

Digitalisation of the (International Freight) Capacity Planning/Production Process: Challenges and Solutions

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First Reduce Complexity, Then Digitalise...

The Industrial Revolution 4.0 (digitalisation) is highly dependent on the adaptability and efficiency of the systems. Although innovations are also regularly introduced to the railways, the system is nevertheless shaped by technical and organisational principles, which tend to develop more slowly than other competing transport systems.

Without going into the intricate institutional processes that vary from country to country, it can be seen that institutional complexity, fixed costs and length of long-term investment and maintenance cycles in the railway system make it often difficult to remain compatible with the principle of adaptability and short-term effectiveness.

Three basic processes can be distinguished:

- **System Planning:** The investigation of scenarios or several variants, the long-term dimensioning of resources in an evolving political, institutional and macroeconomic context
- **Production Planning:** The allocation of pre-dimensioned resources into an execution model to meet both the commercial needs as well as the short term production requirements
- **System Operation:** The use of available resources in real time, which are necessary for the whole or partial execution of the pre-determined production plan

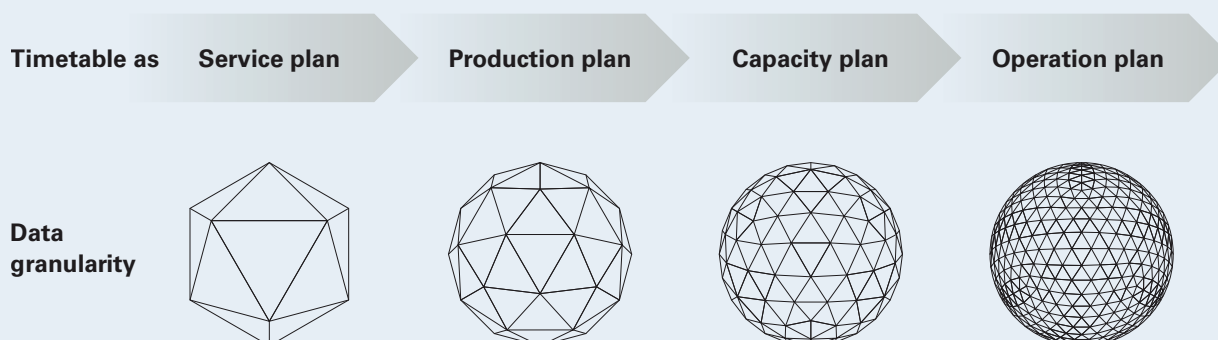
While the unclear and evolving political, institutional and macroeconomic environment at least partially limits the possibilities of automating the process of system planning, the two other processes are predestined for digitalisation and automation.

Railways must be able to rapidly develop their business model and build scenarios. A scenario-based approach involves modelling work. In generic terms modelling can be considered as the rationalisation and reduction of the complexity of a system with the aim of better understanding it, and as a result of this modelling process it becomes possible to predict the behaviour of the system. But... to quote a famous (possible mis-) quote of Albert Einstein, "Everything should be as simple as possible, but not simpler".

The best way to automate production planning and operation is through planning methods and systems/tools (digitalisation) that allow numerous scenarios and variants to be anticipated and developed through the simplification and systemisation of the processes.

To do so the stakeholders have to understand the transversal element spanning the railway system process landscape: The timetable. Understanding the timetable and its various forms means understanding a large part of the railway system: its totality, its interactions, its organisation and its complexity. The timetable is not an end in itself but a means to an end for continuous and integrated implementation across the core processes of planning, production and operation of the railway system. What we need in this matter is data continuity and consistency, across the processes and the stakeholders:

- Continuous refinement of infrastructure models and train definitions with the appropriate precision for the task. Sort of metamorphosis (with different granularities of the data used)
- Temporal and spatial coherence of the system.





As a result, the resources (infrastructure, capacity, rolling stock, ...) insights derived in the preliminary stage of the service planning remain consistent throughout the processes. The ability to adapt the granularity of the timetable is a powerful means of placing the railway system in an optimal state for each planning phase and most importantly to manage this development coherently through the various phases, despite the overall complexity. In summary:

- A Scenario based approach is the key to adaptability and short-term effectiveness
- The real innovation is to put the timetable - the ultimate promise to the customer - at the heart of the system.
- Methods and tools that guarantee data continuity (continuous refinement) and consistency (spatial and temporal coherence) throughout the processes should be implemented at international level.