

Rail Value for Money Study
**Whole System Programme Management
Final Report**

Contract Number – RVFM10004

ISSUE 1.4
25th May 2011



Although this report was commissioned jointly by the Department for Transport (DfT) and the Office of Rail Regulation (ORR), the findings and recommendations are those of the authors and do not necessarily represent the views of the DfT and the ORR. While the DfT and the ORR have made all reasonable efforts to ensure the information in this document is accurate, the DfT and the ORR do not guarantee the accuracy, completeness or usefulness of that information; and cannot accept liability for any loss or damages of any kind resulting from reliance on the information or guidance this document contains.

Department for Transport
Great Minster House
76 Marsham Street
London SW1P 4DR
Telephone: 0300 330 3000
Website: www.dft.gov.uk

Office of Rail Regulation
1 Kemble Street
London
WC2B 4AN
Telephone: 020 7282 2000
Website: www.rail-reg.gov.uk

© Crown copyright, 2011, except where otherwise stated

You may re-use this information (not including logos or third-party material) free of charge in any format or medium, under the terms of the Open Government Licence. To view this licence, visit www.nationalarchives.gov.uk/doc/open-government-licence/ or write to the Information Policy Team, The National Archives, Kew, London TW9 4DU, or e-mail: psi@nationalarchives.gsi.gov.uk.

To reproduce third-party material you need to obtain permission from the copyright holders concerned.

Table of contents

Section

1.	Executive Summary	5
1.1.	Outline of the Model	5
1.2.	Assessment of GB Rail	6
1.3.	The Way Forward	7
1.4.	Potential Savings	7
2.	Introduction	9
2.1.	Asset Management and Supply Chain Management Benchmarking	9
2.2.	Whole System Programme Management Study Scope	12
3.	Approach and Background	14
3.1.	Iterative Model Development	16
4.	Whole System Programme Management	18
4.1.	Impelling Purpose	19
4.2.	Governance and Stakeholder Management	20
4.3.	The Integrated Project Team	21
4.4.	Whole-life Design Assurance	22
5.	Case Studies	25
5.1.	Thameslink	25
5.2.	Crossrail	28
5.3.	GSM-R	31
5.4.	London 2012 Olympic and Paralympic Games	33
5.5.	Strategic Freight Network	35
5.6.	HS1	36
6.	Assessment of GB Rail	39
6.1.	High-level OGC P3M3® Assessment	39
6.2.	Whole System Programme Management Assessment	40
7.	Implementation	42
7.1.	Whole System Programme Management Maturity Model	42
7.2.	Improvement Enablers and Barriers	44
7.3.	Tactical Improvement Plans	46
7.4.	Strategic Improvement Plans	48
7.5.	Implementation Outline Option	49
8.	Conclusions	53
8.1.	Potential for Savings	54
9.	Appendices	57

Appendices

Appendix A.	References	58
Appendix B.	Interview Programme	60
Appendix C.	Thameslink System Migration Plan	61
Appendix D.	Programme Management Background	63
D.1.	Managing Successful Programmes	64
Appendix E.	Our Approach and Incremental Models	68
E.1.	Model Evolution	69
E.2.	Whole System Programme Management Wooden Man Model	72
E.3.	Whole System Programme Management Straw Man Model	81

1. Executive Summary

[1:1] The Rail Value for Money team commissioned Atkins to develop whole system programme management into practical approaches that reduce all aspects of costs associated with delivering major enhancements within GB rail. (e.g. Crossrail, Thameslink, High Speed 2, Strategic Freight Network etc).

[1:2] Our approach was to develop a model of good practice, test this with stakeholders to elicit the current state of GB Rail practice and identify those areas/elements that represent the greatest opportunity to improve. In summary, our approach was to seek the 20% of good practice that will deliver the 80% of the benefit.

[1:3] The conclusion of this – albeit accelerated – study confirmed that, while there are noteworthy pockets of good practice, the GB Rail industry has significant scope to improve in whole system programme management. The study finds that the industry has the drive and capability to make these improvements and that they will substantially improve the value for money – **reducing capital costs by 6-18% and avoiding overrun costs of 17-30%**, which are likely to result from overruns if no action is taken.

1.1. Outline of the Model

[1:4] The model combines MSP™ (the government's programme management standard) with good practice relating to the creation and delivery of complex engineering solutions and systems. This is the fusion of pragmatic wisdom in:

- organisational transformation, optimised for delivering high-level, often qualitative, strategic goals in politically, economically and socially changing environments, and
- whole system engineering, that assures the right problem is solved, the optimum solution is selected and the requirements are correctly defined.

[1:5] The central tenet of good practice is that **programmes deliver outcomes**, which are high-level, often qualitative, strategic goals; these outcomes are quantified in the form of benefits. In contrast, **projects deliver outputs**. Thameslink, for example, is a programme which delivers outcomes (increased north/south passenger capacity through London, supporting economic growth in London and the southeast). Projects within the Thameslink programme include the new rolling stock, reconfigured stations, and longer platforms. The projects deliver outputs which when integrated deliver the programme's outcomes.

[1:6] The model developed a number of pillars, each representing an aspect of good practice. The study has used a subjective consensus approach to distil these down to just four, which present the greatest opportunity for delivering value to GB Rail; the remainder being parked for future development. The four selected pillars have been developed into an initial maturity model that can be used to support improvement. The model may be summarised as requiring projects to have:

- an aligned, agreed and succinct driving or **Impelling Purpose**;
- effective and appropriate **Governance**, including senior **Management of Stakeholders**;
- a highly-effective, dedicated, core **Integrated Programme Team**; and
- **Whole-life Design Assurance**, to provide confidence that the programme benefits will be delivered and to quantify (and optimise) the effect on **railway system whole-life costs**.

[1:7] Programmes deliver outcomes and a rail programme's purpose needs to be expressed in terms of transportation outcomes. The purpose provides overall direction; a coordinating and uniting vision for the whole team. Therefore, the impelling purpose requires clarity of industry strategy and if necessary it must be changed to remain consistent to that strategy throughout the programme lifecycle.

[1:8] Governance requires an empowered and representative Sponsors Board with representation from the funder(s) and directly involved stakeholders, including at least one representative of a passenger or freight customer facing organisation. The Sponsors Board must be incentivised to deliver value for money, assessed as a lowest whole-life cost vs. affordability trade-off, and enforced through a gated lifecycle, which should be standard for all GB Rail enhancement programmes. The following four gates are proposed as the optimum set, which aligns with HM Treasury processes:

- **Entry Gate – Authority to Analyse Options** – demonstration of strategic alignment, a robust case for change and an initial simple analysis of a wide range of options.
- **Initial Gate – Authority to Develop an Option** – identify a preferred concept solution which demonstrates value for money, having fully evaluated options, trade-offs and risk reduction opportunities. This gate confirms affordability, procurement strategy and management arrangements for successful benefits realisation.
- **Main Gate – Authority to Invest** – demonstration of a robust understanding of the investment costs, risks and the whole-life costs of the programme, as well as confirmation of business case and affordability.
- **Final Gate – Authority to Transfer Accountability** – demonstration of benefits and acceptance of handover to the operator and maintainer.

