Digital Data Tools to Improve Efficiency in Rolling Stock UK

As an American statistician, William Edwards Deming, stated: "Without data you're just a person with an opinion." This was one of the fundamental reasons why the team at Hitachi Rail's manufacturing facility in Newton Aycliffe implemented a full suite of digital data tools, enabling a step change in operational performance and management visibility. This cutting-edge set of tools is future ready and aligned to the long-term vision of establishing global systems within Hitachi Rail and Hitachi's overall vision of leading IT/OT technology. The benefits of this at Newton Aycliffe include supply chain visibility, forecasting and effectiveness, production efficiency and overall management visibility of the live situation across the plant. These improvements have been made by the in-house team, and without the need for external consultants, meaning that very large benefits have been established at very low costs. This article describes the use of digital data tools at the plant in Newton Aycliffe.

Tim Rutter

1. Introduction

Hitachi Rail Rolling Stock UK includes Hitachi Rail's UK state of the art train vehicle manufacturing and testing facility at Newton Aycliffe (NAY), as well as design, procurement, and commissioning teams. The facility was established in 2015, including the recruitment of an entire team completely new to train design and manufacture. The team has been on an exciting and rapid learning curve and improvement transformation ever since.

The initial priority was to ensure the teams were ready to deliver the iconic Intercity Express Programme (IEP) of high speed trains for the UK Department for Transport to the high quality standards Hitachi Rail is globally renowned for. Following close learning relationships with Japanese colleagues the project was successfully delivered alongside a project to build 234 commuter cars (70 trains) for Abellio ScotRail Ltd.

2. Digital Data Leads to Improvements

At the same time that the team was becoming established, different systems for processes and procedures were also being established and implemented. This centred on SAP[*1], and data transfer from Japan to UK. At that time, Hitachi Rail did not have a global product lifecycle management (PLM) system, nor a path for Office 365[*2]. Many tasks were controlled in separate documents and spreadsheets. There were fundamental gaps in system architecture—there was an abundance of data in a number of different systems so it was impossible to analyse and use this data for improvement purposes.

As William Edwards Deming, an American statistician, stated: "If nothing is to be done with the data, then there is

*1 SAP is a registered trademark of SAP SE.
*2 Office 365 is a registered trademark or trademark of Microsoft Corporation in the United States and other countries.

Figure 1 — Example of Mobile Solutions

A number of mobile solutions have been implemented making information more accessible at Hitachi Rail's rolling stock manufacturing facility in Newton Aycliffe, UK. These are used throughout warehouse, assembly, quality, and testing.

no use in collecting any. The ultimate purpose of taking data is to provide a basis for action or a recommendation for action."

As the factory at NAY was brand new, it was not possible to rely on strong processes or tacit knowledge and relationships, which is normal in well-established businesses. This led to a number of issues including:

(1) Low material availability with a lack of clarity on the reasons for shortages

(2) Warehouse pick rate inefficiency

(3) Inability to increase production rates of rolling stock caused by (1) and (2) above

(4) Discrepancies in engineering bill of materials (EBOM) and manufacturing bill of materials (MBOM) globally

The Rolling Stock UK team therefore knew there was a need to implement a number of new technologies to analyse, and subsequently improve, business performance through digital data. A proposal was made to work closely with the Hitachi Rail IT team to implement systems rather than use consultants or contractors.

There was a need to improve in many areas, including:

(1) How to use core SAP functionalities

(2) Maximising the use of SAP Neptune mobile applications

(3) Introducing an SAP Business Warehouse (BW) as a way of extracting and storing SAP data

(4) Introducing Microsoft Power BI[*3] and other local production analysis systems as a way of exploiting and visualising the data

(5) Introducing a two-stage approach for PLM: link to the existing Italian system and jointly upgrade to a new global PLM system

(6) Use of mobile hardware such as mobile scanners, tablets, centralised kiosks, large display screens and barcode printers

---

*3 Power BI is a registered trademark or trademark of Microsoft Corporation in the United States and other countries.

to support the software improvements

These new systems have been key to enable business improvements across Hitachi Rail Rolling Stock UK over the last four years (see **Figure 1**).

3. Supply Chain and Material Availability

Step change improvements in material availability to lineside were achieved through:

(1) Activating new SAP "pull" based interactive pick tools—giving the production teams on-system visibility and control of material provisioning

(2) Multi-stage SAP Warehouse Management (WM) improvements, moving around 10 business critical spreadsheet managed processes into SAP

(3) Implementing SAP BW and Power BI

The introduction of Power BI and improvements to SAP functionality have been key to achieving huge improvements in material supply forecasting, visibility and decision making.

