to channel detrimental impacts in a strong way. Deutsche Bahn, for example, avoids major layoffs during rationalization, opting for mobility and other measures. Westgaard and Winkel (2011) point to positive effects of such policies. Not all parts of the EU rail sector has the possibilities the German rail sector has to cope with downsizing.

Given this starting point - if rail companies want to achieve health and safety situations that are supportive conditions for the future work situations - **what kind of interventions should rail companies look at**? This seems important since current preventive and supportive HR-measures are not yet setting the companies up for this future. From our research, we can point to some more general elements and conditions that companies can take into account, and next to these, some specific policy elements.

1. A first lesson is that investing in health and safety, next to better operations does not mean that company performance will suffer. It has been shown time-and-time again that **both elements can be complementary in helping better performance of companies**. However, it also means that management will need to develop good labour management

relations, good planning and preparation of operations and the right supervision and leadership (Tompa et al., 2016; Ghodatri et al., 2018). These notions may seem abstract, but they point to the fact that health and safety need to be embedded in all operational decision making. Communication itself of nice principles is again not sufficient to bring positive impacts for health and safety performance (Ghodrati et al., 2018). HR and OSH can be integrated into operational management, even if this is a complex matter. Focusing on the operational changes in the coming years, should not exclude continuous investing in OSH and HR policies. With aims to upskill current employees, either through *NextGen-Learning* or *virtual training*, or *by attracting many new employees*, it should be clear that such investments can go hand in hand with better operational performance.

2. A second lesson is that next to focusing on the content of OSH and HR, it is also important to focus **on organisational aspects that support the first lesson**. Worker participation, active management style, information, support, group autonomy and procedural justice can help to further influence better workings situations and outcomes for employees (Westgaard & Winkel, 2011; Mathisen et al., 2017).

3. A third, and more specific lesson, is that reorganisations not necessarily always have a negative impact for employees. It pays to develop strategically focused reorganisations. Rail organisations are big organisations and have more abilities to offer employees more options. From our **D2 report** it is clear that new technologies may seem to offer disruptive change possibilities, rail organisations will always be in the situation that they need to combine old technologies with new ones. If an organisation such as Deutsche Bahn is able to renew one third of its personnel in a period of six years, and at the same time conduct a non-lay-off policy, then preparing for a future with new skills and attracting new employee groups, should be connected to offering the existing employee base equal future opportunities (Andreeva et al., 2017).

4. A fourth, and equal specific lesson, is that rail organisations should learn about **new work organisational approaches** (Oeij et al., 2017). Rationalization strategies such as High Performance Work System (HPWS) are associated with positive outcomes for employees, together with positive outcomes for companies. These HPWS offer sustainable environments for upskilling and continuous improvement (Oeij et al., 2015; Dhondt et al., 2017).

Safe railway operation is at the heart of a successful European rail sector; this can be assured by appropriately skilled staff and workers, supported by automation. These recommendations will be integrated into overall recommendations in next section.

3   Strengthening the Skills Ecosystems in the European Rail Sector

3.1   Introduction

The next equally important question for the S2R JU-CCA Human Capital project is what integration is needed between the different measures that are needed to develop future skills and employment in the European rail sector, given that S2R JU is supporting major changes in the rail sector with five Innovation Programmes (IPs). The objective of this chapter is to strengthen the skills ecosystems in the Railway Sector. This chapter will integrate the results of all tasks in previous reports into the final recommendations. Lessons from other sectors are also integrated.

3.2   Understanding skills ecosystems

What is meant with skills ecosystems? The concept of skills ecosystems has been launched as a concept to deliver better insight in factors that explain skill disbalances in sectors and therefore help in formulating better recommendations. Skills ecosystems are made up of four areas:
› The demand for skills;
› The supply of skills;
› The development of skills;
› And the deployment of skills.
Organisations have a broad set of human capital measures when looking at strategies and trainings to bridge skills gaps. Anderson and Warhurst (2012) show that companies and sectors need a broader strategy to deal with changing skill demand, with the authors insisting on improving all of the skill areas. These areas are embedded in a configuration of institutions consisting of interconnected actors, roles, needs and resources. The process of change in which these institutions operate influence these four areas in any given industry or region. Anderson and Warhurst suggest to use this overall view on these institutions, because it helps us understand that more is needed than just boosting skill supply through the formal institutions of education and training. Strategies and trainings to deal with future skill gaps can only be helpful if they fit a broader approach to skill development. Figure 3.1 summarizes this framework.
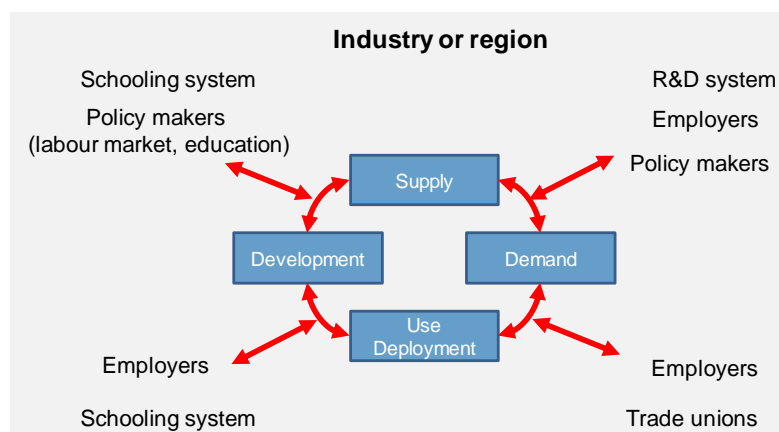

Figure 3.1   A skills ecosystems perspective on skill: elements and stakeholders

Using this 'skills ecosystem' approach, we aim to support the main idea in the rail sector that sustainable partnerships are needed between a broad set of stakeholders who all have a role in knowledge transfer and fostering innovation processes. Report D3a already insisted on the importance of regional, national and international partnerships for skill development (for example: the UK National Partnership on Skills in Rail). Such partnerships are much in line with this 'skills ecosystems' framework. In looking at these partnerships, we aim to identify the requirements for skills ecosystems and to assess the situation for railway transport. The main topics are:

› How to identify the main requirements for what countries/companies need to do from a skills ecosystem perspective.
› How to assess the degree to which the institutional improvements in the ecosystem relate to the results of our previous analysis of the different transfer-of-knowledge and transfer-of-staff mechanisms (see D3a).

To clarify the added value of a skills ecosystem approach, this chapter starts some initial assessment of how traditionally, sectors and companies view skill disbalances, and then presenting a broad overview of skill issues in the rail skills ecosystem and how to address them. From this assessment, strategies for the different partnerships are then formulated.

3.3 The limitations of a skills equilibrium perspective

The S2R CCA Human Capital project takes a skills ecosystem perspective on skills and technology. The starting point is that disbalances on the labour market can have a benefit from using a broad and systems view on the role of institutional partners, the systems failures (disbalances), and measures to develop a way forward for the sector. In this chapter, we are developing a first (rough) cut view on how the current skills ecosystem in the rail sector in Europe (and limited to the experience of 4 main countries) looks alike.

To understand the added value of a systems view, it is good to put this systems view developed above against the traditional skills equilibrium view on skills and technology. In the static skills equilibrium view, as with most mainstream economic thinking, disbalances will solve themselves through the market mechanism (price). Of course, there may be market failures and then either national partnerships are defined or governmental interference is sought to either allow for the market forces to have more impact, or either to manage the system in such a way, that the market can be directed.

For example, employers may demand to or push for an increase in supply of students and apprenticeships from the educational system. This may be done by diminishing opportunities of young unemployed and forcing them to take-up apprenticeships in sectors. Figure 3.2 summarizes the comparative-static 'skills equilibrium perspective' on skills.
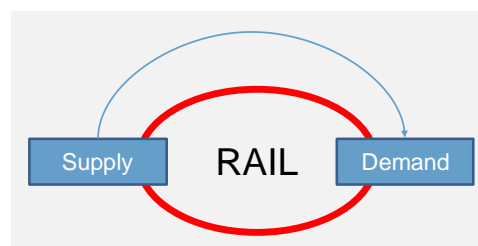
Figure 3.2 A static skills equilibrium perspective

In the Figure 3.3, this equilibrium model of skill is used to illustrate the skill gaps for the rail sector. The rail sector wants to see that supply of talent (from schools, from the labour market) is in balance with demand from the companies. A cause for disbalance may be that the companies have too little recruits or recruits with the wrong qualifications. The red boxes in Figure 3.3 show the drivers of the disbalances and the yellow boxes show some potential (negative) outcomes of these disbalances.