[1:9] The Integrated Programme Team must be **led by a driven and charismatic leader who is able to build effective working relationships with the senior stakeholders**, empowered to deliver the whole programme, and it must have the right balance of skills, capability and experience from across the railway domain. The team must include technical, operational, analysis and commercial skills and experience, with explicit effort directed towards forming and maintaining a highly-effective team.

[1:10] Programmes must understand and manage how they will **deliver the required outcomes and optimise the effect they have on rail system whole-life costs**. They must rigorously and hierarchically structure the requirements and interfaces, so that each project, sub-project and component of the programme is clear what is required, via which interface and why. The whole-life cost of enhancements has traditionally been managed through standards. However, in order to develop optimal designs, it will be necessary to change culture and behaviours to **design to the requirements** and as opposed to designing to specifications and standards.

1.2. Assessment of GB Rail

[1:11] The study suggests that overall the GB Rail industry is at level 1 of a five step whole system programme management maturity model – where level 1 is ‘awareness’ (the lowest level) and level 5 is ‘optimised’ (the highest level). This assessment applies a single organisation model to the whole industry and is specifically directed at ‘programme management’, as distinct and different to ‘project management’.

[1:12] A significant barrier is the **generally poor appreciation of the difference between a project and a programme**. Therefore, while all programmes recognise the importance of having some clear mission statement, most do not articulate a transportation purpose in terms of the outcomes and benefits required from the programme.

[1:13] The fragmented nature of the industry is frustrating the adoption of consistent whole programme lifecycle thinking. It is normal for different elements of a programme to be delivered, funded and governed separately – for example, Thameslink and IEP. As a result, benefits are limited as teams are constrained to only have partial responsibility and authority.

[1:14] The industry still largely relies on peer and expert review approaches to assurance, and typically employs standards to manage whole-life costs. There was little evidence presented of programmes understanding the current or future whole-life cost, or actively managing this as an outcome.

1.3. The Way Forward

[1:15] The nature of major programmes is that they last many years, so this study has developed a two tier approach to improvement. This comprises tactical steps that should be taken to gain benefits in the short to medium term, and strategic plans, which will secure longer-term, sustainable savings.

[1:16] The principle **tactical improvement recommendations** are:

- Create an improvement programme and cross-industry implementation team under the guidance of a cross-industry Sponsors Board. The implementation team should finalise and pilot the maturity model, and classify all existing major cross-industry programmes in order to identify those which present the greatest opportunity and capability to improve and deliver benefits.
- Establish the new governance framework, including the new programme management lifecycle, sponsors board terms of reference and any necessary supporting models or tools.
- The selected programmes should undertake the maturity assessment, develop and implement improvement plans, under the governance of the Sponsors Board and supported by the implementation team.

[1:17] These tactical recommendations should be complete and realising benefits within 12 months.

[1:18] The principle **strategic improvement recommendations** are to:

- Investigate how industry structure can best facilitate the provision of clear, long-term strategy and direction for the industry;
- Allow major cross-industry programmes to be funded and governed as a whole, such that whole-life and whole system trade-offs can be employed to maximise value for money; and
- Empower programmes with the clear and unobstructed authority to deliver major cross-industry programmes, without undue interference from stakeholders.

[1:19] It is outside the scope of this study to consider the overall industry and commercial structures that would achieve this. However, based on the good practice described in MSP™ and the practice observed, an outline of the essential roles is proposed as an enabling piece of the overall solution.

1.4. Potential Savings

[1:20] The Infrastructure UK Cost Review (1) estimates that infrastructure programmes across the UK can save at least 15% of capital cost, through adopting a range of good practice – all of which is consistent with the recommendations of this study.

[1:21] Atkins' assessment is that there is a range of likely potential savings, which is dependent on the phase of the programme as shown in Figure 1-1. There is also strong evidence that implementing these recommendations will result in significant cost avoidance.

[1:22] To value the potential savings, it is necessary to make an estimate of the potential future capital spend. Given that a large proportion of the investment in the next 20 years is linked to programmes that, to some extent are already in progress, savings at the top end of the range indicated are unlikely to be achievable. Therefore, our judgement is that the **savings and cost avoidance estimate previously indicated by Atkins are validated by this study** (2).

[1:23] Extrapolating these savings, based on an assumed major GB Rail enhancements expenditure in the next 20 years of £40bn, of which £20bn is already in the delivery phase, gives (note: reduced overspend may not be added to savings, as this is a cost or scope cut avoidance):

- Savings in capital cost of 6-18%: £4bn (±£1.6bn)
- Reduced overspend of 17-30%: £9bn (±£2bn)

[1:24] We recommend that the findings of this study should be considered against, and validated with, the findings of the wider Rail Value for Money Study and other relevant work. We note that great caution should be exercised in combining these potential savings with those from other work streams, as there is likely to be a large degree of overlap.

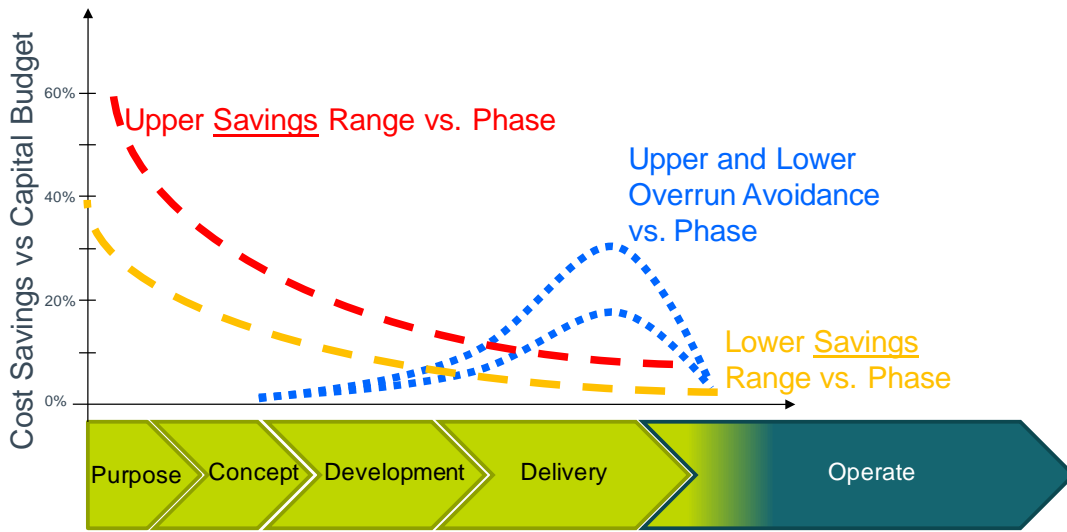


Figure 1-1: Potential Benefits

2. Introduction

[2:1] The Secretary of State for Transport announced an independent study into Rail Value for Money (RVfM) of the GB rail industry on 9 December 2009, jointly sponsored with the ORR. The aim of the study is to examine the railway and make recommendations to improve its value for money so as to build a financially and organisationally sustainable platform for future growth (3).

[2:2] The Rail Value for Money Study identified asset management and supply chain management as two key areas where there is significant opportunity for improving rail value for money. Work undertaken by Atkins suggested that whole system programme management represented a significant value releasing opportunity. This report details the result of an additional, focused study that investigated this proposition further.

