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Beyond visions: survey to the high-speed train industry

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Abstract

In Europe, the technology development of high-speed trains is increasingly exposed to societal needs, driven by ICT advancements, external to traditional design. Together with the liberalisation of the rail markets and increase pressures from other transport modes leads to an unprecedented situation where planers, operators and suppliers of high-speed have to take decision in this complex and competitive environment.

In such broadening of elements influencing design and, thus, product development process, from the survey here to be presented, it was not observed technology options assessment or strategic agenda setting from visions shifting in the same way.

For the high-speed train industry this new trend requires going beyond the visions of the past 15 to 20 years' practices of "sector endogenous" and structurally closed strategic methods approaches to a broader interaction with the widening of societal actors now capable of being active contributors to innovation from digitalization.

This way to understand the European industry readiness for undertaking such supra systemic challenge, this paper presents the results from a survey conducted by the authors to 74 representatives of the high-speed train innovation chain regarding to which extent societal embedding is considered in the drafting of their visions and technology development projects.

This work becomes even more pertinent if considered that the debate is now open in the railway industry (not exclusive to high-speed trains) as they are launching the joint initiative SHIFT2RAIL, revise ERRAC (the European Rail Research Advisory Council) mandate and enter in a new research cycle with the European research framework Horizon 2020.

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1. Main text

Emergent digital society – based on social media, big data and cloud combined with widespread use of mobile technology – introduces a revolution in the understanding of new products and services selection, with society itself becoming an active contributor to new technology developments.

For the high-speed train industry in Europe this phenomenon adds additional pressures to the ones driven from the ongoing railway liberalization and increase competition from other transport modes. To succeed it became not enough to supply the "best" technological solution from the engineering and regulatory stand points. Widely known example is BlablaCar-sharing community of 20 million users[1] significantly impacting the French SNCF's high-speed train service[2].

A broader study from K. Giannakouris and M. Smihily (2013), which extract is here shown below in figure 1, demonstrates that transport and manufacturing, including the high-speed train industry, fall short on embedding emergent social networks in their value chain.

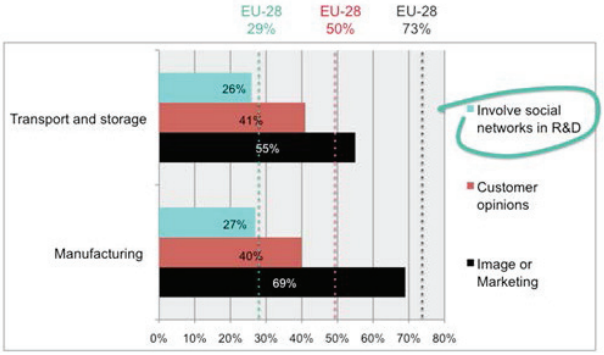

Fig. 1. Transport & Manufacturing: use of social networks in Europe 28, reference year 2013 (in K. Giannakouris and M. Smihily, 2013).

Is the high-speed train industry missing the opportunity to create value from societal linkages? To find out we further surveyed the high-speed train industry. We demonstrate how it falls short and provide the methodology for improvement.

2. Theoretical references

The survey here being presented was constructed mainly from a quite established theory of innovation called Technology Assessment addressing the management of technology within society. A central article is the one of Deuten, Rip & Jelsma (1997) on the "*Societal Embedding and Product Creation Management*" arguing that new technologies to succeed require broad product selection.

[1] Figures from 2015. Link http://www.lesechos.fr/thema/transformation-digital/021131533536-la-course-de-vitesse-de-blablacar-1129325.php

[2] "Frédéric Mazzella, le patron de BlaBlaCar, le souligne régulièrement en comparant le nombre de clients mensuels du site (1 million) à 2.000 rames de TGV pleines", retrieved from Le Echos.fr 15/21/2015 link http://www.lesechos.fr/02/07/2014/lesechos.fr/0203613823111_le-succes-de-blablacar-bouscule-la-sncf.htm#drWXwTcdbJlbyQQ5.99 Link http://www.lesechos.fr/02/07/2014/lesechos.fr/0203613823111_le-succes-de-blablacar-bouscule-la-sncf.htm

Already in 1997 the authors, inspired by the multi-actor-network theory, referred that new products have to pass different environments of selection. They range from business and regulations extended to the wider society. Firms have to deal with them simultaneously, from early stage of development, contrasting with dominant sequential practices. This is what the authors called "extended innovation journey" (Deuten, Rip & Jelsma, 1997, p. 136:148).