Figure 3.3   Skill gaps from a static skills equilibrium perspective and outcomes

Drivers for the disbalances from the **supply side** can be that:

› There are just too few candidates going to the rail educational system (VET, apprentice-ships, graduate, academic);
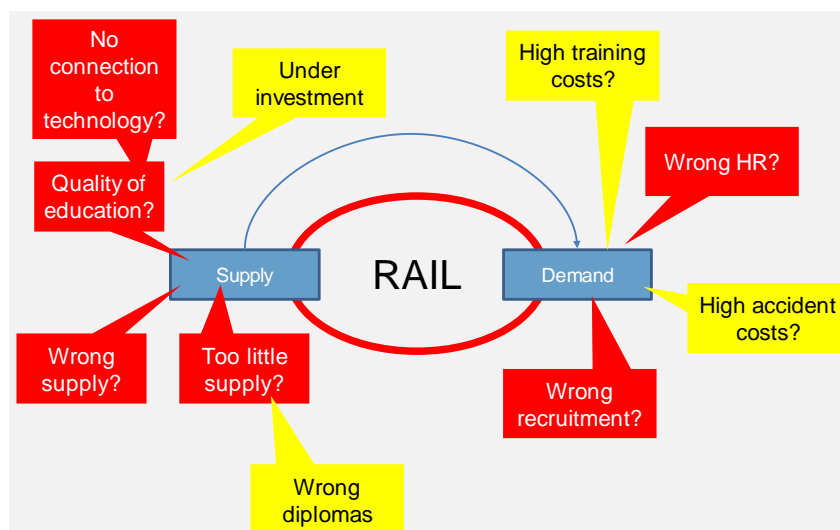› Students that come out of an education do not have the right qualification (example: what existed in the Netherlands before TechniekFabriek for rail technologists was created);
› The teaching may not be up-to-date because the link to technology may not be there or schools do not have up-to-date technologies.

But the drivers can also be at the **demand side**:

› HR-policies may be not strategically focused leading to high turnover or wrong allocation of talent (see previous chapter);
› Recruitment policies may be disconnected from the future of the rail sector: for example, mainly be focused on recruiting white men with technical background.

Outcomes can be high training costs, but also for example high accident rates and absentee-ism costs. Some of these points are readily recognisable in the sector: e.g. high absenteeism rates, students with rail diploma's not getting jobs (see TechniekPact), frustrated schools be-cause of underinvestment in technology and teachers, but also high training costs for compa-nies because of mainly in-house training. In the rail sector, training costs are substantial be-cause of the nearly non-existence of well-equipped VET-systems, strongly developed appren-ticeships and in-house training systems, etc.

The current discussion in this project has as main focus how developments in new technology can be connected to adjustments in the educational system and to the demand side. In Figure 3.4, the six measures under research in this project (light green and brown boxes) are con-nected to the (possible) disfunctions in skill area.
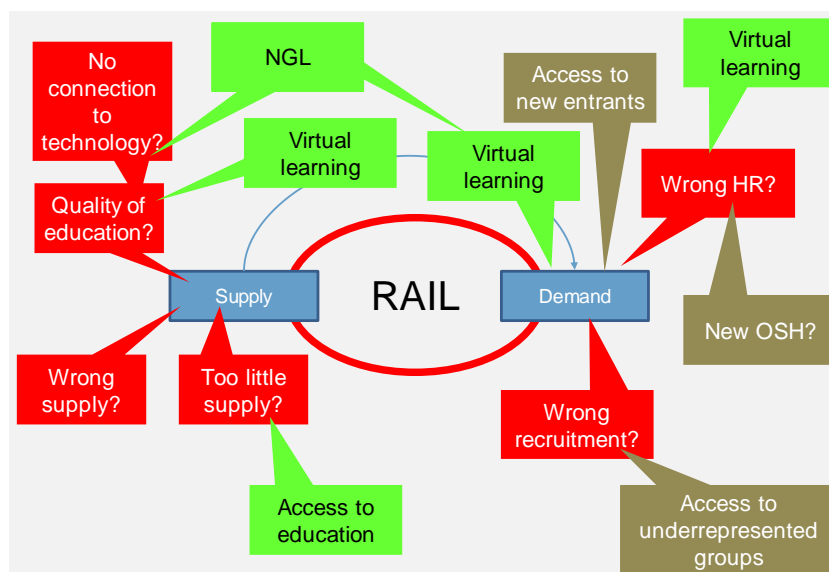
Figure 3.4   The six measures to deal with skill gaps from a static skills equilibrium perspective

NextGenLearning (NGL) and *virtual training* can help improve the quality of methods in the educational system, but also the in-house training approaches of the rail companies. Improving the access to *education* helps rail companies finding more possibilities to improve the curricula, but also access to students to persuade them to come to the rail sector. *Access to new entrants* helps to find new recruiting grounds for rail companies. New ways to develop *reintegration* can reduce the costs of absenteeism and can possibly be a new recruiting ground for rail companies for unexpected jobs (for example by using job carving-approaches). *Access to underrepresented groups* can help to broaden the recruitment basis, not only in numbers of persons, but also to (unexpected) talent that is needed to deal with the technological challenges in the future.

3.4   The advantages of a skills ecosystem for the rail sector

Over the years, there has been a push to use a broader perspective towards bridging skills gaps and understanding of skills dynamics (Anderson & Warhurst, 2012). The reason is that over the past decades there have been numerous examples of how past skills policies (governments) and strategies (companies) led to actions that have exacerbated rather than relieved possible skills shortages and other systems failures (see article of Anderson & Warhurst). Just pushing for more students leaving the school system without a job opportunity, has a bad impact on students in the school system. Also, supply-demand systems do not operate in a vacuum.

For example, the changes in the Dutch VET-system (diploma-requirement) are meant to guarantee that VET-students leave any school or training system with at least one skills certificate. The fear among employers is that this may lead to a downgrading of the quality of these certificates because schools may just want to give these away at a certain age of the students.
Another example is that the development of in-house training systems by companies may have side effects for the rail labour market. The costs are high for companies and possibly lead to competition frictions between companies. Apprentices may not be able to move

> freely on the labour market. And in the past, a lot of apprentices did not achieve any certification of their skills.

The drivers for these systems failures are not easily explained . The project has also advocated to use a dynamic skills ecosystems approach to give recommendations to the different stakeholders in the human capital domain. In Figure 3.5, we describe the skills ecosystem and align some of the disbalances from the previous figures.
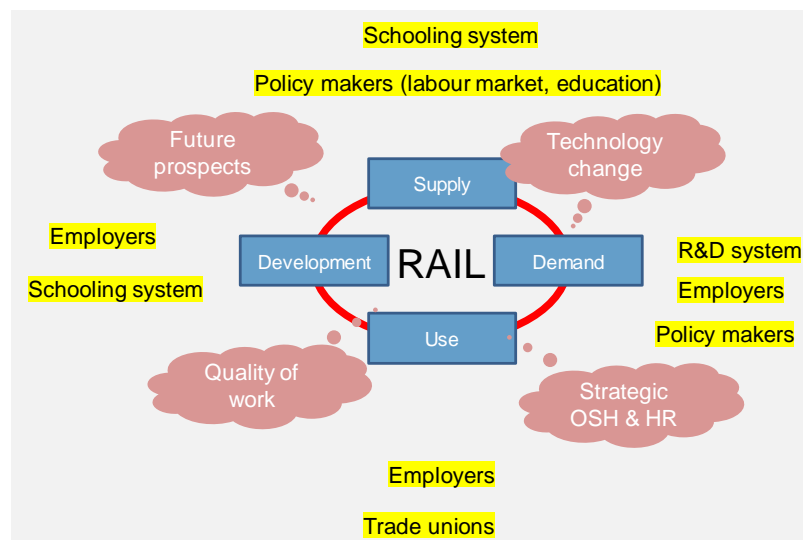
Figure 3.5   A dynamic skills ecosystems perspective: actors and issues

The components of a skills ecosystem

The skills ecosystems approach points to four areas of skills: development of skills, supply of skills, demand for skills, and deployment of skills. These areas are embedded in a configuration of institutions (yellow boxes). We have listed a few of the stakeholders and roles in the network:

› Development of skills is the playing ground of the schooling system and what employers offer as in-house or market based training/schooling;
› The supply of skills can be regulated by what the schooling systems delivers as diploma's, but also by how policy makers want to play an influencing role. For example, in the Dutch system, the SBB (=cooperation VET-system and employers)[1] and CREBO (=central registry occupations) play an important role to identify training needs and accreditation of diplomas;
› On the demand side, companies may be influenced by what R&D-systems predict as nature, direction and speed of technological change, and by how employer associations and policy makers interact;
› The last element is also crucial: the use of skills. The type of jobs and the type of OSH/HR-policies may have an effect on which skills will be actually used by employees. Social partners may be wanting to influence this. Social partners may also be engaged in the supply side, influencing training needs. In the Netherlands, trade unions are also part of the SBB (see Eurofound (2018) for an overview of apprenticeship systems in different countries).