[2:3] This section provides a summary of the findings and conclusions of the asset management and supply chain management report. Section 3 outlines our approach to this study and Section 4 details the elements of whole system programme management that represent the greatest opportunity for GB rail to improve value for money. Section 5 comprises a number of case studies that illustrate current practice and how it compares to good practice. In Section 6 we provide a whole industry assessment of performance against good practice.

[2:4] In support of the integration of this work with the other RVfM work packages, to form an overall implementation plan and investment case, Section 7 provides advice in respect of enablers and barriers to implementation and some options for possible implementation and organisational approaches. The report concludes with a refinement of the potential savings possible as a result of successfully improving the practice of whole system programme management in GB Rail.

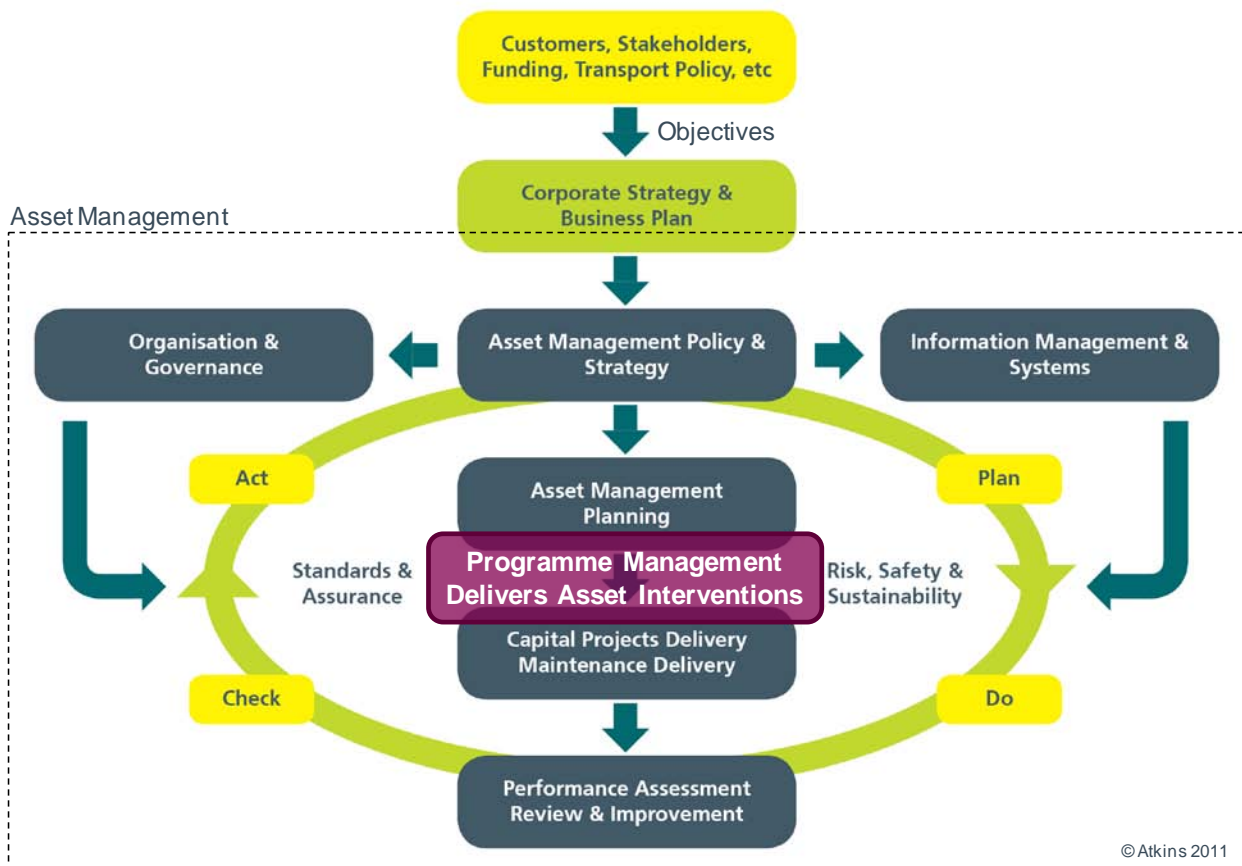


Figure 2-1: Asset Management – Optimally and Sustainably Achieving Corporate Strategy

2.1. Asset Management and Supply Chain Management Benchmarking

[2:5] The independent RVfM team commissioned several studies as part of Phase 2a of their work; one of which, by Atkins, assessed asset management and supply chain management across the

GB rail industry. Amongst other things, the Atkins work concluded there were significant savings to be made by improving whole system programme management of major enhancements (2; 4).

[2:6] Asset management comprises the systematic and coordinated activities and practices through which an organisation optimally and sustainably manages its physical assets, and their associated performance, risks and expenditures over their lifecycle for the purpose of achieving its organisational strategic plan (5). Supply chain management similarly seeks to optimally and sustainably manage the supply chain to balance quality, capability, risk and cost of supply in the context of the organisation's objectives.

[2:7] Programme management plays a pivotal role in successful asset management and, during execution, it typically relies heavily on the performance of supply chain management. Figure 2-1 is a graphical representation of asset management; programme management fits in the centre of the improvement cycle, where it is employed to implement asset plans through interventions that balance the ever-present cost, risk and outcome (performance) paradigm. Hence, programme management emerged as a principal value enabling theme for Rail Value for Money.

Box 2-1: IUK "Evidence and example from the investigation indicate that when objectives can be aligned between clients and through all levels of the supply chain, innovation can be harnessed, reducing out-turn costs to clients and safeguarding profits for industry, for example, the British Airports Authority's [sic] partnering model for Heathrow Terminal 5" (1)

[2:8] Atkins concluded, based on comparisons with other industry sectors and rail organisations outside the UK, coupled with analysis of accepted 'good practice', that there is much room for improvement in asset management and supply chain management, with initial indications suggesting potential annual **savings could be £1.25bn (±£0.57bn) pa** after 5 years (nominally 10% savings pa).

[2:9] The principal findings relating to both asset management and supply chain can be broadly summarised as follows:

- Objectives that provide long-term direction and purpose are not set at an industry level and consequently lower level objectives are poorly aligned.
- There is inconsistent application of whole system good practice.
- There is inconsistent application of good practice whole-life programme management techniques.

[2:10] Overall Atkins found that Government struggles to set the right level of specification, stick by it and see it appropriately delivered through the industry.

[2:11] Atkins found that a lack of clarity and stability of whole railway objectives leads to differing expectations of the degree of change within enhancement projects. Industry structure and misaligned planning timescales led to programmes with complex interfaces or only partial system scope; this results in solution-focused project requirements, as opposed to output focused requirements. It is important to note that a lack of accurate and comprehensive asset knowledge and cost information limits the ability to make robust and enduring whole system, whole-life trade-offs. Route Utilisation Strategies currently investigate broad options to assess value for money. However, following the HLOS and Periodic Review process, programmes are often severed into separate infrastructure and operational projects.

