

CROSSRAIL

MANAGING INFORMATION
IN MAJOR INFRASTRUCTURE PROJECTS

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Introduction

As part of the University of Hertfordshire MBA programme, students have been tasked to identify, research and study a project management issue or story, that has occurred on a real project.

In light of the recent developments and media awareness, given my interest in ICT and in major infrastructure projects, I decided to analyse the information management aspects of a Crossrail project.

Crossrail was initially introduced in 2005, was fully supported by the UK government through Crossrail Bill in 2009 and is due to enter service in 2019. The project claims to be “Europe’s largest construction project” and it includes upgrading 30 existing rail stations and creating 10 new ones (Crossrail, 2017).

Given the size and the duration of the project, I deemed it important to research and study the techniques employed by the project team, to manage information and assure a smooth and consistent information flow at all levels from senior management to field operatives.

It is also important to study the topic given its iconic image and mediatic impact it has on Britain, as well as the benefits claimed it will provide by connecting two opposite sides of London (East and West), effectively enabling commuters to approach job markets which are now accessible as a result of the changes being made.

It is also important to highlight the connection of Heathrow towards West London and Stansted towards East London - meaning Crossrail will allow residents on one side of London to access an airport located in the other side.

Although the benefits are substantial, the purpose of this paper is to analyse the information management aspect and whether Crossrail can be considered a success or otherwise.

The Programme

The Giant

Crossrail project initiated in 2005 and was initially awarded with £3.33bn funding (Crossrail, 2017), of which 78% was allocated to joint ventures (£2.64bn) and 22% was allocated to independent suppliers (£796m).

The total allocation made by the government, paved way for a mixture of partnerships between Crossrail Limited, Network Rail as future maintainer for the infrastructure and multiple design and build agreements, generating over 60 tenders for main construction work, 24 consultancy frameworks for long term development and over 31 advanced works contracts for activities such as investigative work, feasibility studies, etc. (Simpson, 2016).

The most complex 12 tenders ranged their values between £62.2m and £676.9m and were allocated to joint ventures of 2 or 3 well known construction giants (Phillips, 2015) such as BAM and Kier, mobilising a total of 55,000 full time roles (Crossrail, 2017). The service is expected to enter production in 2019.

With over 100 large consultancies and construction companies employed to design and deliver Crossrail and over 3000 small and medium companies subcontracted to assist with resources and equipment between 2005 and 2019, one is asking how Crossrail will address the information management and knowledge retention elements of the project and whether these will form a successful story for Crossrail.

Leadership

Given the multilayer organisational structure and the number of employees engaged in the programme, Crossrail is distributed on 5 levels: strategic, programme, geographical area, project and contractor (Crossrail, 2017). Each layer focuses on a limited audience where interacting entities function as independent systems having inputs and outputs, as described by the Systems Thinking theory (Tate, 2009).

This means that the level of influence exerted through basic situational leadership behaviours (Blanchard and Hersey, 1977) including all styles from directing to coaching, would only influence nearby connections and would not be enough to maintain not even a fraction of the programme, in sync.

In terms of the Supply Chain and Resourcing aspects, Crossrail emphasises on individual skills and capabilities recruited to be fit for the purpose and to only deliver in safe conditions (Crossrail, 2017), whilst fully aligned with Network Rail's motto: "Everyone home safe everyday" (Network Rail, 2017).

The company's focus on safety and individual's competencies is also reflected in the 10 strict organisational Safety Rules (Network Rail, 2014), the company is suggesting that this form of authoritarian leadership style (Tannenbaum and Schimdt, 1973) is more suitable for the organisation, where the leader makes decisions and informs its followers through instruction.

The skill-based approach relates to the transactional leadership paradigm specific to the period 1970-1980, which contains very little incentive for charismatic, inspirational, transformational leadership.

The transactional leadership model is suitable in a military environment where the focus is on giving clear strict short orders to be executed with immediate effect at maximum potential, the transformational leadership model would drive through inspiration, would focus on mentorship and supporting the team, consulting the team and investing in others and empowering the team members in making decisions.