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[1]   https://www.s-bb.nl/

The figure shows several 'clouds' with possible outcomes and drivers for developments in the skills ecosystem. Technological change may change demand for skills. Strategic OSH and HR can influence actual use of skills, but also of who is in the company. Quality of work can be low or high, making employees more or less satisfied. Future prospects employees may have, can influence their views on training and participation in developing their skills.

The broader approach of the skills ecosystem allows linking the issues identified in the simpler static approach (see red boxes) and adding new issues (see purple boxes) in Figure 3.6.
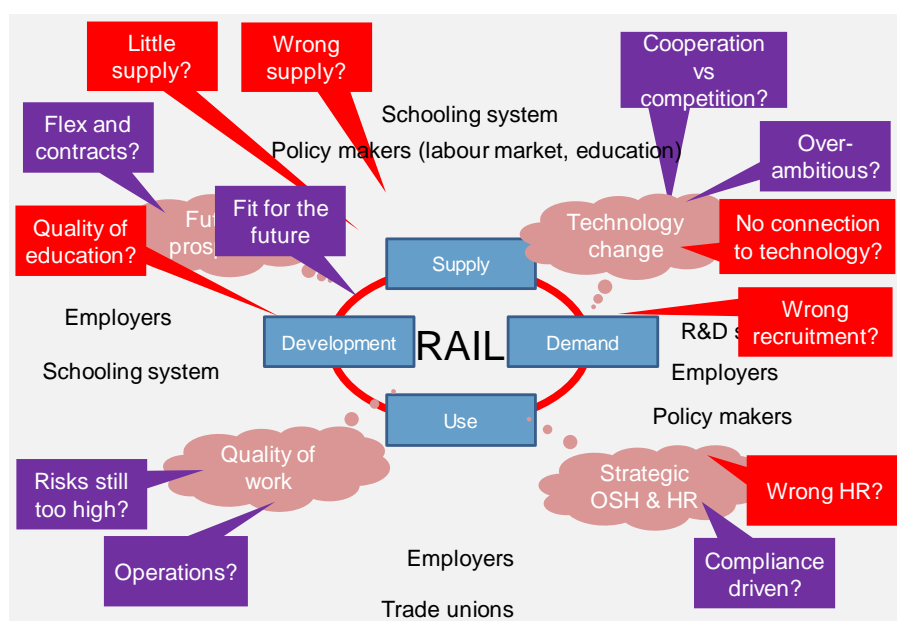

Figure 3.6   Issues with skill gaps from a dynamic skills ecosystems perspective

Next to these 'red' issues, there are many more subjects that can be identified. Of course, the framework allows to monitor how good things are functioning too. For the discussion about future skills related to the S2R IP projects, the framework helps to identify possible attention points.

More challenges can be identified
The issue of supply and demand of students can also be checked in this framework.
› For the Dutch situation, separate analyses of the SBB show that the demand for train drivers is in line with what companies demand. However, the question is here if this current balance in demand and supply is in line with the future development of these train drivers. In the DB Training case, for instance, it was highlighted that the current demand for train drivers is high in Germany, but that it is clear that new train drivers may have short term careers. In term of solutions, it is necessary to already think about possible extra skills and competences for these train drivers so they can keep their employability in the longer term.
› In another example of our investigations, the number of trainees was greater than the number of positions available at the end of the training period. This led to complicated situations in which graduates came into conflict with each other for job positions. Over-supply in in-house training systems may not always be positive for future expectation about the previous employer.

New issues that were not identified in the static equilibrium approach, but are real issues for the rail organisations are shown in the purple boxes in the figure:

› Technology and innovation development at the S2R-level is important for the sector. The technology roadmap defined in this EU-programme seems in a lot of ways comparable to the technology roadmap defined at the different country levels. Participants in the different programmes may be quite the same. The question is to what degree the whole development is a cooperative effort, and where maybe separate developments are kept confidential from other parties, and maybe rightfully so. The point is that the roadmaps may be dominant for the assessment of skill shortages as is the task of this project. But do these roadmaps give the full overview of skill needs on the longer term? Are they sufficiently comprehensive?

› The technology roadmaps create expectation amongst many partners. Here the question is to what degree the roadmaps are over-ambitious and what this ambition may do with expectations in the schooling system and among future candidates. The reality of daily work may be very far from the development work in these IPs. There could however also be a solution to this, in this sense that students at any level could be engaged in these development projects. This could bring more sense of reality among the developers, but also some sense of perspective among future (and maybe current) employees about what may happen. Such a discussion could be translated in a broader discussion in the whole ecosystem;

› Between demand for skills and actual use, there may be a great disconnection. As was shown in the previous chapter, most rail organisations stress a compliance driven rule system. The question is if HR and OSH-approaches may be in need of re-orientation. How strategic are these systems?

› The framework shows that the (current) quality of work in rail companies, and the organisational context, are strongly missing from the debate about future skills. New candidates in any position in the rail sector have expectations about their future work situation. It is nice to project an image of high tech rail systems, but if the reality is high noise and demanding ambient environments, then there may be a disconnect here with what new candidates may experience. On the other side, there may also be a lost opportunity to project important interesting employment opportunities in the sector to new candidates. Jobs in the rail sector are team based, having quite some autonomy and with balanced job demands. This may be even more attractive to newbies than the mobile app they may be working with;

› A lot of the discussion on skills is run by HR departments, innovation departments and the schooling system. The operational departments of rail companies only rarely talk about the options they may have to support (new) skill development. The fact that was stated in the previous chapter, is that operational managers have more options in designing their division of tasks. Precise options for the division of tasks may also be uncertain and unclear, and so experimentation may be needed. *The example of the different options ship owners have to man their vessels is telling in this respect: make captains multi-functional (with deck and engineering responsibilities) or split the role into specialisms. These different organisational set-ups have different consequences for jobs and such differences should be a discussion between the different stakeholders in the ecosystem. In the case of the maritime sector, the discussion was between operators, ship owners and the schooling system.*

Easier to identify solutions

The broader perspective of skills ecosystems is not only useful for identifying more problems, but also helps to make clear where the solutions need to be developed, who the stakeholders

are and what possible KPIs are. To solve future skill gaps, a collaboration is needed for the points listed in the previous chapter:

› Better use of skills requires a perspective on better quality of work. To define this, social partners need to agree on the perspectives. Operational specialists and innovators need to collaborate together with social partners in this debate. They can come to an agreement on the required developments;

› The skill gaps are identified as an extrapolation of developments in technology. These gaps should be identified in a broader discussion between social partners, technologists and operational specialists;

› For school programmes, the schooling system (in the Dutch case) now works on information provided by the companies. The future perspective of jobs is not really a topic for discussion. In the Dutch system, only the quantitative expectation for the short term is included in deciding about allowing new candidates to follow a VET-schooling. The long term development and the perspective sustainable employability is not really taken into account. Discussion should be between, again social partners, schooling system, policy makers, but also the technologists and operational specialists.

In summary

In the end, the dynamic skills ecosystem approach allows to make us understand that the possible skills gap in the future requires much more than a static equilibrium perspective. A better solution is to build more resilience into the rail skills system. Younger (and older) workers need to have the ability to change jobs if needed, or at least be able to adapt to new tasks in the future. The discussion with the partners in the rail organisations has given the perspective that to achieve technological change in the future, a broad set of old and new skills will be required at the same time, and possibly for longer periods of time. This may require that young workers need to get acquainted to old technologies too.

Preparing for this future of technology and skills means that for the companies it is better to work on a set of solutions for different levels of workers. More room for academic technologists seems necessary, which also allows for graduates and maybe even professional specialists to upskill their knowledge over time.