[2:12] No evidence was presented to demonstrate a universally applied test or criteria to assess value for money for GB rail enhancements or that there is a whole rail business case or owner. Neither GRIP nor industry processes require projects to review and reconfirm their cost benefit ratio once they are initiated. There is evidence that the different commercial, contractual and regulatory pressures applied to organisations, which share critical technical interfaces, leads them to have their own different project governance arrangements. The complex industry structure means in many cases the benefits of an investment are realised remotely from the necessary

investment source which is likely to stifle innovation even with common whole rail benefit to cost ratio assessment criteria.

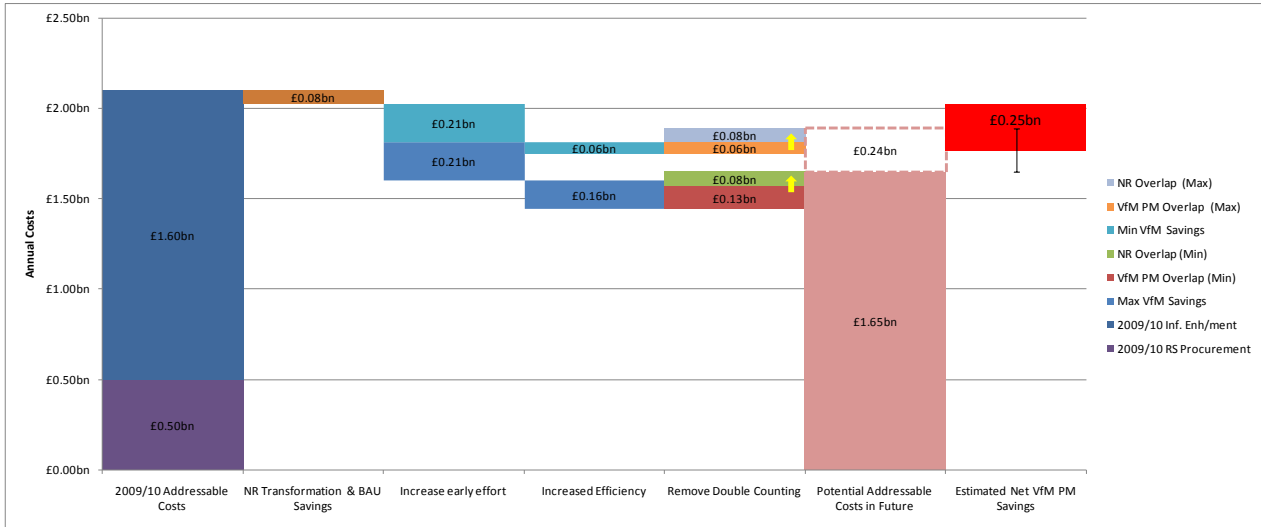


Figure 2-2: Summary of Potential Whole System Programme Management Annual Savings

[2:13] Over prescription is apparent in a number of areas with a tendency for the industry to fasten onto solutions too early and before all the options have been considered; for example, in the procurement requirements being introduced by the DfT for new rolling stock. **As a result enhancements become defined in terms of the solution – rather than the outcome or benefit.** The evidence suggests decisions are made without necessarily considering a whole systems cost benefit analysis (6). This reduces the scope for innovation and significantly restricts the ability to deliver value.

[2:14] The potential savings from improving the industries approach to whole system programme management, based on the 09/10 level of enhancement spend of £2.1bn pa, were estimated to be £0.25bn (±£0.12bn) pa. This savings estimate is based on a number of assumptions and is net of the savings that Network Rail is planning to make as part of its Efficient Infrastructure Delivery Transformation Programme, as depicted in Figure 2-2.

[2:15] These potential savings were arrived at, based on the experience, judgement and were informed the following public and shared evidence:

- The ORR Reporter found that, over a small sample of similar projects TOCs, which typically have a more output and value focused project approach, are 73% efficient at capital investment and Network Rail is 58% efficient (7). In other words, TOCs spend 15% more of every pound they invest on assets on the ground.
- Devoting appropriate effort to early project phases – International Council for Systems Engineering data shows that effective early investment on clarity of objectives and evaluation of options can lead a reduction in cost of up to 20% and an increase in on-time delivery of 50% (8).
- Prior to 2009, project expenditure on major infrastructure enhancements up to the end of GRIP 3 was on average 4-5% of the total, which is recognised by Network Rail as being below recognised industry benchmarks of around 10%; it is recognised that around 60% of a programmes whole-life cost is fixed by the first 15% of spend (9). This is being addressed by the Transformation Programme.
- Using requirements management tools to manage requirements and interfaces on major rail infrastructure projects, Carillion have demonstrated up to 5% savings in cost, in addition to valuable time savings
- In Kassel, Germany, a comprehensive and pragmatic approach was taken to develop a minimal set of standards for the tram-train system, which balanced safety and the need for standardisation to support the supply chain. This has resulted in a sustainable rural/regional railway that has achieved significant cost savings.

[2:16] This assessment is supported by the recent IUK report (10), from which Figure 2-3 is taken. This presents data collected by EIB and used to compare average cost of rail projects in the EU and USA.

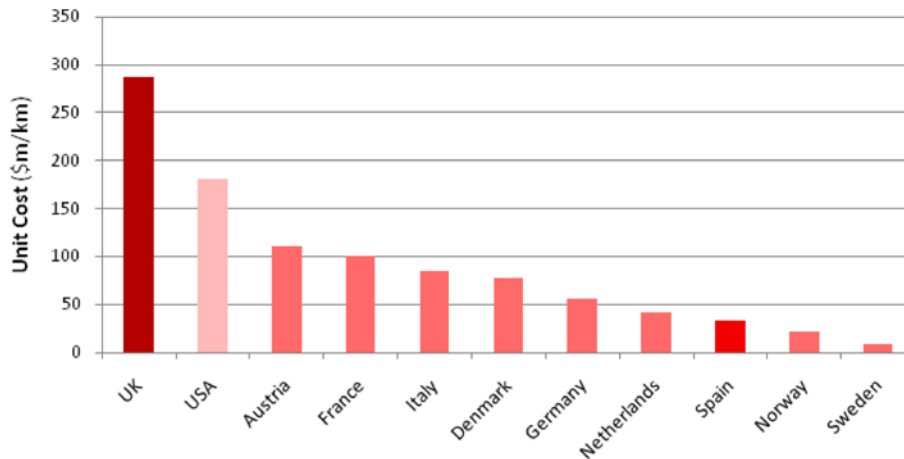


Figure 2-3: Normalised Unit Costs for Rail Projects in EU and USA (EIB/IUK)

[2:17] It has been reported that typically GB rail infrastructure projects overrun by 67%, against initial (GRIP 1) estimates (11). This is comparable to the situation reported by Bernard Gray (12) where the application of Smart Acquisition in defence procurement the MOD, which incorporated whole system approaches and integration programme teams, led to a reduction in average cost overruns from 53% to 25%.

[2:18] Therefore, it is suggested that improvements in whole system programme management in GB Rail offers the additional benefits of cost avoidance (due to overruns) of in the order of £350 - £630m pa, or 17-30% of the total annual spend of £2.1bn (based on a reduction of 25-50% in the most likely 60% overspend).

