An explorative case study

Collaborative working and integrated data management in track renewal projects

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RAILWAY SYSTEMS BACKGROUND

Available evidence affirmed by Shaw (2017) indicates that the use of railway transport in the UK has substantially increased over the years and is projected to continue growing in the foreseeable future. The global trend in the use of railway transport is also showing steady growth year on year. As a result, governments and railway asset managers are continuously looking for cost effective ways of increasing capacity to meet current and future demands while maintaining the existing railway infrastructure in a good condition to support the efficient and safe running of train services.

Track renewal projects are part of the maintenance operations that are mainly delivered during weekend possessions to minimise service disruptions for commuters during the week. Handover documents from track renewal schemes and other maintenance and inspection records provide input data to Railway Asset Management (RAM) datasets/ models. The data is processed to provide information which is relied upon when making decisions about maintenance requirements, long after the site works have been delivered.

RESEARCH AIM AND METHOD

The aim of the research was to investigate why and how the adoption of a Collaborative Culture (CC) and Integrated Data Management Systems (IDMS) could add value in the delivery of track renewal projects and enhance the quality of asset data using known approaches supported by technology. The Exploratory Research Method was deemed to be the most appropriate and was adopted for use in the case study. The Exploratory Research Method is suitable for answering the 'Why or How' research questions focusing on contemporary events without the need to control behavioural events and thus allowing the researcher to retain holistic and meaningful characteristics of real-life events as suggested by Yin (2009). Furthermore, this method is evidence based, provides in-depth exploration from multiple perspectives of the complexity and uniqueness of a particular project, policy, institution, programme, system in a 'real life' context, with the primary purpose of generating in-depth understanding, knowledge and/or inform policy development, professional practice or community action.

Research data was collected with the gatekeeper's permission using semi- structured interviews, direct meeting observation and analysis of project documents that were not commercially sensitive. Ethical considerations were included to improve validity of the research findings for the benefit of the railway sector.

LITERATURE REVIEW AND INDUSTRY PRACTICE

DRIVERS FOR CHANGE

In the last few decades, the UK government has engaged with the construction industry to find solutions to the poor performance of the industry following the publication of the

Image 1: Installation of new rail. Photo Transport for London©

Latham (1994) and Egan (1998) reports. The government proposed digital construction and smart procurement strategies and mandates to address issues of poor performance (Cabinet Office, 2011 and 2015). These initiatives are influencing changes in the procurement and delivery of construction projects that are aligned to the Building Information Modelling (BIM) processes that encourage collaborative working and the use of digital tools. The delivery of track renewals in the current economic climate of reduced funding should be aligned with government strategies and the digital revolution, (with the associated rapid advances in data processing technologies), to benefit from the expected efficiency savings.

Since the privatisation of the railways in 1993, the cost of track maintenance and renewals has risen from around £2.4 billion per annum to £5.4 billion per annum by 2009/2010, according a study by Taylor and Sloman, (2012). However, recent reports show signs of a reversal of this trend which can be attributed to efficiency savings and suggesting that further efficiency improvements should follow in the future.

A study by Bente, Kindler and Wittmerier (2008), found that Network Rail (NR) was spending £433 million and £1.305 million more on track maintenance and renewals, respectively, compared to its European peers. They argued that NR could unlock contractor efficiency contributions through a fundamental shift of supply chain relations based on the idea of competition and partnerships. They identified the main areas of improvement to be in planning, better use of possessions, standardisation of asset configurations and a focus on the quality of the asset condition. Crucial to the successful implementation of the strategy is the development of CC and IDMS throughout the supply chain.

PROCUREMENT OF TRACK RENEWALS

Partnerships and collaborative working have long been the preferred method of procuring track renewals (Gourvish, 2002) to maximise efficiencies. The UK government construction strategy and its commitment to long-term partnerships to deliver infrastructure projects is revolutionising ways of working and data management techniques. According to Roberts, et al., (2016), contracts generally tend to drive behaviours and if a contract were to contain specific provisions that actively discourage adversarial behaviours, the parties are more likely to behave accordingly.