3.5 Recommendations

3.5.1 Building the skills ecosystems

The main issues for the short future for the sector are then the following:

› **There is need for a broader discussion within sectors on the significance of the skills ecosystem in the rail sector**. In some countries, such discussions have started at the regional or at the national level (see Report 3a). It is important that this discussion looks at all the elements in the framework, and not focus on one specific topic pushed by one stakeholder. In most countries, mainly employers are pushing the subjects. The national skill alliances and National Skills approaches are good settings for this, but it is important to assess which perspective is dominating in the debate. In the UK, there seemed to have been an overstress of the role of employers (Anderson & Warhurst, 2012). Also, it is good to remind ourselves that the net-effectivity of certain actions needs to be assessed. *In the Netherlands, a lot of action is undertaken to make the supply of technical students rise. After five years, still half of the technical students with a diploma leaves for other sectors outside of manufacturing. This would seem to be an important loss in investment in technical education. For new to be developed skills ecosystems, such investments should be directed more precisely*;

› The current reports have produced a list of issues of what is working well and what needs to improve in the ecosystems. These issues are not the same in the different countries. **For each of the countries, a separate analysis may be needed to make the recommendations specific**;

› **Next to this fact, there is of course the issue of the institutional and competitive differences between the countries**. The apprenticeship systems are not the same, even though the partnerships and stakeholder parties seem to be recognisable in all countries (Eurofound, 2018). For the current research project, the difference between the Netherlands and the UK on the one side, with both a strongly privatized and decentralized market, versus France and Germany with one major company dominating the market, is important to understand the impacts on the skills ecosystems. If decentralization of the markets continue in France and Germany, then maybe the skills ecosystems in the Netherlands and the UK can shed some light on the major future changes;

› **The six measures dealt with in report D3a can be placed in the skills ecosystem framework (see figure 3.6).** Figure 3.7 shows where the six measures should have a role (see yellow and green boxes). The positioning of the measure with respect to all the issues and interrelationships shows that these six measures are good step forward, but more needs to be done. In the previous chapter, some points have been recommended. For example more attention to higher apprenticeships.
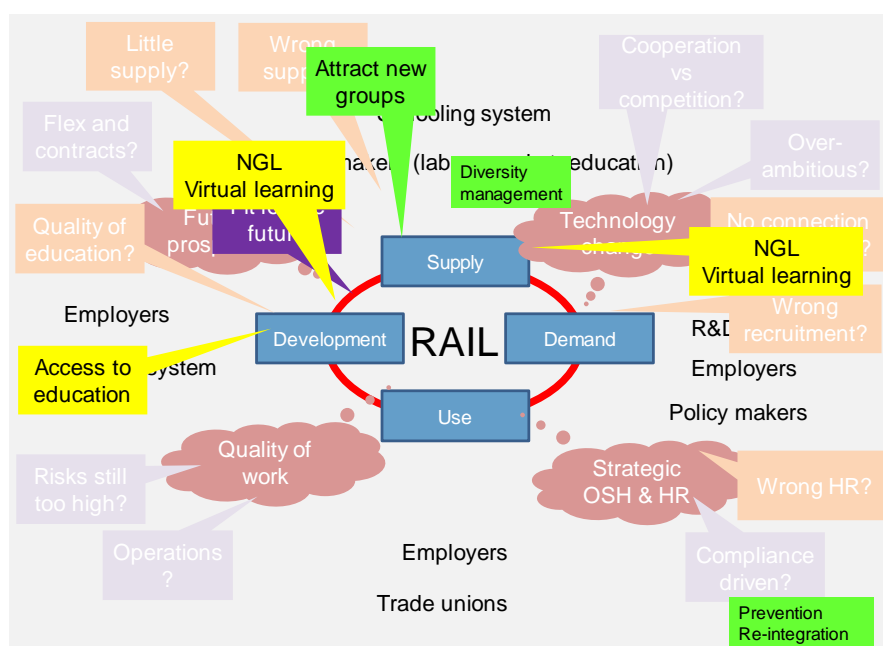

Figure 3.7   The six measures to deal with skill gaps from a dynamic skills ecosystems perspective

3.5.2   *Understanding the changing role of the different stakeholders*

The different stakeholders in the rail sector can help create an environment in which the matching and development of skills can be vastly improved. The ecosystem approach show what the playing field(s) are for these stakeholders but also that most stakeholders will need to change their mindsets and positions:

› The future of the rail system is one of more openness and more clear relations, but also more competition as is the case in the UK and Netherlands. It is clear that the stakeholders in such open and clear competitive systems need to change their mindset on the factors they can influence. The overall transition process to reach such a more competitive system requires new roles for a lot of partners in the system. The examples of what

happened in the UK and the Netherlands can act as examples for other national rail systems;

› The organisations facilitating the change process need to change their attitudes in the whole ecosystem. Now they are focused on strict task allocation and control. Schools only look at the interest of teaching. Companies are focused on their operation, but have little interest in what schools are confronted with. In the future, both stakeholders need to operate in a networking approach, and act on a broader set of priorities. They also need to have an understanding of 'interconnection' between the different segments of the skills ecosystem.

3.5.3 Building a European initiative

A last point that needs to be discussed is if there is need and space for a dynamic *European* skills ecosystem approach? The examples discussed in this and the previous report D3a saw the development of regional and national partnerships in the skills domain. It is clear that these partnerships are a necessity for the future of employment and skills in the sector. This project started with the question what the impact S2R IPs is on skills and employment. This means that there is need for learning at the EU-level on this subject. For developing a European skills ecosystem, this learning about skill gaps needs to be used in a broad European discussion. There are already well organised European partnerships and stakeholders. The building blocks for a skill ecosystem are there. The topic of skill gaps and employment risks are sufficiently important to discuss within this ecosystem. For the further development of a European skills ecosystem, it is necessary to define in a collaboration a common perspective on the challenges defined. Table 3.1 summarizes on which topics this European partnership could have its focus to help improve the supply, demand, use and development of skills in the sector. The actions are also linked to the six main measures from S2R.

Table 3.1   Action plan for the EU rail sector to prepare for the future of skills

	Action plan to prepare rail for the future
Supply of skills	1. Understand the institutional difference between one party vs multi-party dominant country eco-systems for rail for demand. (FR/GE vs. UK/NL). The UK and Netherlands have open rail systems, still very much the exception in Europe. Other countries can learn from these experiences with education, schooling and training. 2. Create more engagement from the companies in the education system to secure a realistic profile of the sector in schools and to secure right-sizing of educational programmes to need of companies. *[access to education]* 3. Continue to improve the quality of education: connect training situations of VET (and other levels of schooling) to real world practice. Develop the in-house training systems to the educational system. 4. Engage in national partnerships for aligning interests in four areas of skills and not over-focus on supply-demand nexus. 5. Support further development of (multi-party) simulation tools, also into the education system. Work on EU-level projects for this. *[virtual tooling]*
Demand for skills	*Broaden supply base of talent* 6. Broaden supply base with new talent from other sectors, but also internal in companies. 7. New entrants may be more receptive to new technical requirements (new recruits). 8. Attract IT-talent from other sectors. 9. Focus on higher apprenticeships and access to academics to channel new talent to rail companies. 10. Use diversity as an asset.

	Action plan to prepare rail for the future
	Understand impact technological change
	11. Engage technologists in discussion with innovation, HR, social partners and education systems to get a better understanding of future skill demands. Proactively engage workers when scanning new technological applications.
	12. Develop **more access** to knowledge areas in schools and innovation systems.
Use, deployment of skills	*Quality of work*
	13. Improve quality of work ahead of development of new trainings and systems.
	14. Align messages in campaigns etc. with actual work in the sector (or with planned changes) *[access to new groups]*.
	15. Connect better working conditions to the needs of the under-represented groups in rail. *[access to under-represented groups]*
	16. Take account of future of mix skills: engage in sustainable employability to secure re-engagement of specialists in the future (ex. from maintenance to other fields).
	Better Occupational Safety and Health policies
	17. Understand and develop concepts of strategic OSH and HR to help make human capital fit for the future and resilient for disruptive changes. *[re-integration]*
	18. Make prevention policies more active.
	Organise work otherwise
	19. Engage in better understanding of new operational concepts with split-up or integrated occupational profiles of drivers.
	20. Prepare for managing more unknown technical capabilities (e.g. with suppliers, ageing groups).
	21. Integrate quality expectations of network on innovations, technologies.
	22. Prepare for rising (technological) risk situations that need managing.
	23. Develop methodologies to use prospective thinking about possible future risks (learning in the future).
	24. Use virtual tools purposeful, with intent to manage risks.
	25. Develop cooperative relations in networks to understand unknown technological capabilities.
	Organise more flexibility
	26. Organise for unpredictable growth and decline of tasks in organisations.
	27. Organise to deal with faster changing personnel composition.
	28. Consider impacts of contracting-out of work in rail sector and impacts of skill.
	29. Assess impacts of new contract systems: negotiate security and flexibility engagement of personnel
Development of skills	30. Develop practices within the rail systems of learning with virtual tools and adapt HR-practices to incentivize this. *[virtual tooling]*
	31. Develop methodologies for faster and more specific learning, use Next Generation /Virtual Learning.
	32. Develop methodologies to faster assess changes in occupations and translation into training.
	33. Adapt learning-systems from compliance-focus to fit-for-the-future.
	34. Make human capital more resilient for change. Engage in systematic retraining; 'broad' functions. Challenge workers to try new tasks in safe contexts.
	35. Develop advanced IT-skills among current personnel, recruit new talent.

At this moment, not all recommendations can be made more specific. These recommendations should be the result of discussion and negotiation between all stakeholders involved.