[2:19] It should be noted that the Atkins report was based on the CP4 enhancements budget and a smoothed approximation of the required annual rolling stock spend of £0.5bn (based on the need for 400 vehicles per year and an estimated cost of £1 to 1.5m per vehicle). This equates to £2.1b pa. This figure excludes the following schemes: Crossrail (£15bn), High Speed 2 (£15bn), IEP (£7bn) and Electrification (£1.1bn).

2.2. Whole System Programme Management Study Scope

[2:20] The RVfM team subsequently commissioned Atkins to further develop these whole system programme management findings into **practical approaches that reduce all aspects of costs associated with delivering major enhancements** within GB rail. The scope of whole system programme management was defined in the brief as:

The application of a whole system approach across GB rail to major enhancement programmes (see definition below). Its application should ensure that GB rail capital investments deliver the intended outcomes with the optimal use of resources.

It shall cover the 'cradle to grave' programme lifecycle, starting with how the problem is first identified, how conceptual alternatives are rigorously tested, how the chosen solution is procured, delivered, commissioned, and how the benefits are tracked and verified when the new assets are in-service.

Major enhancement programmes shall comprise cross-industry and/or cross-route enhancements that would not otherwise be delivered by route-based organisations. Current examples include GSM-R, Kings Cross station upgrade, Strategic Freight Network, ERTMS, Thameslink, etc.

[2:21] We have further defined major enhancement programmes as ‘goal orientated programmes’ (as described further in Appendix D).

[2:22] This work package has run concurrently with a number of other studies that, among other things, looked at the structure of the GB rail industry. Hence this work was directed, wherever possible, to be based on the current railway industry structures and processes. Where the current arrangements have been identified as a barrier to the full delivery of benefits, this has been identified with suggestions of the minimum changes (in terms of structure, governance, culture or any other relevant constraints) necessary to deliver these benefits.

3. Approach and Background

[3:1] This study was delivered in five steps, over an eight week effort period, as shown in Figure 3-1, below:

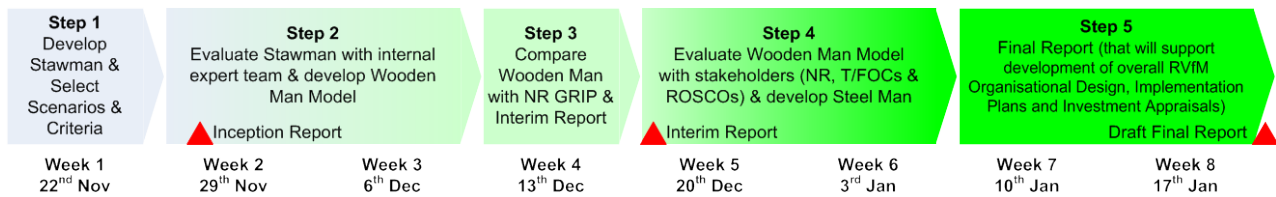


Figure 3-1: 5-Step Study Delivery Plan

[3:2] Our approach was to develop a strawman model of good practice and test this with stakeholders to elicit the current state of GB Rail practice and identify the those areas/elements that represent the greatest opportunity to improve. In summary, our approach was to **seek the 20% of good practice that will deliver the 80% of the benefit.**

[3:3] The initial strawman good practice model was developed based on a number of fundamental assumptions about the nature of programme management and drawing from established good practice. This ensured the study was about application, not invention.

[3:4] The de facto standard for programme management in the UK public sector is OGC's Managing Successful Programmes (MSP™) approach (13); there is evidence that it is widely used in the private sector (14) and in some cases abroad. Hence, we adopted this as our foundation for good practice.

[3:5] MSP defines a programme as:

“a temporary, flexible organisation created to coordinate, direct and oversee the implementation of a set of related projects and activities in order to deliver **outcomes and benefits** related to the organisation's strategic objectives.”

[3:6] MSP defines a project as:

“a temporary organisation, usually existing for a much shorter duration [than a programme], which will **deliver one or more outputs** in accordance with a specific business case. A particular project may be part of a programme.”

[3:7] Therefore, the central tenet of good practice is that **programmes deliver outcomes**, which are high-level, often qualitative, strategic goals; these outcomes are quantified in the form of benefits. In contrast, **projects deliver outputs**. Thameslink, for example, is a programme which delivers outcomes (increased north/south passenger capacity through London, supporting economic growth in London and the southeast). Projects within the Thameslink programme include the new rolling stock, reconfigured stations, and longer platforms. The projects deliver outputs which when integrated deliver the programme's outcomes.

[3:8] The roots of MSP are in IT lead organisational change/transformation, and on occasions it has not entirely shed this heritage. In the development of an MSP programme, while the framework includes all the right principles, there is little reference to trading-off alternative technical solutions. For major infrastructure projects, the decisions made at this early stage are crucial, as commonly depicted in the Cost Influence Curve, as shown in Figure 3-2; put another way, the selecting the conceptual solution will fix in excess of 60% of the whole-life cost (9) and is therefore a decision that should be weighed carefully. For example, increased rail capacity may be achieved by increasing the infrastructure's capacity to accommodate more trains, increasing the trains' capacity to carry more passengers, or changing the ticket pricing or car parking to spread the peak, or indeed, by application of a range of such measures.

