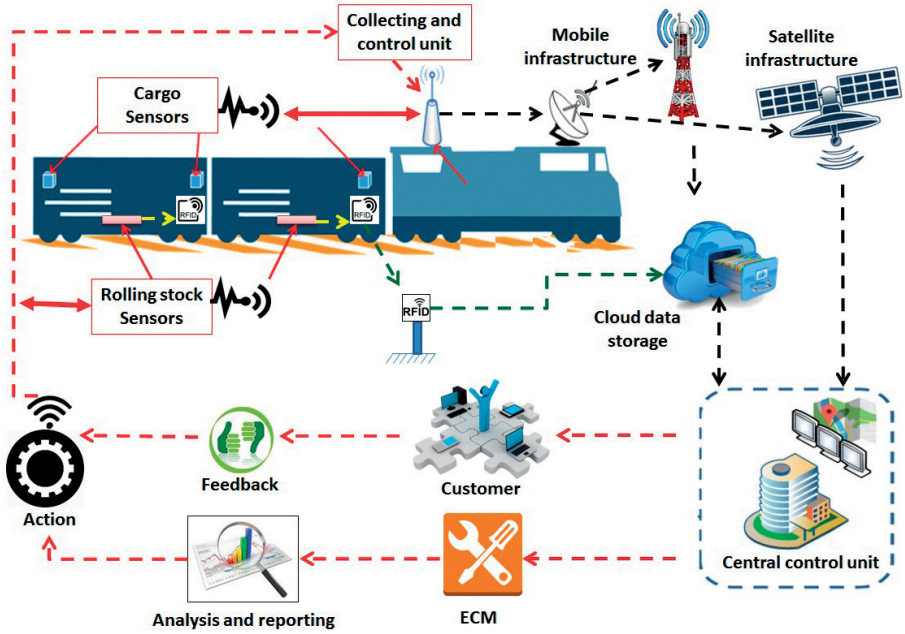
Rejuvenating Europe's rail freight sector

by Franco Castagnetti, *Vice President of NewOpera Aisbl and Partner of the INNOWAG Consortium*

The lack of awareness about the customers' needs – particularly those related to longer, more sophisticated, and complex supply chains – is one of the major points of discussion around the rail system's inability to respond to evolving market challenges. The ambition to increase rail's share with the use of the TEN-T is very likely to remain wishful thinking, unless a true paradigm shift occurs in the minds of major rail operators that would lead them to finally focus their attention on innovating both technology and marketing in order to meet the rapidly changing demands of the European service-driven economy.



The rigidity of the rail system, which is, by definition, a "closed" system, represents an additional constraint towards the creation of a more user-friendly service offer. This is particularly the case where the system's flexibility and costs competitiveness are the main criteria settling the market choice. This is the fundamental reason why the end results have been disappointing despite all the efforts made in the last decade by the European Commission and local governments alike to revitalise rail freight.

This, however, is not surprising in the least if one looks at the issue from the user's perspective. The general prevailing attitude of rail operators has not changed from that of "production-driven" organisations where the customers' needs are given nothing but marginal consideration. Likewise, those in policymaking positions did not take heed of the market demands for adapting rail freight services to the new requirements of cargo mobility (especially amidst the post-crisis new normal of no normal). Quite the contrary, the users' contributions regarding requests and ideas for service improvements have been perceived as criticism rather than as fundamental market requirements, which, if duly satisfied, could lead to opening new business ventures and gaining a first mover competitive advantage. As such, the challenge of delivering rail freight services that match market needs at lower costs has remained unresolved.

Innovate or perish

In order to overcome this long-standing cultural barrier, a group of advanced technology providers, universities, equipment manufacturers, associations, and consultants have gathered under the umbrella of the Innovative Monitoring and Predictive Maintenance Solutions on Lightweight Wagon (INNOWAG) project consortium. The aim of this initiative is to demonstrate the viability and attractiveness of a new business and operational model. The model is based on technologies necessary to substantially improve the quality of rail services, while reducing their cost, all to increase the system's overall flexibility to channel more cargo flows onto railways (but on a market basis).