Deuten, Rip & Jelsma (1997) recognized that societal embedding in new product development would inevitably create a "dilemma" of wider diversity of interests that firms imperatively aim to avoid. To address it they suggested a shift to the conventional approach. When interacting with society firms should not aim for promotion and control of acceptance of their new technology (that is uncontrollable anyway), they should rather adopt an approach of mutual learning through actions of anticipatory mapping on what each actor can bring to a new development.

Necessary pre-engagements and alignments requires a third party "orchestration" (Deuten, Rip and Jelsma, 1997) through "bridging events" (Paradian 2012) resulting in "socio-technical scenarios" (te Kulve & Rip, 2011). Only when society is recognised as a stakeholder gets a constructive role in new product creation process and firms became capable of creating value from societal linkages (Deuten, Rip and Jelsma, 1997).

3. Methodology

The questions were constructed from the theoretical references here cited. In April 2012, the survey was first pilot tested on a sample of stakeholders taking part in the technology development system of high-speed trains on a "face-to-face" format. In February 2014 the online survey was launched[3]. Invitations were initially sent to the wider railway community (e.g. train operators, manufacturers and component suppliers, infrastructure suppliers and managers, users, policy makers, regulatory and certification bodies, railway associations, consultancies, academia and research centers). The survey closed at the end of January 2015. Seventy-four people responded.

4. Findings

Respondents to the survey were from Europe and took part in the high-speed train innovation-chain (such as governmental agencies, regulatory and certification bodies, academia, manufacturers, component suppliers, as well as train operators in the key corridors and industrial associations). The majority had been involved in the European Technology Platform for Rail (ERRAC) and in R&D projects under the European Union Framework Programme for Research. See figure 2, bellow.

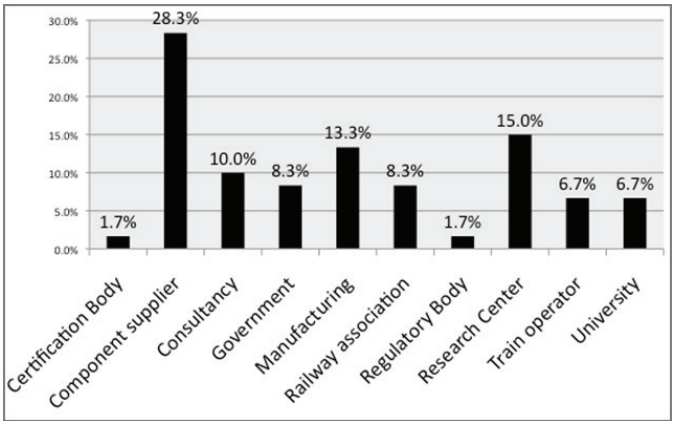

Fig. 2. Respondents categories.

[3] http://www.surveygizmo.com/s3/1542466/Innovation-Management-in-High-Speed-Trains-and-Societal-Aligment

France and Germany were the countries from which came the highest number of responses. It reflects the two countries leading position in the high-speed train industry in Europe (in terms of market-share, technology and knowledge) as can be seen in the next figure bellow.

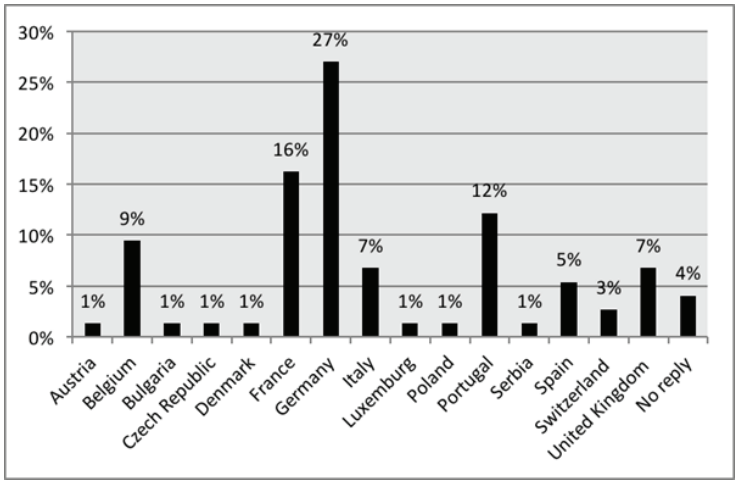

Fig. 3. Respondents split by countries.