Although very effective in military conditions, due to the focus on precision and immediate or short-term effects, authoritarian approaches and transactional leadership models will likely pass influence only through corrective actions and may not be suitable for 14 years long engineering programs to which any member of the public with no military experience can join.

From the information management perspective, a sign of failure would be represented by breaches in communication or information flows. One of the purposes of this paper is to analyse Crossrail's structure in light with the recent academic studies, with the view to establish if from the above angle, the project can be classified as a success or otherwise.

Given the programme embraced a transactional leadership model, it may be argued that this decision would do a disservice to the taxpayer, by not choosing an inspirational leadership framework focused on continuous improvement, motivation, research and support.

Management

For engaging with over 100 large consultancies and construction companies, for employing directly and indirectly over 55,000 full time staff (Crossrail, 2017), the project will rely on resources recruited, trained and exposed to a variety of environments, starting from training schools, universities or workplaces.

The element of diversity also includes international talent (Home Office, 2017) as published by official governmental sources and backed by The Construction Industry Training Board which claims that 1 in 8 construction workers is non-UK (rising to half in London where Crossrail is located), and 1 in 4 employers directly employs at least one non-UK worker.

Although it is accepted that the construction industry is much wider than the size of Crossrail (in terms of resources), it can be assumed that if the ratio remains the same then one quarter of the 55,000 are non-UK (13,750). In short, one quarter of the total resources engaged in Crossrail

have benefited from a rather diverse work experience, which may include different training, line management and team coordination.

Alongside communication and information interpretation challenges, the above goes to show how vital it is to have a robust information system in place to bypass other challenges around mixed and diverse work experience.

Distributing project information / project knowledge within large diverse teams with the size of Crossrail, requires both exceptional management tools and inspiring leadership behaviors able to consult and resolve as groups (Longman and Mullins, 2005) or through others (Verma and Wideman, 2002), to trigger a sentiment of belonging through constant engagement and appreciation (Maslow, 1943) throughout the entire project lifecycle (Cooke-Davies, 2002). The findings from the previous section, are evidence to the fact that Crossrail employs a more transactional, perhaps rigid, approach (focused on rules and orders), rather than transformational leadership models (driven by inspiration).

Methodology

The highly transactional model employed by Crossrail will require a project management methodology to facilitate the distribution of the information across dozens of parties, to assure uniformity and to facilitate prompt and effective reporting at all levels.

From a variety of methodologies available, including Agile, Waterfall or Prince2, Crossrail embraced GRIP (Governance for Rail and Infrastructure Projects) to govern the entire duration of the project (Office of Rail Regulation, 2012).

GRIP is characterised as a linear project methodology with eight consecutive phases, with the largest phase deemed to capture the entire construction, testing and commissioning activity scheduled between May/2009 (Crossrail, 2017) and 2019. Although there are control mechanisms when progressing from one GRIP phase to another to check alignment with the programme and schedule of delivery, there are no clear processes and procedures defined within a phase.

Therefore, during a period of 10 years in *GRIP Stage 6: Construction, Test and Commission*, evidence shows there are no mechanisms to manage knowledge retention and share project information both vertically and horizontally, to assure equal distribution of project knowledge and emerging information to all contractors delivering works at 40 stations (Crossrail, 2017). Such mechanisms should include capturing and sharing Lessons Learnt, Risk and Issue registers, SWOT reports, site news, information about resources and staff, etc.

Failure to provide an effective dynamic information management system to 55,000 employees, during a period of 10 years would generate small groups of contractors or staff working in isolation, only communicating one way (top-down - through instructions), using the authoritarian leadership model identified above.

Replication of work due to teams working in isolation would lead to operational inefficiencies and resource stretching, which would cause shortfalls in management, shortcuts in processes, which will later normalise and become part of the project culture. A project culture is likely to reject elements which are not aligned with the values advertised by the culture customs.