3.5.4   Future research

S2R JU has developed the Cross Cutting Activity on Human Capital to support the innovation projects. The focus of research by S2R JU has been on the following topics:

›   Change of job profiles – Effects of digitalization & automation on the job profiles;
›   Skills and qualifications – Change of qualifications & skills due to new technologies and specific training programmes;
›   Flexible organizations - Identification of sources of disturbances, and solutions on how to build resilient organizations in a rapidly changing business environment;
›   Costumer-oriented design of mobility - Simplification of specific aspects of railway system and whole journey from door to door based on the customer´s needs and requirements (user-centered design).

Three projects have been commissioned to deliver insight for these topics. The work on Human Capital has only started with these projects. The following further development is recommended:

›   Further research into the assumptions used in the analysis of skills and employment development (see conclusions Report D3a).
›   The current research has had a focus on Germany, France, the UK and the Netherlands. More work is needed to understand if the results are equal for the New Member States and the South of Europe.
›   In report D3a, over 45 measures have been identified to help improve rail organisations. Rail organisations need to have the opportunity to come together to discuss these measures and learn from each other. A series of workshops could be hosted by S2R JU.

More understanding is needed of the use of new organisational concepts to improve working conditions and performance in the rail sector.

4 Results from the final workshop

4.1 Objectives workshop

In November 2018, the results of the three final reports have been submitted to an audience of 40 persons to deal with the following objectives.

1. Discuss scenarios for reducing the skills gaps for major workforce categories in these countries;
2. Discuss the current working practices and partnership in the four sample countries on health and safety issues and the relationship to the skills issue;
3. Validate the strategies and recommendations formulated in the reports.

These objectives were integrated into the agenda of the workshop. The workshop was made interactive with the use of the Mentimeter-voting tool. In Annex 2, the discussions are summarised. In this chapter, the impact of the discussions for the conclusions are evaluated. First, some background on the participants is given.

4.2 Participants: background

In total, some 42 participants had indicated to participate in the workshop. Eleven of these participants linked-up to the webinar. In the following two figures, the affiliation of the participants and the country background are identified.
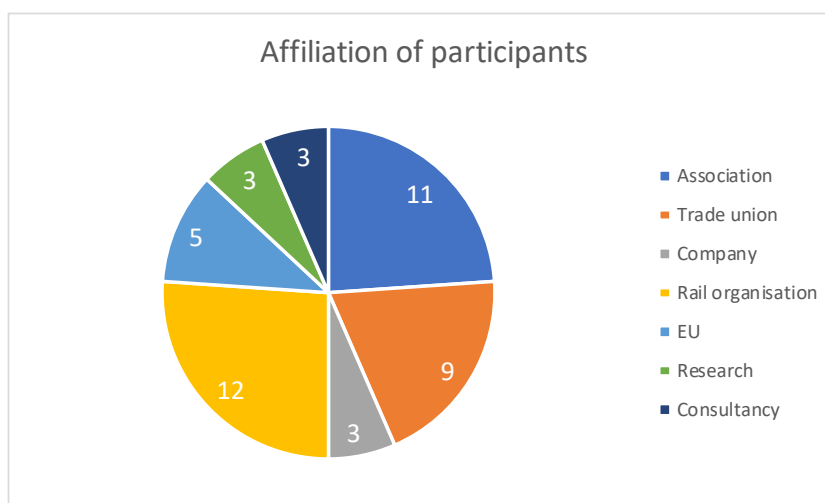

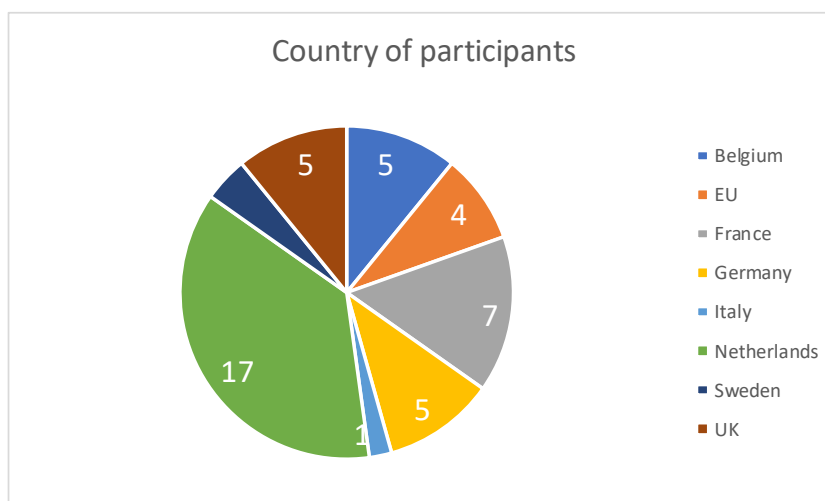Figure i. Affiliation of the participants in the workshop.

Figure ii. Country background of participants

Most of the participants come from employer associations or other international associations working in the rail sector. Important for this workshop is also the presence of the major rail companies of the Netherlands, Germany, UK and France. This international presence of companies helps to underpin the importance of the research issue for the S2R JU.

4.3 Discussions

The discussions were focused on five questions:
› Which shift in skills are most likely?
› Which priority ranking in the six measures do you think necessary?
› Which other measures are needed to deal with the future skills gaps?
› Which priority in measures for flexible provision of personnel?

Which shift in skills do you think more likely?
The participants understands that the shift in advanced skills will be extremely likely, but also in technical and in softer skills. A majority also understand that more academic thinking will be needed in the future. And the fact that nearly everyone did not think that other shifts were more important, confirms the findings of the team. The reason given for not seeing the shift to more academics, is that knowledge areas in work are becoming more and more modularized, and this makes it more likely that tasks remain executable by graduates and/or professionals.
The opinion is also that the future on the rail will be complex. Employees need to understand that they need to be able to adapt and change. Most important observation for, for example, the French situation is the need for more soft skills. But it is clear that the current rail organisations need to do a lot to make sure that not only the requirements for occupations are changed, but that these new skills sets are actually used. So, the organisational context is of importance to allow this use. Another point is that it is also about the balance between the different dimensions of the skills set, not so much the stress on one of them.
A last remark is that we need to be aware that in parts of Europe, the rail systems operate with a lot of people with zero-skill levels. The developments described by the research team document what is happening in the four selected countries. The gap with the other parts in Europe is broadening. This will pose major problems for these countries.

Which priority ranking in the six measures do you think necessary?

The participants rated Next Generation Learning as the most important measure to deal with future skills gaps. Individualised learning paths are needed to help individuals adapt to the future workplaces. Important in this respect is that all of the six measures are needed, but there needs to be an understanding of the issues that should be addressed.

Which other measures are needed to deal with the future skills gaps?
The participants point to three important measures for the future: collaboration, outsourcing and training. Collaboration is needed between organisations (rail and non-rail) to speed up the innovation process on learning. The suggestion was made that S2R JU spend more attention to possibilities for collaboration between rail companies to share learning experiences. A main reaction to the discussion is that all also depends on the preparedness of employers to invest into training. Social dialogue is the basis for all elements that have been reported. This should be well understood.

Ranking the measures for flexible provision of personnel
To secure the future flexible provision of personnel in the rail system, the participants thought that human capital should become more resilient through retraining, broad functions and job crafting. Occupations will transform. It is important to train new generations of personnel to prepare themselves to be working in more jobs over their career. Employees need to have a better understanding of the connection of each job to the other jobs.

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Annex 1: Some Facts from the Skills Ecosystems in Four Countries

A1. Introduction

A web search delivered some insight into measures from SNCF, DB, NS and ProRail. For Network Rail and other UK-operators, the journals delivered major insight into single practices. The measures are classified according to transfer of knowledge and transfer of personnel. The dates of the measures are cited in the summaries. The objective is not so much to provide a view on strategies, but rather to show to what degree such HR-practices are aligned with skill-challenges of the future. All of these rail organisations have very professional and strongly developed HR-functions. More information about these organisations can be found on their websites.

A2. France: SNCF

A2.1 Transfer of knowledge
› The company has own initial basic training programmes, that are supported with following qualifying continuing education. The amount of training has grown over the years (2015: 7,700,000 training hours for the total group (80% of employees were trained in 2017); 6% of total payroll (7% in 2017)).
› An e-platform is used and updated for a full range of training (2015).
› The group also applies apprenticeship and mobility programmes. New apprenticeship programmes were launched in 2012 in connection to the *jobs of the future* action aimed at younger candidates of 18-25 years of age.
› An agreement exists for individual training leave for all employees, allowing up to 36 consecutive months for secondary, higher and university training and education (2012). SNCF has own Universities.

A2.2 Transfer of personnel
The group has developed a myriad of measures to attract new talent, combat discrimination and develop inclusive policies.
› *Attracting new entrants*: in 2015, several actions were conducted as recruitment campaigns, promotions in engineering colleges and universities, women's network.
› *Diversity*:
  • 2012: GEODIS has developed an action against gender discrimination. SNCF Logistics (2015) conducted a diagnostic study on drivers for higher female employment and new strategies. In that year, there were 23% of employees in all branches are women (25% in mobility; 13% in network);
  • Other measures were actions to train older workers, provide longer career paths, benchmarking of transfer of knowledge and skills; and aligning best practices to keep and transfer skills (2015).