It should be noticed that Portugal over representation results from the high participation to the survey from component suppliers from that country , integrating the global supply-chain of system integrators.

4.1. Drivers for R&D

When asked on the drivers for research, respondents attributed high relevance to the “Societal Environment”, above “Policy & Regulations”. Yet “Business & Engineering” prevail. Social drivers are associated to the attractiveness elements of the vehicle perceptible to the traveler. See figure 4, below.

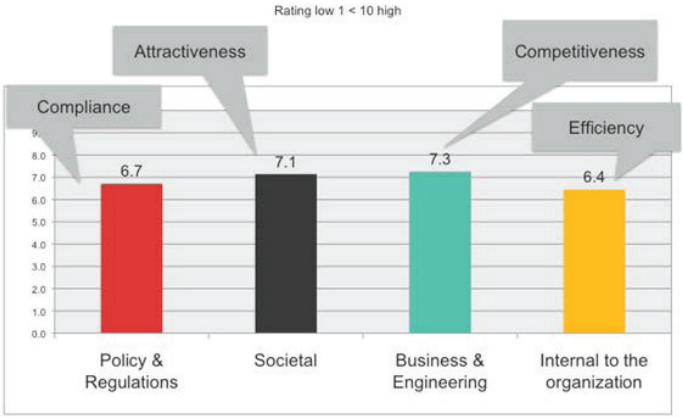

Fig. 4. R&D drivers (rating: low 1 < 10 high).

The breakdown of results by stakeholders reveals that societal divers are at the top for Universities (i.e. both engineering & social sciences) but not for Manufacturing, Certification Bodies and Railway Associations. This pattern will be reflected throughout all the responses collected for the other questions.

4.2. Technology readiness levels (TRLs)

Technology readiness levels (TRL) expose the stages in which societal drivers are considered along the technology development process. See figure 5, below.

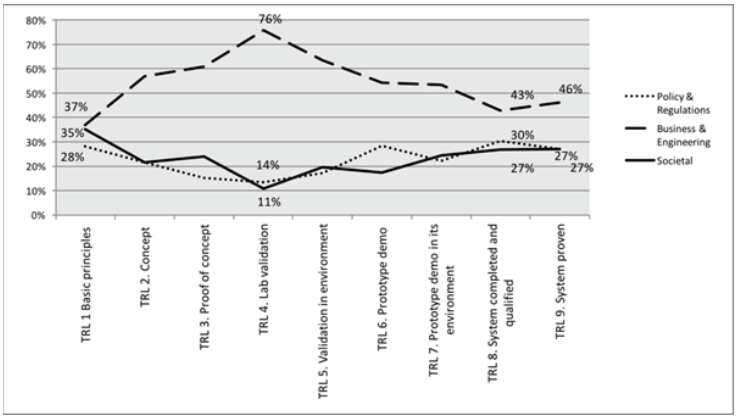

Fig. 5. Societal embedding in TRLs.

As figure 5 shows, respondents consider societal drivers relevant at the initial stage of technology development process, progressively declining to its minimum during technology validations, and regaining relevance when the technology is ready to enter the market.

Societal drivers are at its maximum in TRL1 when basic principles are observed and data is collected. At this level the majority of train developers are thinking strategically.

Then societal requirements relevance progressively declines to its minimum in TRL4, when the technology is validated. Here engineering is at its pick with many of the train developers selecting the “winning solution”.

Later in TRL8 & TRL9 societal embedding regains momentum by the time the new technology has matured and is ready to market. At this stage marketing dominates and many of developers are preparing for their technology to become commercialised.

From the breakdown of results by stakeholders was noticed that different from manufacturing, component suppliers tend to consider societal requirements in all stages of development. This because component suppliers responding to this survey were mainly providing interior parts and sub-systems.