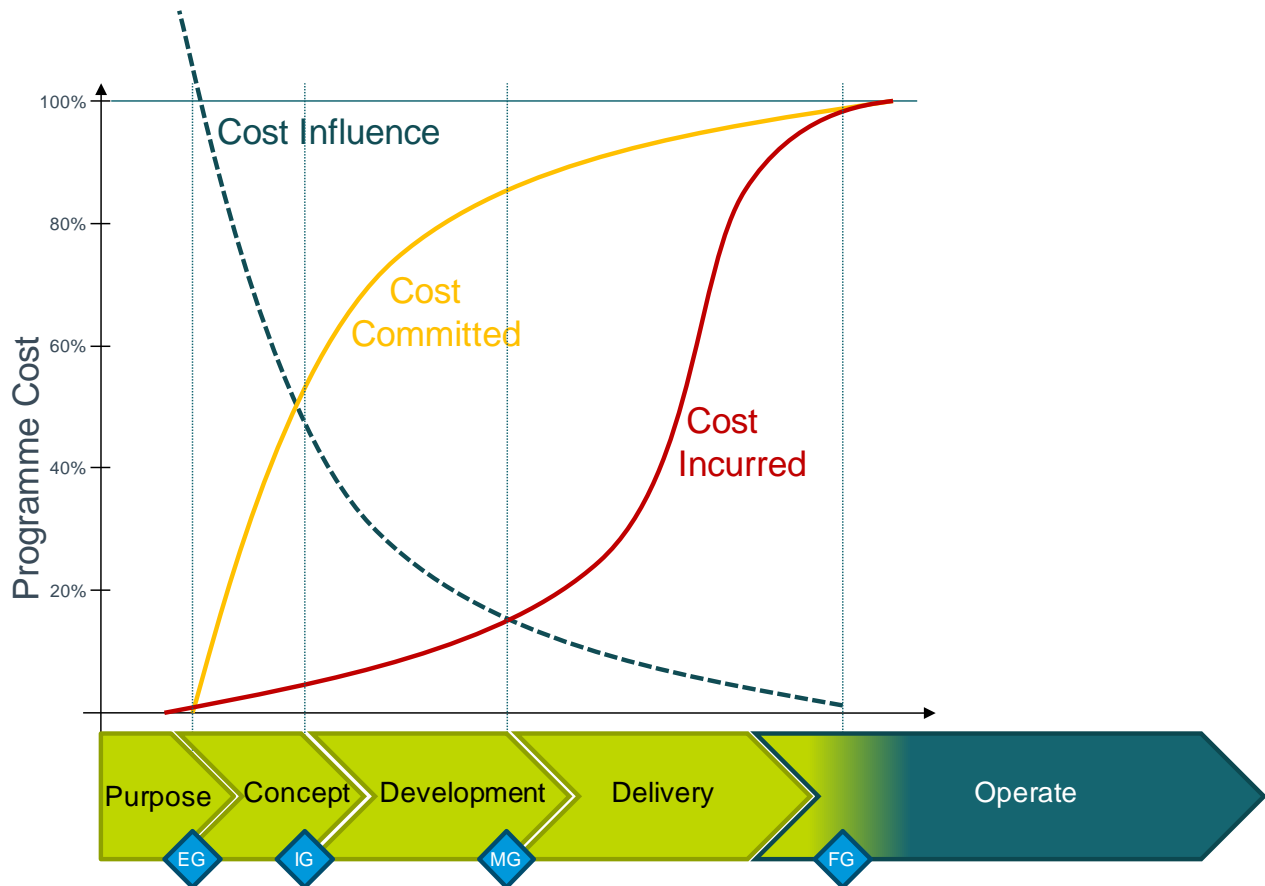


Figure 3-2: The Cost Influence Curve

Box 3-1: An airport on a holiday island was doing so well, it was running out of runway capacity. The first reaction was to decide that extra runway and extensions to terminal and aprons should be built at great cost. Traffic came mainly from the USA with tourists keen to arrive between 3:00 p.m. and 6:00 p.m. so that they could enjoy their cocktails before dinner. A systems approach was suggested and used early in the programme. The result was that, instead of providing extra capacity for those hours at great cost, a new landing fee structure was worked out. The scheme rewarded those who could land outside of the three-hour period most in demand. The solution redistributed the demand. The result was that the revenues into the airport were doubled at no significant cost. (15)

[3:9] The OGC Gateway™ Review Process (See Appendix D, Figure D-4) is applied in concert with MSP to many major, cross-industry rail enhancement programmes. However, this approach fails to single out the importance of the early defining or concept phase of the programme. As with MSP, the gateway process appears to afford more attention to the managing the delivery phase, with specific gateway reviews for a series of project lifecycle stages, mandating just one generic strategic assessment applied at the programme level.

[3:10] Therefore, we have sought to augment MSP with additional good practice relating to the creation and delivery of complex engineering solutions and systems. This is the fusion of good practice in:

- organisational transformation, optimised for delivering high-level, often qualitative, strategic goals in politically, economically and socially changing environments, and
- whole system engineering, that assures the right problem is solved, the optimum solution is selected and the requirements are correctly defined.

[3:11] In their publication, 'Creating Systems That Work' (16), Royal Academy of Engineering experts responsible for the design and delivery of major systems have identify six general

principles that encapsulate their experience; principles that work and set out the contextual framework for engineering in the 21st century. These archetypal engineering design principles are:

- Debate, define, revise and pursue the purpose
- Think holistic
- Follow a systematic procedure
- Be creative
- Take account of the people
- Manage the project and the relationships

[3:12] Overlaying these engineering design principles and the insight from the RAEng paper with the MSP framework, it is suggested that the key areas for focus are:

- Ensuring the programme team has the capability and experience to think holistically and creatively about the problems and solutions – focusing on truly understanding the purpose and exploring all possible conceptual solutions.
- Providing a systematic process for governance at a programme level.
- Combining holistic thinking and rigorous process to ensure that requirements and interfaces are managed at a programme level to ensure the whole programme is greater than the sum of the parts/projects.

Box 3-2: Engineers have been building systems, without saying so, from the Egyptian pyramids through to Brunel's Great Western Railway. But the scale and complexity have changed; it is no longer possible for a single engineer to conceive and hold the entire programme in his head. Brunel could personally design everything, from the Box Tunnel to the decorative scrollwork on the stations. Once that is no longer possible, a systematic and disciplined approach is needed to focus the efforts of a team of people.

In **complex** systems the parts interact with each other and with the outside world in many ways – the **relationships** between the parts determine how the system **behaves**. As complexity and scale increases intuition becomes increasingly ineffective at predicting behaviour.

[3:13] These themes align with the key enablers for whole system programme management that were presented in the Atkins' Asset Management and Supply Chain Management RVfM report (2), which were to provide:

- Integrated Programme Teams,
- Industry-wide Programme Governance,
- To rigorously investigate conceptual alternatives, and
- To engineer and manage requirements and interfaces.

3.1. Iterative Model Development

[3:14] Our approach was to combine these two bodies of best practice in a strawman model, and then identify and develop those elements where we found most evidence of their potential to deliver value to GB Rail. This process is shown graphically in Figure 3-3.

[3:15] The model comprised four layers with the elements of best practice expressed as pillars within each of these layers. The model was developed through a series of interviews and workshops, as well as drawing on a variety of literature.