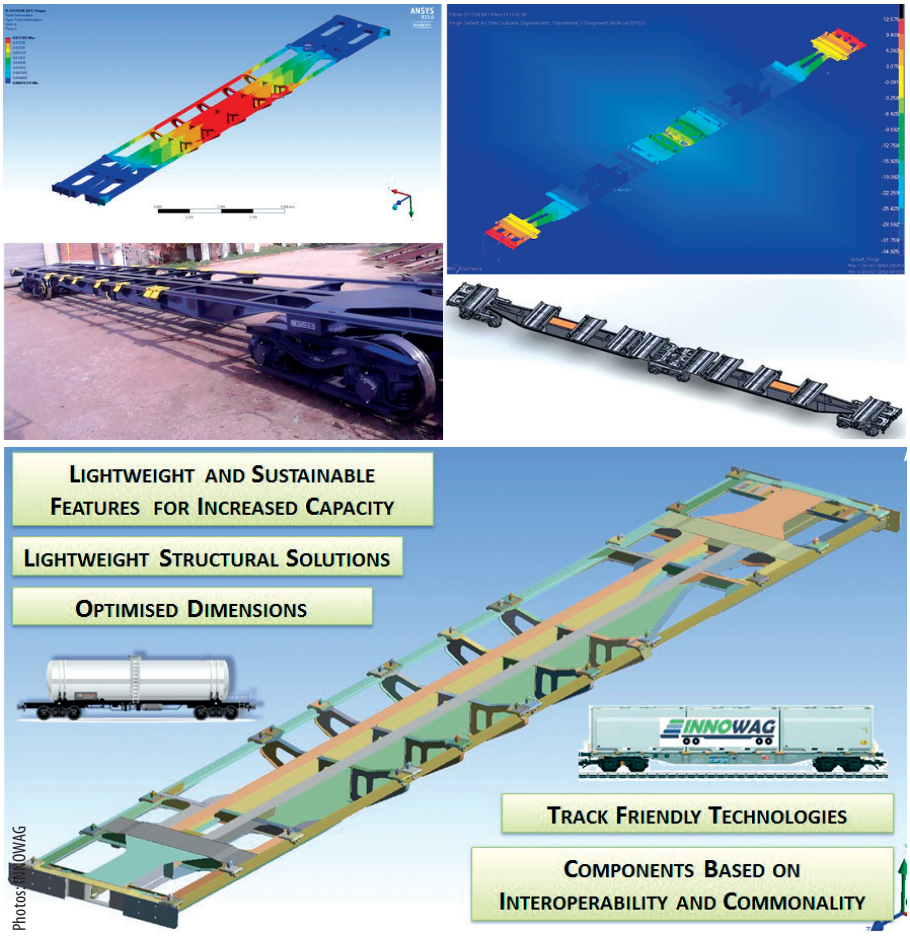
Transport innovations stem from market trends. External drivers of change, such as economics, changing demographics, flexibility, environment protection, new mobility patterns, and IT developments impact the future of European railways by changing basic transport and distribution habits. In turn, internal drivers, like new needs, cost reductions, sustainability, simplification, train hardware/software technologies, and the impact of time and spatial distribution affect the supply chain and its services that dictate customers' choices. In Central Europe, for instance, the rail infrastructure needs to improve its performances in terms of both quality and quantity for it to properly respond to societal needs for increased service accessibility, preferably reducing the carbon footprint at the same time. The challenge for rail in the medium-to-long term is to achieve a better use of its capillary infrastructure, extracting from it a much higher degree of efficiency.

INNOWAG intends to develop technologies and operational models for bringing the rail industry service offerings into alignment with these drivers of change to induce the desired modal shift onto rails. Innovations planned by our project centre around three macro-areas; namely, cargo condition monitoring, predictive maintenance, and lightweight wagon design.