4.3. Alignment with society

It was then asked how railways considered alignment with society. See figure 6 below.

The majority of respondents were positive towards societal alignment. They mostly stated it as a way of early monitoring public acceptance. This clearly reflects the intent of the industry in promotion and control as referred in Deuten, Rip and Jelsma (1997). Only 16% mention social alignments as being “beneficial for shared R&D paths” and, thus, point at creating value from social linkages. It resulted below from the 26% and 27% inclusion of social networks in R&D for transport and manufacturing respectively as found in K. Giannakouris and M. Smihily (2013), in figure 1.

Results breakdown indicate that manufacturing and research centers have the highest of support but also of concerns. Their concerns are mainly on the disclosure of confidential information and premature negative reactions it might cause.

The benefit of shared technology paths it is the least considered by manufacturing. Such reinforces their promotion approach when in interaction with societal actors and networks. One respondent left a comment saying that “alignments are difficult as one increases partners each bringing their own views and expectations”.

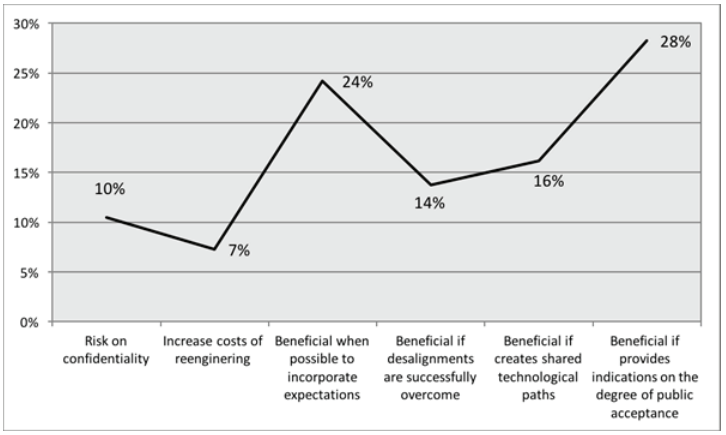

Fig. 6. Societal alignments.

Moreover it was found that societal alignment is dominated by informal practices. See figure 7 below.

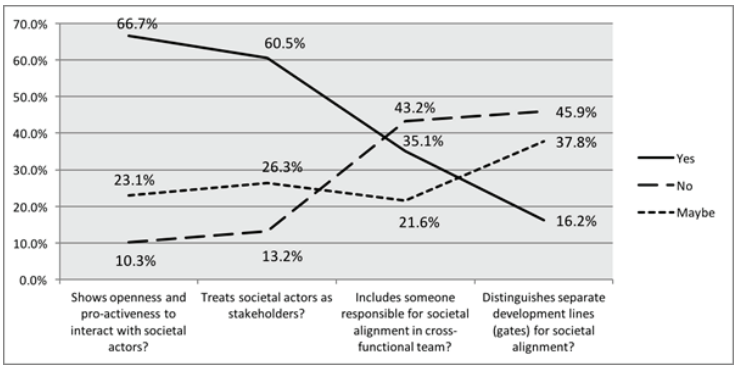

Fig. 7. Societal alignment practices in R&D – formal vs informal.

Figure 7 shows that almost 70% of respondents stated interacting with societal actors and even 61% recognize them as stakeholders. However only half of them, 35%, refer employing someone to monitor social alignment and even less, 16%, of respondents, indicated including technology assessment gates on societal requirements during their R&D projects.

What is here shown int is a clear indication that societal alignments are dominated by informal practices, with the majority of respondents not embedding societal requirements in their R&D.

Futher breakdown of results by stakeholders, not here represented, also reveals that the ones formally aligning their R&D projects with societal requirements are a small percentage of surveyed component suppliers, consultancies and railway associations.

4.4. Strategic formulations

In its turn, in which concerns strategic formulations, where anticipation is the key element, all stakeholders enquired considered mapping and monitoring societal environments relevant. See figure 8, below.