Power BI draws on data from multiple sources such as global product lifecycle management (GPLM) and SAP, and creates one single view of data that can be used by all departments. This reduces waste and accurately identifies material availability shortfalls ahead of time, thereby improving production planning and efficiency.

Perpetual inventory counting has moved from being a manual process and has been integrated into a mobile application providing improved stock accuracy from 51% in 2018–2019 to 96%+ in 2020. The introduction of an SAP development tool, Neptune, has meant that SAP can now be viewed on mobile formats such as tablets and kiosks, making it more accessible to all.
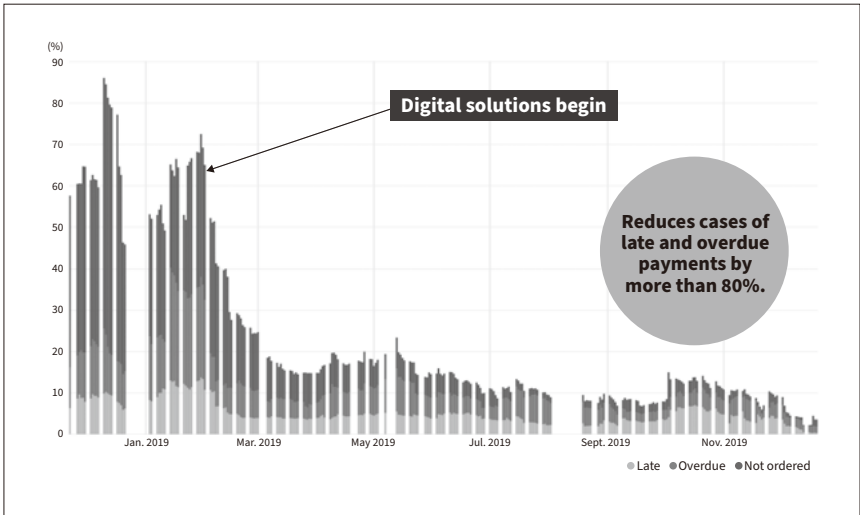
Figure 2 — Step Changes in Materials Management Efficiency

A step change in materials management has improved pick performance in the warehouse from an average of 80% delivery to 97%. This is sustained improvement.

Automated stock replenishment, which has been embedded into daily routines, has removed a daily, three-hour manual task and improved accuracy. This has led to a 40% reduction in recalled stock.

Automated warehouse goods receipt using mobile applications and barcode scanning has allowed a 25% increase in daily "goods in" volume with 60% of the original headcount.

Improved pick performance in the warehouse, also thanks to mobile scanners, has allowed greater stock traceability throughout the process of delivery to lineside. Pick performance has improved from an average of 80% of standard operating procedures (SOPs) delivered to 97% (see **Figure 2**). Delivery of available material rose from 94% average to 99.97% and the individual pick rate increased from 175 units per person to in excess of 250 units per person.
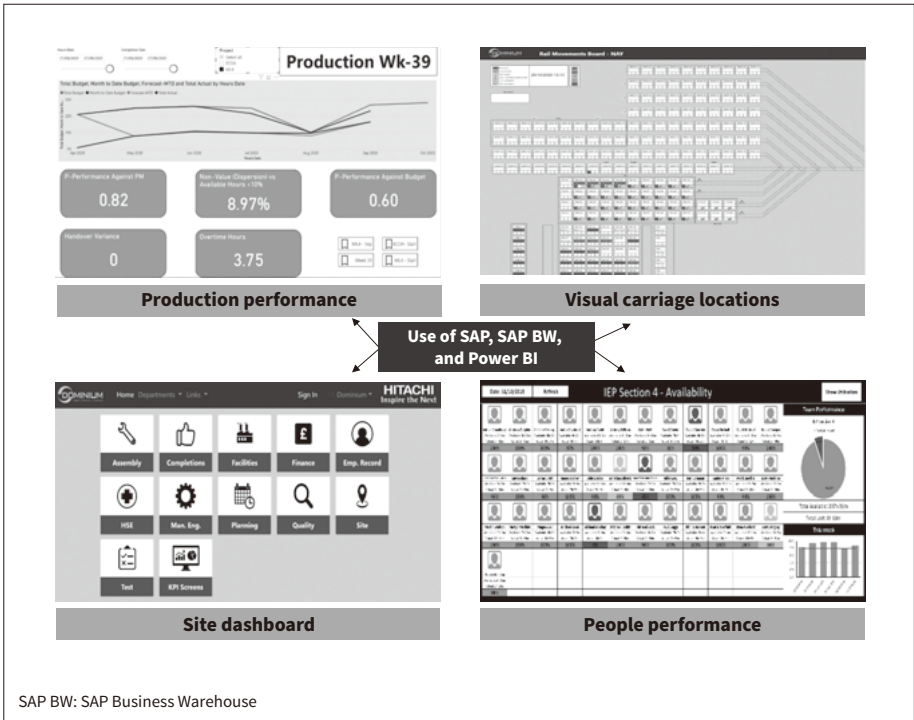
4. Production Effectiveness and Efficiency