A3.   UK: Network Rail

A3.1   Transfer of knowledge

›   *Insistence on non-technical skills*: development of STEM is very important for the sector, but the RSSB also stimulates attention to non-technical skills. For Network Rail, tests are done to understand how workers perceive extra information next to their technical tasks and duties. Understanding non-technical skills requires understanding other new personalized training methods.

›   *Skills-monitoring and use*: in the UK, a lot of experimentation has taken place to support or connect to the development of methods and methodologies to allow individualization and personalization of training and development. A first example is the SkillsID database. This provides employees with the possibility to follow more closely their skill development and make their progress more clear to new employers. NR has supported this initiative. At its core is a full list of all relevant qualifications, skills and competences, accessible by the individual and their sponsor/employer, but hidden to others. A second example are the Skills Swap schemes: employees are offered the possibility to enlarge their skill set by working in different settings with other companies. Apprentices from one company and another will be swapping places throughout a month as part of a cross-organisational skills exchange. For example, those employed by the operator will now get a chance to find out what happens behind the scenes across the rail network. There are no examples of NR participating in such an exchange.

›   *Access to education*: in the UK, a lot of attention is directed at newcomers to the sector, starting with the development of traineeships for 16-19 year olds, and apprenticeships for 19-24 year olds. For apprenticeships, it is also necessary to understand that in 2016, the UK-government decided to raise levies for apprenticeships. Companies would forfeit such funds if they did not make use of apprenticeships. Network Rail has been deploying apprenticeships long before this date. Network Rail supports the Trailblazer standard, developed by the National Training Academy for Rail as a new standard for apprenticeship management. This is intended to provide a framework to ensure apprentices in the rail sector receive technical, professional and occupational learning in railway engineering. Next to these measures, a lot of attention is directed at the availability of very specific training courses that were not available previously. These training courses are needed to deal with rising skill demands. These courses require public funding to get started. Network Rail has developed 7 new training centres in 2015 to provide more access to train related education.

A3.2   Transfer of personnel

›   Attracting new talent: Network Rail develops or participates in a lot of promotional measures such as events and prizes to attract new groups to the rail sector. An example of schools visits in given in Text box A1.

Text box 1   Tomorrow's Engineers Week

Tomorrow's Engineers Week: volunteers visited schools to encourage children to consider careers in engineering. The week is an annual national initiative which seeks to address the skills shortage faced by the industry. Until 2024, the country will need 186,000 engineers annually, with the skills gap costing the economy £1.1bn a year in that time. Tomorrow's Engineers Week saw over 300 employers and professional bodies from the engineering community join forces with universities, schools and individuals to inspire the next generation of industry professionals. The graduate visits also make up part of Network Rail's own year-round project of engagement with schools, which includes workshops about STEM subjects and railway safety. The activity days were held in schools near the organisation's Milton Keynes office, visiting two schools each day.

> Sessions were delivered to around 500 of the schools' promising science students. Teams of the 12- to 14-year-olds were challenged to build a bridge, project-manage a task, and build a level crossing out of Lego.

› *Diversity*: Network Rail has been developing over a long period of time measures to attract different groups on the labour market. These measures are aimed at stimulating apprenticeships or training of the groups, closing the possible pay gaps, instructing employers how to deal with different kind of employees, giving special support to disadvantaged groups. In the following list, several examples are shown: Network Rail has set a target of percentage women in the workforce and in all types of jobs (2015; 2017); Women in Rail (2016); attracting former military (Career Transition Partnership helps military resettle in civilian jobs, as for example in the rail sector).

A4.   Germany: DB

Deutsche Bahn (DB) has a long tradition in investing in different measures to secure that employment and knowledge of its workforce remain up to date. A difference in comparison to its competitors, is the fact that most of these changes have been officialized in collective agreements with trade unions.

› *Access to education*: In the last collective agreement (2016), apprentices are offered a rental allowance and a company pension. This make apprenticeships even more attractive to new candidates.
› *Attracting new entrants*:
  • DB runs a strategic workforce planning (SWP: SPP Speedboat). Managers are informed about personal development through navigator tools. A lot of effort is invested in talent acquisition (high school recruiting; influencing parents; employer branding). DB also invests into changing the corporate culture (customer focus, cooperation, leadership skills, responsibility and performance capability), gender balance, flexible work practices, generation management and diversity management;
  • Deutsche Bahn agreed in 2013 with the Railway Workers' Union on further improvements in vocational training and the dual study program. What is new is that the junior staff collective agreement is also valid for the participants of the introductory qualification "Chance plus". The undertaking to offer permanent employment to any trainee who successfully completes vocational training has also been included in the collective agreement;
  • DB works with an employment guarantee in the whole DB Group. Continuing employment is guaranteed, only this employment does not always needs to be at the same place. In addition, the employees are also free to switch to competitors of DB. This is the case DB loses parts of its services to competitors;
  • For the first time, a collective agreement has been signed that will enable the employer, trade unions and works councils to monitor and shape the effects of digitization and the resulting change in working and employment conditions at an early stage and with foresight. For example, DB employees can choose their place of work themselves if their work permits mobile work. In this context, both sides also agreed on a Group-wide uniform regulation for on-call duty.
› *Re-integration*:
  • DB has agreed with trade unions that train drivers who are no longer able to pursue their profession as a result of traumatic events will receive a full-time remuneration of 100% of the former table pay. Engine drivers who permanently lose their aptitude

as a result of traumatization, work or leisure accidents receive a right to choose between job-rich DB employment security and a severance payment. Severance payments will be introduced for different groups of train drivers unfit for driving, and the already existing priority for local placement on a DB workstation will be further developed.

› *Diversity*:
- Some organisations have developed general measures to ensure that no discrimination arrives at the selection DB has abolished pre-selection for new students who want to start a vocational training or a dual study from autumn 2014. Thus, the DB eliminates the preselection of school grades. Grades are no longer the decisive recruitment criterion. The Deutsche Bahn launched an online test for all students to focus on strengths and abilities of the individual. This "Neues Bewerberverfahren bei der Deutschen Bahn" is an online test for all students who want to start a vocational training or a dual study from autumn 2014. Thus, the DB eliminates the preselection of school grades. Thus, grades are no longer the decisive recruitment criterion. Strengths and abilities of the individual take centre stage, according to the group. All applicants will be invited without pre-selection. Training is personalized to the strengths and weaknesses of applicants;
- Measures are developed to attract different groups: DB has been working on measure to attract women to DB over a long period of time.

A5. The Netherlands: ProRail

The labour market in the Netherlands is nearly in a situation of full employment. This is also visible at ProRail. In 2016, Recruitment managed to fill in around 700 vacancies in close coordination with line managers. Approximately one third of these vacancies have been filled in by internal candidates. The latter means that, in 2016, ProRail succeeded in keeping internal mobility at a relatively high level (10%). Internal training is an important issue. New approaches are geared to this need. Next to internal mobility, ProRail puts an equal importance on external recruiting and sustainable employability.

› *Next Gen Learning*:
- A lot of attention is paid to the learning needs in the company. The available training budget is well utilized for individual and collective learning, coupled with the results to be achieved;
- An introduction day for new employees was carried out five times. Forty managers and employees have followed a mentoring training.

› *Virtual learning*:
- Every day there are multiple requests via the training catalogue in which learning and performance are central. Fifteen e-learnings have been developed for learning questions from the business and various learning lines for function groups have been realized, particularly in the business unit Projects;
- 100 employees have already used the practice lab: a powerful tool to learn close to work. In this way, learning becomes more and more self-evident, a joint stimulating daily activity, with and for each other and for the company.

› *Attracting new entrants*:
- Continuing to stimulate internal mobility contributes to an important extent to the sustainable employability of our employees. ProRail launched a fit @ workscan, numerous career workshops, career markets and individual career paths, and these actions helped the Career Centre to respond to the need of employees to fulfil their sustainable employability;

- Finally, the hiring and secondment market is important for ProRail to meet the flexible needs of staff. 2016 was characterized by optimizing the hiring chain within ProRail in order to bring supply and demand together.