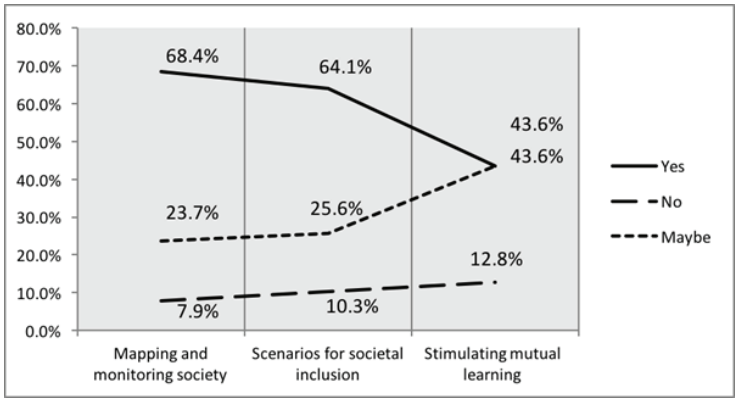

Fig. 8. Societal embedding and strategic innovation management.

Figure 8 shows however a decrease in responses on the articulation of those scenarios with social inclusion, e.g. “mapping for stimulating mutual learning”. This reinforces the tendency by this industry in mapping for controlling such articulation.

The orchestration of societal inclusion to occur would have required a different result, with a higher percentage of positive responses on the two last references “scenarios for societal inclusion” and “stimulate mutual learning”.

Moreover, it was also found that the industry sources of information for strategic formulations are each other reports, as shown in in figure 9 below.

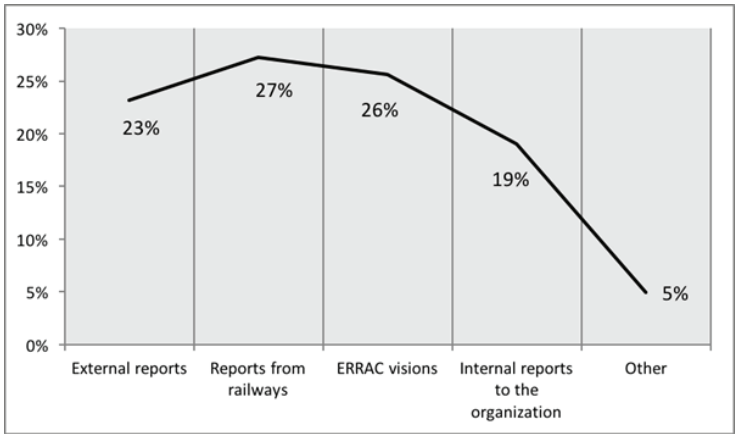

Fig. 9. Sources in strategic formulations.

The industry is endogenous on their strategic formulation approach, they are in-breading, mainly sourcing from their sector reports and ERRAC technology platform visions and roadmaps. The breakdown of results by stakeholders reveals an exception for governmental bodies and some consultancies.

5. Conclusions

From the above one can easily arrive to the conclusion that railways are a very technocentric industry. They risk not meeting new demands from the fast emerging digital society, from which they have not been exposed. This arises from the fact that railways, as one could expect, are engineers’ domain. Despite their awareness and good will to interact with emergent digital society, they have neither inclination nor training to address it.

A respondent comment states society is associated to a high degree of heterogeneity in terms of interests and values further adding uncertainty to an already complex technology system as railways. Engineers tend this way to leave society out from their R&D collective action, which they compete to control. To survive today's digitalization era railways have to go beyond their technocentric visions and to include societal actors.

6. Recommendations for discussion

There is potential for adding value to the technology development process by enlarging the business network to include social actors when elaborating collective visions and undergoing collaborative R&D. This requires tailoring interactions to suit the TRL development stage of the R&D project, to optimize the value from such an interaction. It also requires drawing on third parties to orchestrate such interactions (a number of types of third parties are possible, but must be chosen with care as it is more than marketing and requires targeted and informed orchestration). Railway have to move towards stabilizing design trajectories (reducing uncertainty and risk) by reviewing societal requirements at early stages of the R&D projects. It can also be suggested to draw on expertise in linking societal engagement to technology design processes. As presented in the theoretical references Technology Assessment is a clear example of this, as provides methodologies and third party experts to whoever might be interested in handling technology in society.

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