Managing change in the delivery of complex projects: Configuration management, asset information and 'big data'

KEYWORDS

- **Complex projects**
- **Configuration management**
- **Change**
- **Asset management**

Article Highlight:

This article provides insight into how change is managed in three organisations delivering complex projects – Airbus, CERN and Crossrail – and how those methods are evolving in the era of 'big data'. It has been taken from the International Journal of Project Management.

What does the paper cover?

The paper starts from the idea that asset information, as well as physical products, are becoming a deliverable of complex projects. As digital technologies such as mobile hardware, cloud computing and integrated software become increasingly used in project delivery, they are changing established approaches, enabling more rapid and agile forms of organisation, but they bring new challenges.

The new approaches to project management are being developed in industries such as consumer electronics and biotechnology, which operate in dynamic situations where data analytics and visualisation using large digital data-sets provide the basis for more responsive, flexible and real-time decision-making. But how can organisations manage complex projects in an era of 'big data'?

Complex projects are high-tech, capital-intensive engineering projects that are of a significant scale, relatively long duration and require firms to work collaboratively. Information about complex product systems is developed across multiple firms, involving diverse professions and trades as these organisations interact through digital systems.

The paper considers the emerging new practices of managing change in complex projects as asset information is becoming a project deliverable, and as internal and external data-sets become linked. There is a tension between the need for control, to manage the configuration of complex systems (particularly in regulated and safety-critical industries), and the responsive, flexible and real-time decision-making implied by new approaches to project management.

Methodology:

This paper analysed the change management practices used by Airbus, CERN and Crossrail using a combination of desk-based review, interviews, visits and a cross-case workshop. It then compared the findings to discover how the organisations delivered complex projects using digital technologies to manage the large amounts of data involved in each industry.

Research findings:

Each of the three organisations studied have different levels of experience of configuration management, specifically:

1. Airbus
The aircraft manufacturer has mature processes and systems, with interest in leading development of future systems to manage and control the growing amount of data produced in the delivery of complex products.

2. CERN
The European organisation for nuclear research introduced configuration management in the 1990s. CERN has ongoing initiatives to update processes of change control of large data sets, has processes in place to manage information on assets through the supply chain, and is formalising feedback from operation and maintenance teams as input for new designs.

3. Crossrail
Established in 2008 to deliver a new 118km rail route through central London, Crossrail is a complex but temporary organisation. It has a configuration management team and has drawn on industry standards to rapidly embed configuration management processes in the delivery of asset information.

The regulated nature of each of the industries (aerospace, nuclear research and civil engineering) means these organisations all need to be able to track configuration items in order to revisit designs and comply with future regulation on safety-critical facilities.

Conclusions:

- All three organisations studied use hierarchical, asynchronous and sequential processes to manage change. Therefore, the unstructured nature of 'big data' presents challenges to complex projects that deliver assets.

- 'Big data' challenges existing approaches to ensuring the integrity of assets in regulated and safety critical environments, forcing new ways of thinking and doing.

- There may be situations in which managers can benefit from 'big data' to implement new approaches in order to understand future scenarios. But they must maintain the validity of the information on which the delivery of complex product systems rely.

Significance of the research:

The paper exposes the limits to flexibility in complex projects, as well as the challenges of managing change. It considers the evolving nature of configuration management, the potential use of analytics on complex projects, and the implications for research and practice.

Comments from authors:

Since this article was published, the management of complex projects continues to be transformed through the use of digital data – indeed the questions about configuration management, verification and validation are more important today.

Digital data is bringing professions into contact in new ways, and changing the nature of their work in profound ways with, for example, new connections across the life-cycle such that data on the operation of complex projects can inform design. The research landscape is also changing: The first author is now leading a grand challenge on 'Data-driven design under uncertainty' as part of the Lloyds Register Foundation/Alan Turing Institute 'Data-centric engineering' research programme.

Complete article

The original version of this article was published in the International Journal of Project Management, Vol number 34, Issue 2, February 2016, J. Whyte, A. Stasis, C. Lindkvist, Vol number 34.2, (2016), p.339–351. It can be accessed via:
sciencedirect.com/science/article/pii/S0263786315000393

For further information please visit **apm.org.uk/research**. Please contact us with your views and suggestions at **research@apm.org.uk**.

apm RESEARCH

Glossary:

Configuration management	A process for establishing and maintaining consistency of a product's performance, functional, and physical attributes with its requirements, design, and operational information throughout its life.
Big data	Extremely large data-sets that may be used to reveal patterns, trends and associations.
Configuration items	Sub-systems or components that have value to the organisation, in which changes will often have systemic consequences on the function or layout of other items within the product structure and hierarchy.