

Applying Lean Principles in Railway Operations

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Abstract Lean principles, exemplified by Toyota Production System (TPS) continue to interest the operations community. Although, TPS was widespread in manufacturing industries since 80's, it was rare companies non-manufacturing apply lean principles. However, nowadays, others economics sectors, such as services, introduced these concepts in their culture and operations management routines, most of them using TPS as example. Railway companies are older, and commonly apply older management models. As an example, in the state of Minas Gerais (Brazil), there is a logistic integrated company called VLI, a transportation company which includes terminals, railways and ports, and have operations all over Brazil, divided in four (4) logistics corridors. The principal incoming corridor is the Central-East corridor which has grains (soy beans and corn) as principal product transported. The production system at this logistic corridor was based on pushed system. In other words, to ensure the customer demand, all the process was executed based on the cycle time of each process working separated, always trying to make it faster. Although, the loading process works well in this model, the railway circulation did not have a stable performance, occurring overproduction, because the bottleneck process was not being considered during the planning, so it was used more assets than the necessary. The change in planning system was required when trains started to stop fully load during more than seven (7) days waiting it's time to unload (a week, normally, is the time between two load process). In other words, trains were staying stopped during the same time that they should be in loading twice. The case study started defining the ideal amount of trains between the terminal (loading process) and the port (unloading process) based on the customer demand (normal and not normal reference) and the ideal transit time between the loading yard and the unloading yard. For this we represented the demand as amount of train per day that should be loaded, dividing per 24 hours we had the interval between trains or train headway, in the future it was realized that headway is the applications of takt time in railway operation. Furthermore, dividing the transit time by the train headway was defined the ideal number of trains in the rail. Finally, with new operational indicators, number of trains in circulation and the trains headway, it was created a Floor Management Development System (FMDS) routine where the problems were stated and solved using Gemba, another TPS tool. With these new operational management routine and performance indicators focused on productivity, the train circulation achieved the stability after few months. It is important do highlight that, as this is a case study all the applications should be adapted for the scenarios of new studies in the future, where some of the methodologies can replicated and some others cannot. The results with the new process, which we called pulled circulation system, were 14% reduction in transit time (34% reduction in standard deviation), energy efficiency was improved in 4,3%, 37% reduction in drivers' extra hours, permanent way maintenance availability was improved in 8,5% and locomotives reliability was improved in 40%. Additionally, the pulled circulation system made the integration with operational areas and Operational Control Center (OCC) possible, providing sustainability to the

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new operational process. Despite lean principles is not usually applied in service companies, this paper shows that using them and adjusting to the company reality it is possible to achieve great result.

Keywords: Operational Control Center • Trains Circulation • TPS • Pulled Circulation System