Where's my cargo?

The lack of a workable track & trace system has been a major shortcoming of the rail industry for years now. Again and again, customers have been losing their confidence in rail freight services because of the latter's inability to show the exact location and condition of carried goods, particularly when delivery schedules were shot through repeatedly.

Once a service's credibility is lost, it takes a very long time for it to be regained.



In fact, personal management situations are at stake. When logisticians find themselves entangled in an emergency situation "thanks" to a failure of a transport service and without the ability to propose a corrective action, it's obvious that in the future they'll seek safer alternatives to avoid such a mishap from reoccurring.

To alter this state of affairs, INNOWAG is working on sensors and intelligent modules applicable to railcars that would be capable of transmitting data on the wagons' geographical location in real-time, as well as monitoring the condition of goods onboard. This information can be then integrated into customers' logistics chains, providing them with valuable data to be used for streamlining their processes, now (e.g. in case of exceptions, like extreme weather disruptions) and in the future (e.g. for swifter market demand-induced network reshufflings). This is a considerable improvement over the status quo, and is a pre-requisite for competing with alternative modalities.

To repair or not to repair?

When it comes to the maintenance of rail freight vehicles, the prevailing practice is to carry out inspections and maintenance according to schedules, or when an in-service failure is detected. This approach results in two types of problems. First, components are replaced before their serviceable life, so essentially good parts are being disposed of. Second, a breakdown occurs, meaning that the entire vehicle is not only out of service, but it also needs to be dragged to a repair depot (and let us not forget that a failure of one part can damage the other). Both situations burden companies with avoidable costs.

In other industries, as well as in the rail passengers sector, condition monitoring and preventive maintenance techniques have been put in place. Data is gathered to predict when maintenance is really necessary. This approach has the benefits of reducing in-service failures (and all the system disruption costs associated with them). It also makes it possible for a more cost-efficient maintenance strategy to be implemented to carry out only the required actions. This increased maintenance efficiency also reduces the cost of keeping a vehicle in a serviceable condition by fully exploiting the components' service life, thus bringing the number of replacements to a minimum.

In this regard, INNOWAG wants to identify and model sets of condition monitoring, as well as gather historical data for selected freight vehicle components in order to develop a suitable methodology for predictive maintenance of freight wagons. This work is intended to act as a benchmark and case study for demonstrating the application of predictive maintenance to freight wagons and the potential benefits it could bring. The objective here is to enable increased rail freight competitiveness through greater reliability and efficiency at a reduced cost.

How to lose weight?

Wagons themselves can be improved as well. INNOWAG also researches the structural design of novel lightweight materials, like high strength steels and composites, with optimised profiles. Lighter structures with lower tare weight would enable higher payloads within certain axle-load limits, hence increased capacity and better energy efficiency. A better tonnes/cargo unit ratio would lead to more competitive prices against other transport modes. This process is supported by mathematical modelling in order to verify the structural strength and dynamic performances alongside testing selected aspects of the design to validate the modelling predictions.

Intelligent rail

If all goes according to the plan, in the near future we'll have slimmer and intelligent wagons that keep track of higher loads of transported goods in real-time, simultaneously monitoring the condition of the railcar itself, advising whether particular maintenance is needed. Such rolling stock would give its owners the marketing leverage needed to ask the clients to seriously consider whether rail transport hasn't become actually a better option for them. This – in tandem with other revolutionary yet common sense ideas, like doubling the length of freight trains (to 1,500 metres) – could be the spark that finally ignites the real rejuvenation of the European rail freight sector. ■

INNOWAG

The INNOWAG project, part of the Shift2Rail Horizon 2020 programme of the EU, aims at contributing to the development of rail freight services that fit the needs of modern manufacturing and supply chain, addressing the actual needs of the rail cargo sector for increasing its competitiveness and attractiveness through developing an intelligent freight wagon with predictive maintenance. For more info please visit www.newrail.org/innowag