Careful consideration must be given to the options for procuring track renewals as they influence the conduct and culture of the working of the partnering organisations. Where organisations have true collaboration the focus is on delivering project requirements and there is less reliance on the contract. However, the use of partnerships to procure track renewals must be adapted to new ways of working aligned to the mandated BIM processes to deliver value for money.

COLLABORATIVE WORKING

Track renewal projects are delivered in a complex operational environment where other PWay infrastructure maintenance disciplines also carry out essential works on the network. A collaborative approach for railway infrastructure management will enable more effective use of possessions and data sharing across disciplines leading to better railway infrastructure management, performance and understanding of its condition.

A collaborative culture is an enabler in the development of an integrated approach to data management that could bring about the standardisation of processes, procedures and data formats, used throughout the supply chain. One of the key elements for successful implementation is for data management systems to be supported by data of high integrity. Rapid advances in technology, increases in capacity to handle large volumes of data at lower costs and the development of quicker data analysis tools are increasingly putting data management at the core of strategic planning for organisations (Langdon, 2013).

Rail industry leaders recognise the need for change. Hawkins (2017) wrote that the introduction of BS11000 in 2010 marked a step change in thinking for the UK rail industry led by Network Rail to encourage the adoption of CC. Rahman, Endut, Faisol and Paydar (2014), made reference to the fact that despite the apparent lack of a clear guide for the process of collaboration between the main contractor and subcontractor, project participants now realise that the sharing of knowledge and information is a key element of a successful project delivery and contractual relationship.

Langdon (2013) formulated a strategy amongst many others that can be adopted by organisations to improve collaboration and enhance organisational performance and project delivery success through the management of processes, people and data. However, Langdon warned that despite there being a very strong willingness to collaborate, organisational culture and awareness remain significant barriers to successful adoption. This presents a challenge to the industry that is said to be resistant to change.

DATA MANAGEMENT

As track renewal jobs progress through the delivery stages, various project departments generate a lot of data in various formats and variable quality suitable for their needs. The data is often stored in many different places and in an unstructured way resulting in the creation of project data silos. This occasionally leads to losses of data and time wasted in unproductive searches for data and has partly contributed to the challenges of completing the Mandatory Asset Information Deliverables (MAID) with reliable data.

Improving renewal project data management can enhance the quality of data/information handed over to asset owners. Data of good quality further leads to a better understanding of the railway infrastructure and improves the quality of decisions made in the future about maintenance or upgrade requirements. Delivery strategies and standardised processes agreed collaboratively at the start of the project ensure relevant and high-quality handover Information Requirements are delivered with the relevant high integrity data/ information. Data will be shared/used without transformation across different disciplines resulting in a collaborative advantage. This will, however, require a significant change in culture and must be supported by senior management.

Asset management datasets/models are updated with data from MAID and other asset maintenance records. If these datasets/models are not updated from reliable data sources, future decisions on maintenance priorities will be affected. Incorrect decisions on priority and what must be renewed may result, leading to a waste of resources or even under budgeting for essential works. Predictive maintenance becomes difficult, adding to the challenges in maintaining a world-class track asset under increasing rail usage and a reduction in funding.

In the last decade, infrastructure improvements have contributed to an improvement of approximately 50% in service reliability and passenger satisfaction on London Underground (LU) according to the LU, 2016 publication. Most of the changes and innovation within the P-Way sector have been in railway engineering and improving on-site delivery efficiency. This has indeed improved the quality of project delivery supported by the additional focus to deliver site tasks safely. However, very little has changed with the processes of managing data flow and documenting what was delivered thus making it difficult to handover jobs on time.

Track renewals projects can take the lead and set the tone to improve the data quality of the asset models, but this will also require those models to be updated as the data becomes available. For the sector to benefit from the digital revolution in line with the asset strategy, senior managers must take decisive actions and invest in training and technology.