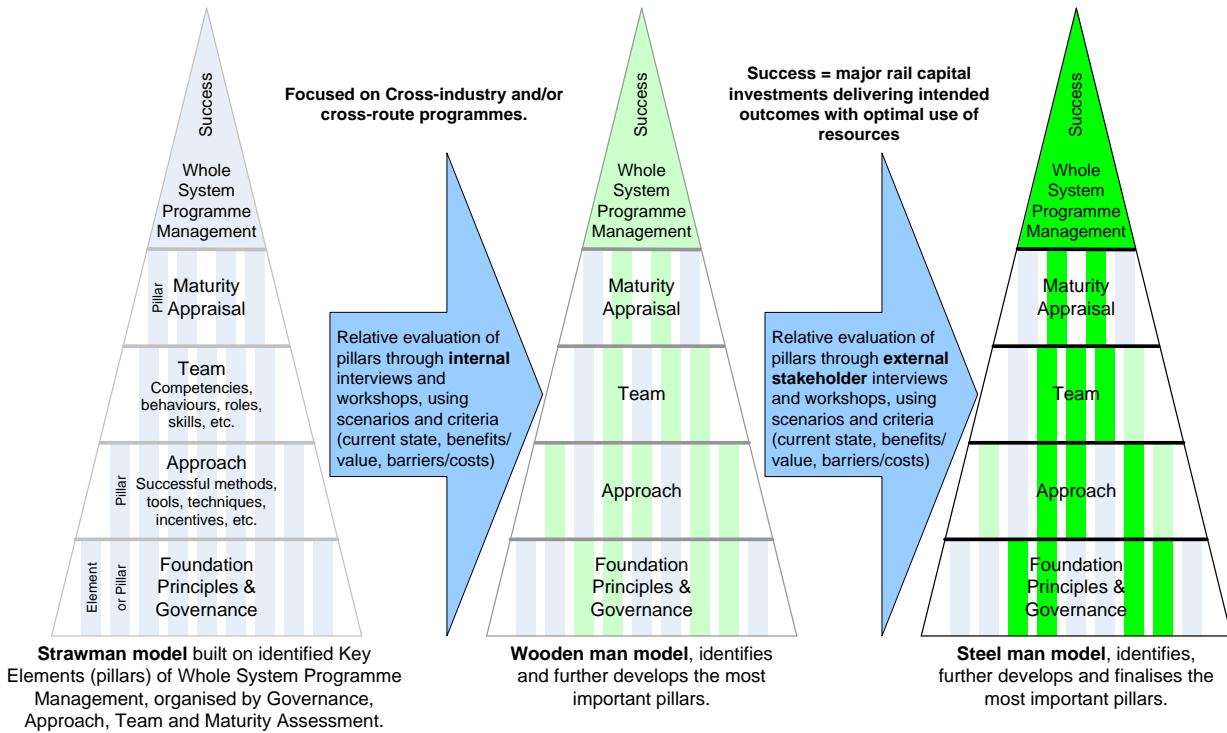


Figure 3-3: Whole System Programme Management Model Development

[3:16] In the course of the eight week study we completed 30 interviews, totalling over 80 hours of discussions, covering Evergreen 3, Crossrail, Reading, Thameslink, GSM-R, The Strategic Freight Network, Kings Cross, Heathrow Express, London 2012 and West Coast Route Modernisation, along with collecting experience from the oil and gas, defence and power sectors and academia. We have also reviewed a substantial quantity of additional reports and presentations, conducted two workshops and presented twice to the Rail Value for Money stakeholder team.

[3:17] Further details of those who were interviewed and the references used in this study are included in Appendix A and B. We are extremely grateful to those who have given their time, experience and ideas to support this study and gratefully acknowledge their contribution.

[3:18] The initial strawman model comprised twenty four pillars. This was refined to twelve pillars in the wooden man model, and four in the final steel man model. It should be stressed that the elements presented in the final model have been selected as those which are most important to reducing aspects of costs associated with delivering major enhancements within GB rail. However, many of the pillars are closely inter-dependent and all will be necessary in some degree to successfully deliver any programme. Full details of the evolution of the model are included in Appendix E, and the expectation is that other pillars will be further developed in the future.

4. Whole System Programme Management

[4:1] The model of whole system programme management presented in this section has been developed as a result of an accelerated and focused study, looking to identify those aspects of good practice that offer the greatest opportunity to save costs associated with delivering major enhancements within GB rail. The intention is to share and develop these elements of good practice, which can then be applied in concert with a comprehensive approach, such as MSP™.

[4:2] The model, depicted in Figure 4-1, represents a fusion of organisational transformation, good practice and whole system engineering, which will result in the release of significant additional value from major rail enhancements.

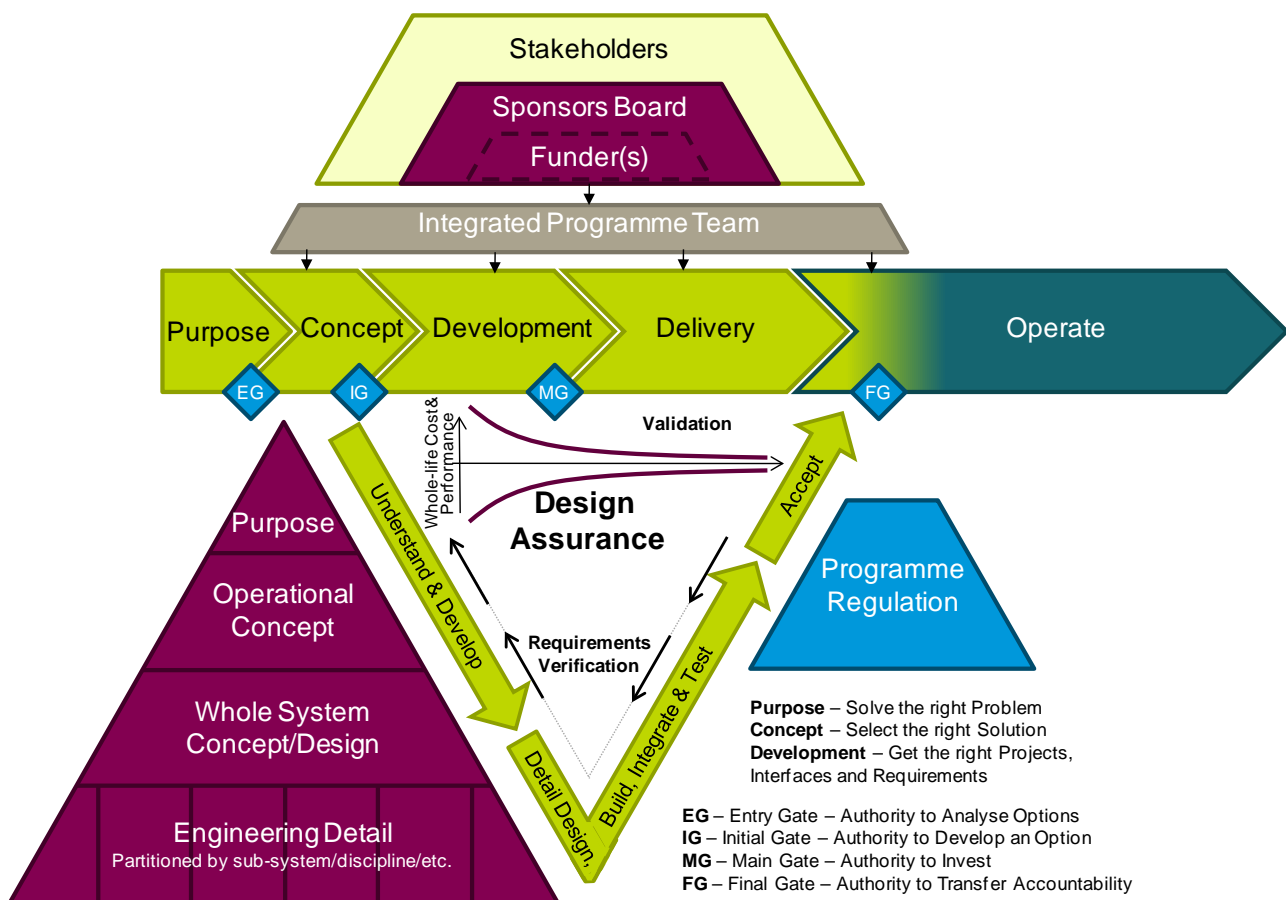


Figure 4-1: Whole System Programme Management Model

[4:3] In summary, all programmes within GB Rail should adopt the elements of this model, which may be summarised as having:

- an aligned, agreed and succinct driving or **Impelling Purpose**;
- effective and appropriate **Governance**, including senior **Management of Stakeholders**;
- a highly-effective, dedicated, core **Integrated Programme Team**; and
- **Whole-life Design Assurance**, to provide confidence that the programme benefits will be delivered and to quantify (and optimise) the affects on railway system whole-life costs.

[4:4] To maintain flexibility, the model assumes that programmes will be conceived through many routes; for example, a programme could be initiated based on a policy vision, it may emerge from a specific need or gap in current capability, or it may surface from a portfolio of related projects. In

each case, the model requires that one or more stakeholders agree to form a Programme Sponsors Board, which is open to other stakeholders to join.