This is evidence to the fact that a methodology not fit for purpose, which does not provide the right tools to control and does not regulate information flow between staff and contractors at all times, is likely to have a more negative impact over the lifespan of the project.

Agile methodologies (Highsmith, 2001) follow a dynamic approach which supports reflection (i.e. Lessons Learnt) and continuous improvement, with self organising teams, it focuses on individuals and interactions, rather than bureaucratic processes and collaboration over than negotiation (The Agile Manifesto, 2001).

Although it can be seen how an Agile approach would be more fit to regulate the information exchanges within Crossrail, to move the focus on individuals and to implement more transformational, inspiring leadership models, previous findings around the focus on regulations and the company's 10 rules, show the overall pressures excerpted by the public-sector member Network Rail of forming a transactional establishment, driven by the execution of orders and instructions.

Another downfall of GRIP is specific to its rigidity to change. GRIP does not offer the means to amend any details of Crossrail developed in Stage 4 (Single Option Development - during 2005-2008), during Stage 6 (Construction, Test and Commissioning - during 2009-2019) (Network Rail, 2017), meaning that if there is not enough slag within the schedule of works or within the delivery Gantt schedule, any emerging change will pose a risk of delaying the programme.

Changes can be triggered in a variety of ways: through stakeholders (e.g. Great Western Railway, Heathrow Express, Department of Transport, other train operating companies), industry regulations (Construction Design and Management Regulations, most recent issue dated 2015), technology improvement and modernisation (i.e. use of cloud technology, tablets), handovers, Lessons Learnt and Pilot Projects (identifying more effective ways of doing things) or external factors such as political (labour market movement, restrictions) or ecological (the use of electric instead of diesel trains).

GRIP is a linear methodology which does not allow reverting to a previous stage. This means that any learning generated by transformation of experience, not only will not be transferred to other teams of the programme (due to lack of communication channels to circulate information horizontally at other 40 stations) but is very unlikely to allow the members who experienced, reflected and concluded they've learnt something new to actually have the chance to implement what they've learnt (Kolb, 1984). This is simply because they already have 10 years of instructions to execute, leaving no room for reflection and corrective actions.

The above example of discontinued information flow is a characteristic of a transactional leadership model, it is confirmed by GRIP and it diminishes benefits of the Systems Thinking integration (APM, 2000, 2018) by not allowing outputs of one system to inform another. This not only avoids operational efficiencies, but it also hinders opportunities such as learning from other's mistakes or developments, etc.

Crossrail employs 31 Principal Contractors between 2009 and 2019 to deliver simultaneous construction work on 40 stations (Crossrail, 2017). Given the drawbacks identified in the project methodology, around poor communication between hundreds of local teams, formed by 31 construction giants, one who seeks answers in academia will find that a group of projects (which can be associated with the the 40 stations) should only be managed in a coordinated fashion in order to achieve benefits and never in isolation from each other (Turner, 1992).

This raises the question of whether Crossrail is a programme or a project, if the government undermined the complexity of the initiative, or if the government did not consider coordinated management of all 31 construction giants as a strategic option to achieve the benefits sought (OGC, 2000).

IC&T

Crossrail released indicative values for the information exchanged in technical formats between the project team and design consultancies or principal contractors, including 500,000 technical drawings and around 5,000,000 documents. Crossrail have also provided interlinked databases for document management called eB and ProjectWise which act as document repositories (Crossrail, 2017).

However, given that the design stage of Crossrail took place between 2006 and 2008, one would look for evidence of integration of modern technology such as but not limited to: cloud based systems for sharing and collaboration, the use of tablets for site accessibility, the use of versioning and the integration of change management within the digital space to track impacts on costs and resources, business intelligence to forecast trends improve governance and many other avenues which look unexplored by Crossrail as a result of having to follow a programme designed over 10 years ago. There is no evidence of modern technology being integrated in Crossrail.