RESEARCH FINDINGS

The case study was carried out on a track renewal project in early 2018 to investigate “why the adoption of a Collaborative Culture and Integrated Data Management Systems by track renewal projects may enhance delivery performance and asset data quality”. Findings of the research had mixed views and gave an insight into the challenges of adopting a collaborative culture and integrated data management systems to provide useful information for the formulation of transition strategies for the adoption of BIM.

In the findings, the project end-to-end process was not followed and project teams had developed their own ways of working in silos. This resulted in the incorrect use of the Common Data Environments (CDE) like Livelink and ProjectWise, thus making it difficult to find the right information, particularly when preparing handover packages. This contributed to jobs being handed back later than the time prescribed in the end-to-end process.

Evidence of collaboration was found in the interaction of the project team members from observations, statements made by interviewees and the project contract documents. However, different ways of working and a lack of clearly defined project processes lead to collaborative inertia and project fragmentation. Observations of inter-disciplinary meetings showed further evidence of collaboration but with challenges in data sharing and use of different data formats by disciplines working in different data environments. In general, participants believed that an Integrated Data Management System (IDMS) in a CDE would be beneficial to the project as supported by various literature sources.

Project documents showed policies relating to document management in Livelink and contract delivery requirements. However, evidence from the interviewees suggested that project team members were not aware of these. This highlights the importance of effective communication in projects. Having processes in place without communicating them and providing adequate training leads to the abandonment of otherwise good processes. Hence the development of a culture of working with non-standard processes and inconsistences in delivery outputs and formats.

The use of technology based on data collected from observations and interviews was very limited, with the paper-based system being dominant. There is scepticism in the use of BIM processes and supporting tools in the project mainly due to the effort and commitment of senior management to fund and support the initiative. The benefits of adopting this technology were mainly perceived to be only on complex jobs that require collaboration with external parties.

A number of researchers also support the notion that some of the rail industry efficiency challenges could be overcome by integrating the vast amounts of data collected from different sources into management intelligence. But the lack of resources and investment in skills and technology present a challenge for the industry that is known to be resistant to change, particularly on soft skills. The quality of decisions made for asset maintenance priorities is dependent on the availability and quality of asset data. Incomplete or poor data quality impacts on the ability to have a clear understanding of the asset condition from which, scopes for track renewal projects are derived and leads to poor scope definition and the unclear specification of deliverables. Going forward, there is a need to engage with track renewal project teams to find better ways of collaborative working with the view to improve knowledge of the railway asset condition. This will help align the industry with the ongoing digital revolution and the much talked about BIM processes to deliver value for money and further reduce P-Way maintenance costs.

CONCLUSION

CONDITIONS FOR A CC AND IDMS IN TR PROJECTS

Research data shows that individuals collaborate with their work colleagues and over time have come to understand how the project works to deliver jobs in accordance with contract requirements but not achieving collaborative advantage. As noted by Langdon (2013), despite a very strong willingness to collaborate, culture and awareness remain as significant barriers to adoption. Project policies and processes on the expectation of people behaviour and data management in a common environment exist, but they alone are not enough if not updated and not followed. This highlights that meeting contractual requirements without a culture change can easily become a tick box exercise and result in missed opportunities for true partnerships to be developed leading to collaborative advantage.

REQUIREMENTS FOR TECHNOLOGY ADOPTION IN TRACK RENEWAL PROJECTS.

The use of the modern processes of BIM and data management technologies and analytical tools is very limited on track renewal projects. Paper based systems are still dominant despite the capability for widespread use of digital data especially of CAD models as observed in inter-disciplinary meets and findings from interviews. Langdon (2013) argued that the expansion of analytical tools and the desire of organisations to produce more for less is driving the view that competitive advantage can be achieved through advanced business analytics.