A6.   The Netherlands: NS

A6.1   Transfer of knowledge

› *Next Generation Learning*:
  - In order to guarantee good operational and financial performance in the future, different behaviour and new knowledge are constantly required. Change and learning go together. NS is committed to informal learning and learning in practice with the aim of accelerating the application of new knowledge and skills. NS invested over € 35 million in training and other learning activities. From the NS Learning Centre, 14,386 employees attended a classroom training day;
  - The craftsmanship of train drivers, chief guards, service technicians, safety personnel and technicians remains central to all learning activities. A new learning module has been developed for train drivers and chief conductors to evacuate tunnels even more effectively;
  - In 2017, NS completed the training courses for preventive maintenance for materials technology and maintenance (FLIRT[2]). The employees of the maintenance companies in Maastricht and Leidschendam and the service companies can carry out maintenance and inspections. In addition, train supplier CAF, together with the NS Learning Centre, has developed the first training courses for preventive maintenance;
  - The TechniekFabriek, the technical training of NS where current and future train mechanics follow an intensive vocational (MBO) programme, celebrated its first lustrum in 2017. In that year, 96 students followed a two-year learning trajectory of mechatronics. In September 33 pupils flew to a job at NS. In addition, in the year 2017 253 current technicians participated in a multi-year vocational (MBO) course. The trajectories have been specifically adapted to the (work) experience of the fitters, so that they can go through the training in a relatively short time. In 2017, 101 participants received a diploma, equality or exemption;
  - In the development of new programs, the emphasis is on informal learning and learning in practice. Think of supported subject information via workplace assignments. NS also use internal expertise from colleagues. NS employees with qualities in the field of (team) coaching, intervision coaching or facilitation supervised more than 170 coach routes, 20 teams and worked with more than 80 teams on team development. Various training courses are available for all employees via the NS learning portal, where they have online access to a large selection. In total, 2,251 training courses are available for employees.
› *Virtual learning*:
  - Some 21,972 employees followed e-learning modules (excluding Retail). 175 learning programs were newly developed or improved;
  - In order to improve the performance of the IC-direct, NS also purchased new train simulators;
  - Information via mobile apps and e-learning are used within informal learning and learning in practice.

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[2] Flinker Leichter Innovativer Regionaltriebzug.

› *Access to education*:
  - There were 19 trainees and 38 trainees set to work;
  - NS has made approximately 200 internships available for pupils of the secondary vocational training program for Rail Transport.

A6.2   Transfer of personnel

› *Attracting new entrants*:
  - In 2017 we filled in 3,779 vocational level (MBO) vacancies and 1,011 vacancies at higher vocational and university level (2016: 3,829 and 722);
  - In recruitment, in 2017 NS paid more attention to the positioning of NS as an employer. For this NS has used new ways of recruitment and developed an appealing concept to show the challenges NS is working on. NS recruits more online and is more focused on specific target groups. In order to implement the agreements from the social security agreement, NS has this year adopted 140 additional main train attendants (hoofdconducteurs) and 60 employees Safety & Service;
  - The hiring desk filled 529 temporary places with external employees. All these employees are also screened, often tested and go through online modules to get to know NS.

› *Re-integration*:
  - In organizational developments with consequences for employees, NS is early on assisting with work to work inside or outside NS. NS does this to prevent redundancy of employees. In 2017, by far the largest part of the redundant employees found other suitable work within the guidance period. NS not only assists employees in the context of reintegration, redundancy and outplacement, but consciously focuses on employability. In 2017, 604 employees made use of help and advice from the Career Advice department on their own initiative. A total of 929 employees received guidance. All 100 career vouchers available at the end of 2016 were redeemed, the number of applications exceeded the offer.

Annex 2: Report of the final workshop

This meeting report summarises the main comments made during the final workshop of S2R CCA – Human Capital on November, 30th 2018 in Brussels. Above is indicated who the panel participants were (see abbreviations). Other discussants are identified with their organisational background.

B1.   Data on skills gaps and HR-responses to gaps

The first part of the discussion was focused on commenting on the quality of the results presented during the final workshop. A panel composed of NA, MC, VL and MA commented on evaluations made by the participants.

The following discussion was observed.

Rate the barriers for upscaling advanced ICT-technologies
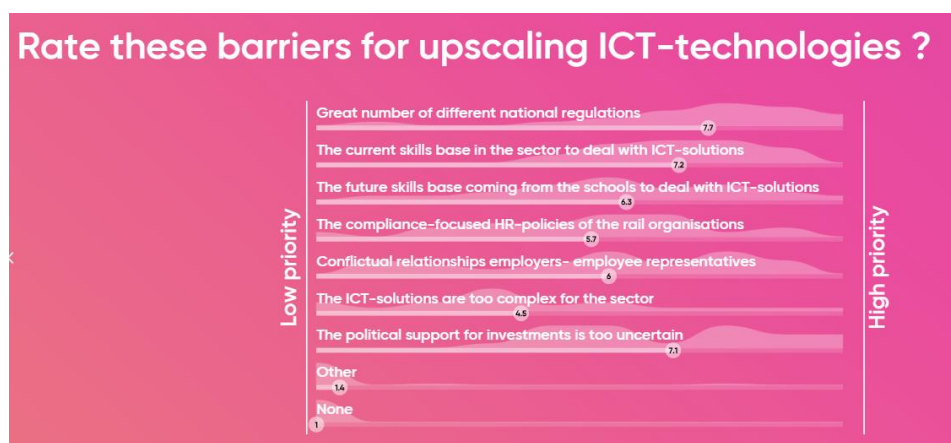
Slide 1 – Rate the barriers for upscaling advanced ICT-technologies

This slide was not discussed with the audience, it was used as an instrument to assess the opinion in the audience on the major barriers for implementation of advanced ICT.

*How realistic are the calculations*?
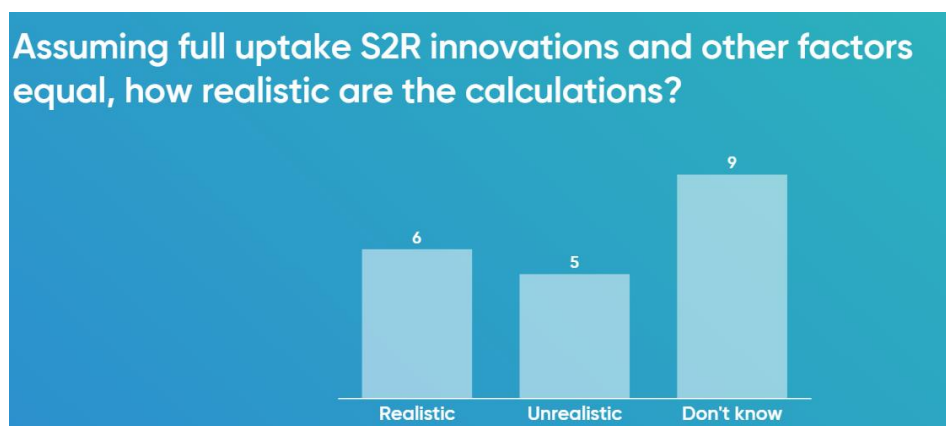
Slide 2 – How realistic are the calculations?

The slide shows the distribution of the opinions in the audience about the figures. About half of the persons present, did not know how realistic the figures were. Of the remaining group, a small majority thought the figures were realistic.

› SD: Asks the audience to explain why some see the figures as non-realistic.
› Representative FNV: A Dutch trade-unionist responded that the figures are too extreme to be true.
› MA: The decline in jobs is realistic. We can expect big changes in the future. In fact, we can already see this with existing jobs at NR. The example of ultrasonic testing on the tracks shows that the new technology allows to do more track, more precise and with much less personnel than before. Staff reductions have been significant.
› NA: The experience at S2R shows that these figures are going to become a reality. The ATO-brake test shows that machines can operate quite better without manual interventions. This will lead to an unknown less demand for employment.
› VL: The results are from the perspective of SNCF probably realistic. We are all experiencing new changes and need to prepare for this.
› MC: It is hard to know how precise the decline will be, and which time frame will exist.

Which shift in skills do you think more likely?
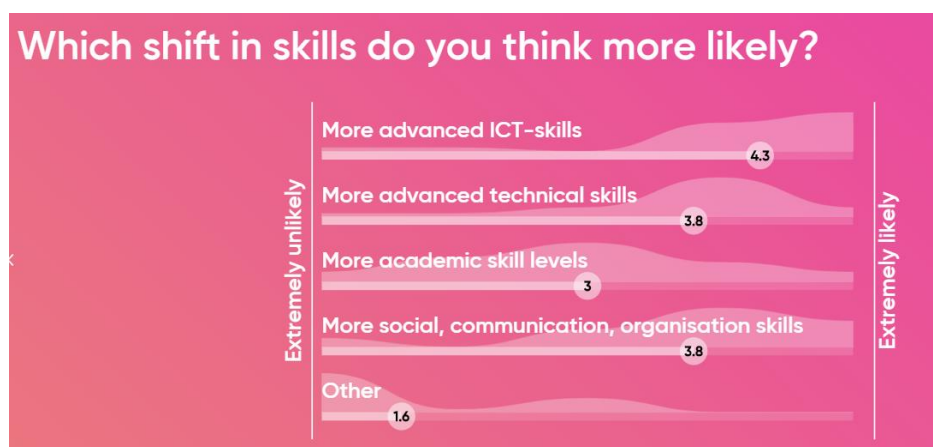
Slide 3 – Which shift in skills do you think more likely?