Visual representation of production data analysis from Dominium, a custom-made system that draws data from SAP, has ensured that optimum efficiency is achieved in the manufacturing and assembly processes (see **Figure 3**). To understand the differences in time taken to complete different SOPs, the production team created the Dominium system to interrogate data created from all production tasks. Analysis and visualisation of this data has led to significantly improved performance.

To date, the Dominium system has reduced the completion time of SOPs against the process master by circa 26%.

Figure 3 — Manufacturing Dashboards Screens

A number of visual manufacturing dashboards have been introduced in the manufacturing facility in Newton Aycliffe. These are built from SAP data-sets, using core IT tools and without consultants.

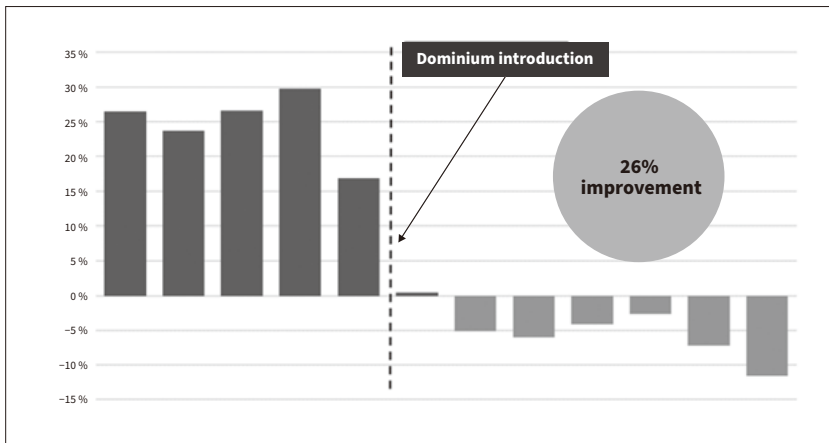SAP BW: SAP Business Warehouse

Figure 4 — Improved average time taken per procedure
The implementation of the Dominium system has led to significant improvements in time taken per standard operating procedure (SOP).

This in turn has led to a huge improvement in the efficiency of the entire factory (see **Figure 4**). Dominium also delivered a reduction in idle time and other non-value add operations increasing overall productivity and customer delivery times.

5. Global Rolling Stock Design and Build

The GPLM system is another excellent example of a digitised data improvement. Engineering design and build data from all global entities is now in a central database, including parts, assemblies, drawings, models and bills of materials (BOM). This improves the time taken for any engineering changes to made as the dynamic system ensures only the latest and correct data is used and available.

6. Conclusions

As result of digitisation and a combination of different tools, overall production rates have increased for Hitachi Rail Rolling Stock UK. The 100% improvement in delivery output rate of the IEP and other projects, thanks in large part to the introduction of digital tools, has led to accelerated sales and therefore improved cash flow for the business. Other management benefits include a reduction in the contractors and external consultants, another large cost saving.

The team will continue to work on standardising and digitising and have recently made customised improvements to SAP functionality and digitised forms to handle data capture, validation and approval. Other newly digitised processes include a procure to pay (P2P) centralised purchasing processes, digitised test house fault tracking and a quality notification system.

Hitachi Rail Newton Aycliffe has demonstrated that as a combination of the highly skilled workforce, using the leading smart factory digital tools, with the right workload level, capable of building any type of train. As technology continues to evolve at pace, the continued digitisation of processes will be fundamental to success as a smart factory fit for the digital age.

Author

Tim Rutter
Hitachi Rail Ltd. *Current work and research:* Management of rolling stock production and delivery. *Society memberships*: Institution of Mechanical Engineers (IMechE) and Association for Project Management (APM).