In the absence of a clear direction and commitment to adopt and develop tools, change towards digital railways and advanced levels of BIM are a long way off. The appetite to use modern processes in a track renewal project is there but there is scepticism on its suitability for track renewals and the commitment of senior management to support and fund its adoption. As noted by O'Neill (2014) a digital agenda enables new ways of thinking and almost endless sustainability opportunities but nothing will happen without decisive action being taken by the industry leaders.

WHY AND HOW THE ADOPTION OF A COLLABORATIVE CULTURE AND INTEGRATED DATA MANAGEMENT SYSTEMS COULD ADD VALUE TO TRACK RENEWALS PROJECTS

The conclusion for this objective is split into three sections; reasons why the adoption of CC and IDMS supported by technology could improve performance, the possible ways to achieve this and value addition.

WHY THE ADOPTION OF A COLLABORATIVE CULTURE AND INTEGRATED DATA MANAGEMENT SYSTEMS SUPPORTED BY TECHNOLOGY COULD ADD VALUE IN THE DELIVERY OF TRACK RENEWAL PROJECTS

The research determined that public funding for track renewals was reducing while over the years, money spent on renewals has been rising. Cowie and Loynes (2012) claimed signs of the reversal of the trend of cost increases on track renewals to be a result of efficiency savings. However, with budgets for annual work packages based on loosely defined job scopes, a result of the client data models not being kept up to date, it is difficult to ascertain the cause of rises in costs. The correct determination of scope at the onset will require better asset data management and will help provide a realistic budget from which comparisons against delivery will determine whether the cost of renewals is indeed going up.

The said lack of updated project data management processes led to different ways of working within project teams, resulting in the unstructured use of Livelink and development of data silos. As a result, a lot of time is wasted in unproductive searches and challenges in determining which files are the right ones to use, raising issues of project data integrity as argued by Surgeon (2013), who added data integrity is one the biggest challenges in the construction industry. Since the project receives and delivers data to the client on completing jobs,

the development of data management policies must be done in collaboration with the client to standardise the format of the files shared, thus ensuring the readiness of the project for future integration with other asset management disciplines. These can then be included in the contract documents as part of project deliverables that will be beneficial to the end user in the future.

Advances in technology and the BIM mandate (Construction Strategy, 2011) require a new approach to managing the renewals delivery processes. Project data management policies will need to be adapted to the approaches of working in a CDE to optimise the use of project and asset data and reduce re-works.

Some rail projects have been delivered following BIM processes and in order that the client/maintenance teams can benefit from their delivery data, they need to align with the BIM processes. A CC will be crucial to the development of policies and processes to meet future project delivery requirements.

HOW THE ADOPTION OF A COLLABORATIVE CULTURE AND INTEGRATED DATA MANAGEMENT SYSTEMS COULD IMPROVE ADDED VALUE IN THE DELIVERY OF TRACK RENEWAL PROJECTS

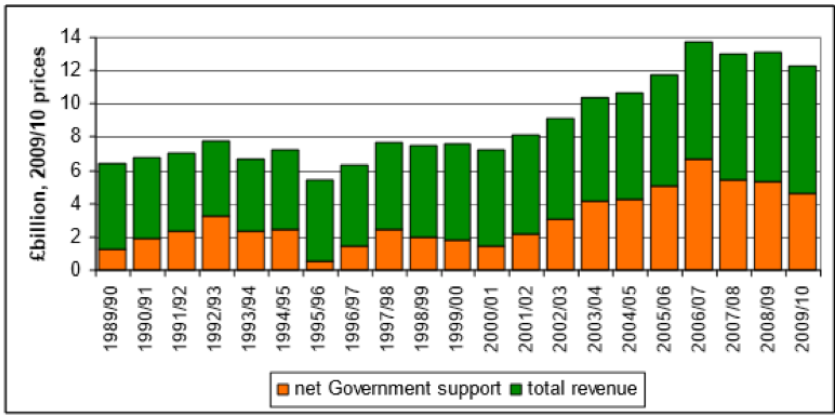
Various models to support collaborative working and the development of CC exist. Depending on the procurement option and contract selected, the level of desired collaboration can be developed using known models such as CRAFT (ISO44001) or Four Ways to Collaborate (Patel, Pettitt and Wilson, 2011), but not limited to these. CC leads to cooperation, with the focus on delivering business objectives and will enable the development of policies and processes that best fit business and project objectives.