The slide shows that the audience understands that the shift in advanced skills will be extremely likely, but also in technical and in softer skills. A majority also understand that more academic thinking will be needed in the future. And the fact that nearly everyone did not think that other shifts were more important, confirms the findings of the team.

› SD: What is the explanation that not all participants see the academic shift as important?
› Representative ERA: She responded an 'unlikely event' because of the modularization of knowledge areas and the possibility to train future cohorts more easily. The necessity for academic thinking would be less than we expect.
› VL: The future on the rail will be complex. Employees need to understand that they need to be able to adapt and change. Most important observation for the French situation is the need for the soft skills. But it is clear that the current rail organisations need to do a lot to make sure that not only the requirements are changed, but that these new skills sets are actually used. So, the organisational context is of importance to allow this use. Another point is that it is also about the balance between the different dimensions, not so much the stress on one of them.

> › MA: Concurs with VL that many changes are going to happen and that the skills are changing in the note direction.
> › NA: We need to be aware that in parts of Europe, the rail systems operate with a lot of people with zero-skill levels. The developments described by the research team document what is happening in the four selected countries. The gap with the other parts in Europe is broadening. This will pose major problems.

Which priority ranking in the six measures do you think necessary?
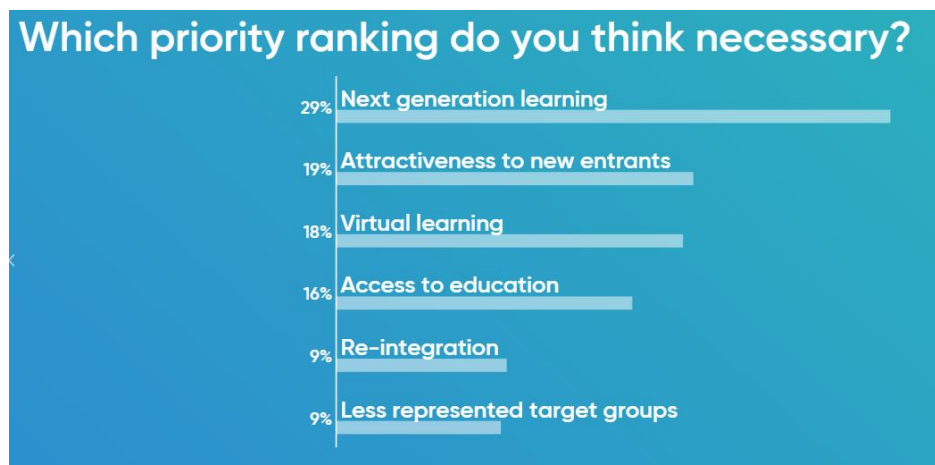

Slide 4 – Which priority ranking in the six measures do you think necessary?

The audience rated the NGL as most important measure to deal with future skills gaps. The attention for less represented groups was least supported by the group.

> › VL: Agrees with the shown distribution of the participants. We are at the beginning of the major changes and this requires attention to making the training more focused to the individual capabilities.
> › MC: Not only will we see the new technologies rise, but also new business models. The platform economy will rise and require other skills sets. Looking at the training methods is certainly important.
> › Representative DG MOVE: The importance in the ranking needs to be related to what the problem is and how this should be addressed.

Which other measures are needed to deal with the future skills gaps?
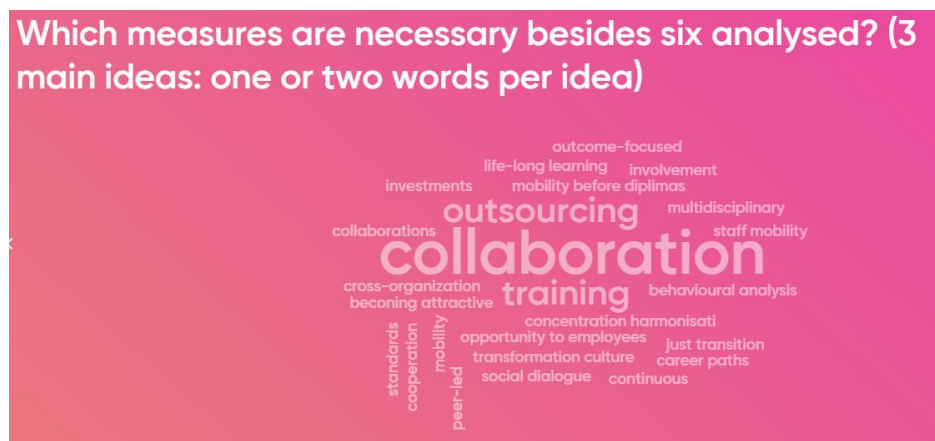
Slide 5 – Which other measures are needed to deal with the future skills gaps?

The participants point to three important measures for the future: collaboration, outsourcing and training.

› MC: Asks the audience what is meant with collaboration?

› MW: Collaboration is needed between organisations (rail and non-rail) to speed up the innovation process on learning.

› Representative FNV: Employers need to invest into training, otherwise collaboration will not happen. Only then there will be a win-win.

› VL: Agrees with this position. We need to understand that the future will be not so much a personal development within one profession, but throughout many professions.

› MC: Collaboration is important, but it can also be framed within the context of the platform economy. In the US, there is a new collaboration between train companies and platform taxi companies such as Lyft. Customers can book mobility solutions in which their train ride seamlessly is connected to a follow up taxi connection.

› Representative ETF: Social dialogue is the basis for all elements that have been reported. This should be well understood. But she also makes the point that there is no room for platform companies and their behaviour, from the point of view of trade unions.

› MA: NR uses a critical performance indicator for collaboration. It is all about creating opportunities to develop oneself. What new technologies can do, that is not known. This requires collaboration between all stakeholders.

B2.   Measures to support the future skills ecosystem in the rail sector

In this last part of the session, Maarten Willems (NS) participated together with Steven Dhondt to discuss one part of the measures proposed by the research team. To secure the future flexible provision of personnel in the rail system, the audience put the statement on top that human capital should become more resilient through retraining, broad functions and job crafting.

Ranking the measures for flexible provision of personnel
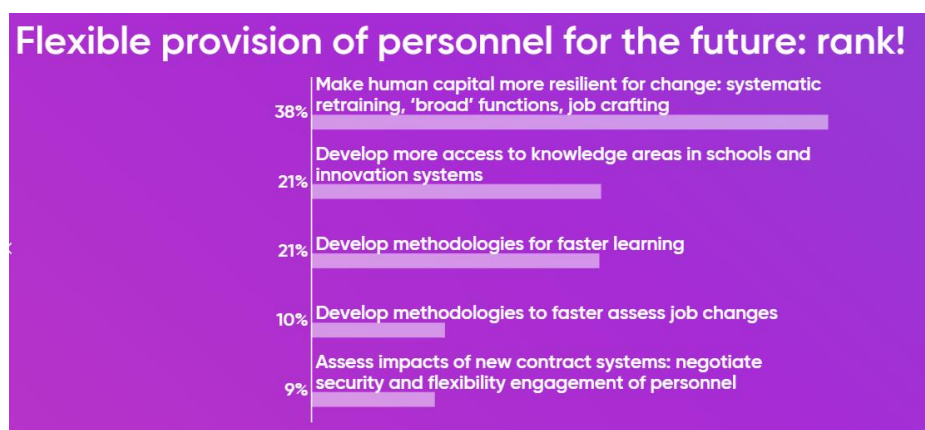
Slide 6 – Ranking the measures for flexible provision of personnel

› SD: Asks if this distribution is not a bit wishful thinking? It is good to point out that the future will show broader functions, but do we really understand this shift to broad jobs? Currently, the rail system operates with mainly specialists. In the maritime sector, experiments to broaden jobs have been reversed to previous task divisions.

› MW: Can understand that this distribution in priorities arises. Human capital needs to become more resilient in the future. Of course, more experimentation will be needed to see what distribution of tasks will be needed.

› MA: It all depends on at which level you are looking at. Different jobs will require different skill sets.

› VL: We will see transformation of occupations. At SNCF, it is not so much that new generations of personnel are trained to prepare themselves for more jobs, but that there is a better understanding of the connection of each job to the other jobs. A lot of training is invested in creating this understanding.

› MW: The only question with the distribution is why NGL-measures has this lower outcome. In the beginning, the participants insisted on the importance of NGL, and now this is not that high. If we want this flexible provision of personnel, then more NGL will be needed.

B3. Closing the workshop

The workshop was closed by NA. He thanked the participants and the research team for their work.

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