Another risk emerges from the general workflow practiced within the project where design consultancies produce technical drawings and preparatory documentation, which will later be issued to Network Rail (who delivers the Crossrail project) for acceptance which is then issued to the principal contractor for construction. Information published by Crossrail indicates that over 30 contracts for design and preparatory work and over 100 contracts for construction, whilst Network Rail or Crossrail remains one single entity. This questions whether this workflow creates a bottleneck and creates too much pressure on Network Rail for being a single point of contact yet having to liaise with both ends: the designer and the contractor. Further research reveals Crossrail did create partnerships with companies such as Bechtel which staffed Network Rail with project managers to cope with the surplus workload (Bechtel, 2015).

Although not related to ICT, the one-way work flow: principal designer > Network Rail > principal contractor, raises a fundamental question about effectiveness. In Crossrail's case the delivery stage is expected to last for 10 years. This means that various changes can take place from the design stage (<2008) to the point of construction (2009-2019+). Given the policy advocated by GRIP, technical designs are to be issued by a principal designer at the design stage, approved by Network Rail and then issued further to a principal contractor at the construction stage. One would ask whether variations will hinder the construction of all original designs and if so, how will these variations be captured in the original drawings, given this happens 10 years later (in the construction stage) when there will be no contractual relation between the design consultancy and Network Rail/Crossrail.

Precedent

In order to analyse Crossrail's project management mechanisms, it became necessary to observe similar projects delivered by other entities than Network Rail and to compare the differences or establish key similarities.

Central Japan Railway Company ("CJRC") leads a national consortium which specialises in both research, design and construction and are now working on expanding their national magnetic levitation ("maglev") based network between Nagoya and Tokyo by 2027.

By removing contractual barriers, since the 1970s CJRC focused on utilising technology to increase performance, making it now possible for maglev technology to reach speeds of up to 375 mph (Central Japan Railway Company, 2017, 2015, 2018).

Although construction costs represents the biggest barrier, the expansion programme will be financed by both private sector (track areas of the project) and public sector (station buildings and facilities), in order to maintain its competitiveness and recruit the the best talent available at the national level.

The above findings show that by shifting the focus on team collaboration and by removing contractual barriers (introduced by Crossrail through the introduction of 100 large consultancies and principal contractors), by having resources, knowledge and information in-house and by stimulating competitiveness and performance, the programme can be much more effective and can incorporate areas such as research and continuous improvement (Kaizen) which are unknown areas to Crossrail's project methodology.

Conclusion

Success in projects can be categorised in 4 levels - at the project management level, at the project level, at the business level and in terms of future potential (Dalcher, 2017).

Crossrail will remain a project in development until 2019, unless any time extensions are applied. Despite being originally allocated with £3.33bn (Crossrail, 2017), reports dated in 2013 show the cost of construction was increased almost 5 times to £14.8bn (Thomas, 2013).

The increase of capital expenditure can be justified based on the inefficiencies and missed opportunities captured in this paper, highlighting the impact of choosing an inadequate project management methodology, focusing on efficiency instead of effectiveness or undermining the importance of information management, knowledge retention and data distribution across all teams in the programme.

The research shows Crossrail has several insufficiencies around information management, induced by its own project methodology for not being change-friendly and for not facilitating reflection and continuous improvement. The shortfalls also include staff pressures caused by having to liaise entre work schedules between principal designers and principal contractors and the use of depreciated software support whilst seeking to aid programme delivery.

In conclusion I would argue that Crossrail did not employ the best project methodologies and techniques to manage information and this is being reflected in the 2013 CAPEX with a value 5 times bigger than the initial allocation of £3.33bn.

Reflection

Managing Projects was a very interesting module which provided a complete package of knowledge about the major project management methodologies used within the industries including details about stages, risks, suitability i.e. Agile vs. Prince2, etc. I particularly liked the debates we had around success and the successfulness of a project and how this variable can fluctuate depending on the perspective embraced (i.e. stakeholder, client, project manager, etc.). I am satisfied I made a right decision to attend the Managing Project's optional module and I seek to continue reading the rest of the reading list, to expand my knowledge around project conflicts and stakeholder management particularly.

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