The complex environment of track renewal projects means that known models of Collaborative Working (CW) and data management will have to be adapted to suit their needs. Managing the expectations of multi-stakeholders is a big challenge that requires a fundamental shift in the culture of the industry in order to benefit from the vast amounts of data collected from various operations. An integrated approach as suggested by ABB (2016) to track asset management can facilitate better asset data management allowing for multi-use of data. However, projects have a critical role in providing high quality as-built asset data to achieve return of investment through multi-use of data and supporting decisions about maintenance priorities.

The framework for data management used in the Cross Rail projects, (MacDonald, 2016), can be adapted for use in track renewals. This will require working with software developers to find ways of using existing data/information and the incremental development of the asset database required for transformation to the digital railways. The principles of ISO9001, BS1192:2007, PAS1192 series and the IGGI guidance can be used to develop strategies and implementation processes. Senior management need to evaluate business needs against benefits to determine the level of support that to which they can fully commit.

VALUE ADDED TO THE DELIVERY OF TRACK RENEWAL PROJECTS AND QUALITY OF ASSET DATA FROM THE ADOPTION OF COLLABORATIVE CULTURE AND INTEGRATED DATA MANAGEMENT SYSTEMS

The adoption of CC leads to cooperation within project teams and can be extended to other disciplines if an integrated approach to asset management is adopted. This provides an environment where there is cooperation in the development of strategies, policies and processes leading to standardised ways of working and consistency in deliveries.



Source: McNulty R (2011) *Realising the potential of GB rail, detailed report*

Image 2: Illustration of increase in track maintenance costs

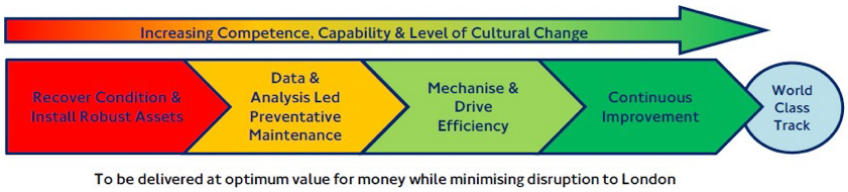


Image 3:

Image 4: Observation of meetings

Standardised processes also help in the development of trust in the way project data is collected, processed, updated and shared. Asset data managers can also make decisions about upgrade and maintenance priories with confidence thus allowing for appropriate budgets to be made to keep the track asset in good condition. Furthermore it will facilitate compliance with BIM requirements that the UK government identified as a process to give the construction industry a competitive advantage (Cabinet Office, 2015).

SUGGESTED RESEARCH TOPICS

Based on the findings on the research, a number of areas of research are further suggested.
a) Are the costs of rail asset management going up or is the poor understanding of asset condition resulting in insufficient budgets that are overrun by expenses incurred on scope creeps?
b) The adaptation of BIM processes for railways asset management.

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ABSTRACT SUBMISSION DEADLINE
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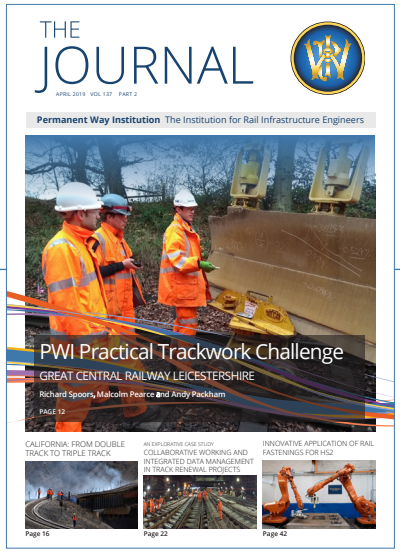

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