[4:5] It is also deliberate that the capability delivered by rail programmes is shown to persist in operation, where it will be maintained and renewed as required. This is designed to reinforce the importance of whole-life and operational perspectives within the programme phases.

[4:6] The following sub-sections provide more detail in respect of each of the model elements.

4.1. Impelling Purpose

[4:7] **Programmes should have an aligned, agreed and succinct driving or Impelling Purpose.**

[4:8] Purpose underpins the whole reason for the programme existing, it answers the simple question 'Why'.

[4:9] Programmes deliver outcomes and a rail programme's purpose needs to be expressed in terms of transportation outcomes. The purpose provides overall direction; a coordinating and uniting vision for the whole team. Most transportation programmes can be abstracted to the point of being to deliver economic and/or social benefits. However, while this context is important, it would not provide a uniting vision.

Box 4-1: President John Kennedy famously provided NASA with a clear, impelling purpose, which was to, 'To land an American on the Moon and return them safely to Earth'.

[4:10] Good practice is for the purpose to be deliberately solution independent, as this encourages creative and innovative thinking. In addition, it is good practice to support the purpose statement with a small number of measurable objectives or benefits, capturing the major requirements or the sponsors.

Box 4-2: The purpose of Evergreen 3 is described universally as being, "90 minutes from London to Birmingham". However, this is a solution and the required output of the infrastructure upgrade project. A better programme purpose might be more like, "40% more passengers, with half of them (2000 per day) travelling via a new route to North Oxford."

[4:11] The programme's purpose is the question posed by the sponsoring organisation in response to a strategic assessment of the current capability against the future desired capability of the GB railway. Therefore, the impelling purpose requires clarity of industry strategy and if necessary it must be changed to remain consistent to that strategy throughout the programme lifecycle.

Box 4-3: IEP Review, "The examples of strategic shift most commonly given were twofold: the (widely welcomed) decision announced in July last year to electrify the route from London to Bristol, Cardiff and Swansea, and the line between Manchester and Liverpool; and the commitment announced in December to proceed with the development of a new high speed rail network. Questions arose in people's minds about the extent to which these developments, running in a different direction to the 2007 White Paper, interact with IEP and whether their impact has been fully assessed. With electrification in particular, the question was asked: has the remit of the programme been adequately rescoped?" (6)

[4:12] It is suggested that there are three idealised purpose types:

- **Vision** led purpose, which is driven by a vision to transform a service or capability,
- **Need** led purpose, where there is a specific and defined need for additional capability, and
- **Compliance** led purpose, which is in response to a legislative or regulatory requirement.

[4:13] For example, Crossrail and Evergreen 3 are vision led; Thameslink and Southern Capacity Package are needs led; and GSM-R is compliance led. In practice, the purpose of real

programmes will be a blend of all three, combining some proportion of vision, need and compliance, as shown in Figure 6-1.

[4:14] The reason for drawing this distinction is that the purpose type is likely to affect the nature of the business case and this is likely to dictate the sources of funding. This will be further developed, as it has been suggested that the sources of funds and implications of funding can have a profound, typically fragmenting affect on the objectives and scope of the programmes.

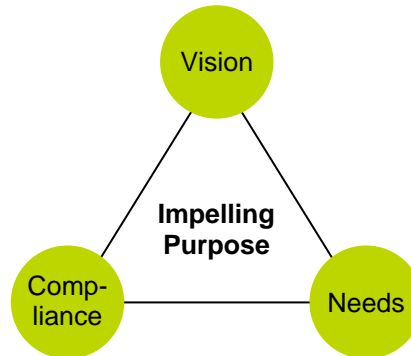


Figure 6-1: Programme Purpose Types

4.2. Governance and Stakeholder Management

[4:15] Programmes should have effective and appropriate Governance, including senior Management of Stakeholders.

[4:16] Effective and appropriate Governance comprises clarity and separation of sponsors, funder and delivery agent (the integrated programme team) roles, and the strict adherence to a programme level gated lifecycle.

Box 4-4: IUK, “Evidence indicates that a major driver of higher outturn costs is a lack of clarity and direction, particularly in the public sector, over key decisions at inception and subsequent design change points. The roles of client, funder and delivery agent – which are often clearly and separately defined in private sector projects and programmes – tend to become blurred in many public sector governance structures.” (1)

[4:17] In the rail industry the term client can be confusing; for a typical infrastructure project, the infrastructure manager, passenger facing operator and maintainer may be different and they might all see themselves as the client of the programme. Therefore, the term Sponsor has been used to include all those stakeholders who have a direct involvement in the delivery of the programme benefits. The Sponsors Board will also include the funder(s) – who will have additional financial responsibility and overriding authority.

[4:18] It is suggested that in all major goal oriented programmes the Sponsors Board must have representation from the funder(s), directly involved stakeholders and at least one representative of a passenger or freight customer facing organisation – in the current structure this would be a FOC or a TOC. The members of a programme’s Sponsors Board must be suitably qualified and experienced people (SQEP).

[4:19] The Sponsors Board must be incentivised to deliver value for money, assessed as a lowest whole-life cost vs. affordability trade-off. It is proposed that this is enforced through the following, independently regulated, four gate lifecycle, which should to be adopted as a standard for all GB Rail enhancement programmes. This aligns with Treasury funding gates (shown in parenthesis):

- **Entry Gate – Authority to Analyse Options** (Strategic Outline Case (SOC) and OGC Gateway 1) – demonstration of strategic alignment, a robust case for change and an initial simple analysis of a wide range of options.
- **Initial Gate – Authority to Develop an Option** (Outline Business Case (OBC) and OGC Gateway 2) – identify a preferred concept solution which demonstrates value for money, having fully evaluated options, trade-offs and risk reduction opportunities. This gate confirms affordability, procurement strategy and management arrangements for successful benefits realisation.
- **Main Gate – Authority to Invest** (Full Business Case (FBC) and OGC Gateway 3) – takes place during procurement and prior to signing of major contracts. This gate requires demonstration of a robust understanding of the investment costs, risks and the whole-life costs of the programme, as well as confirmation of business case and affordability.
- **Final Gate – Authority to Transfer Accountability** – demonstration of benefits and acceptance of handover to the operator and maintainer.

[4:20] The Sponsors Board will hold the IPT (delivery agent) to account and must exercise control over programme risk, contingency and change.

Box 4-5: IUK, “Many large infrastructure projects and programmes tend to be managed within a quoted budget, rather than aiming at lowest cost for the required performance. Often projects are managed within an affordability envelope which is based on the cost budget plus contingencies (including optimism bias). The total affordability envelope is then viewed as available project budget. As a result, there is no culture of managing costs down and all the available money within the affordability envelope is spent, including the contingencies.” (1)

[4:21] Major goal oriented rail programmes by their nature have a wide spectrum of stakeholders and overall management of the stakeholders is one of the principle roles of the Sponsors board. Where stakeholders are managed well at all levels, the successes are plain to see, with normal flashpoints, such as Network Change, navigated smoothly.

Box 4-6: IUK, “Within the Olympics programme, there is a very clear delineation of accountability for cost control and the management of contingency budgets. All contingency is clearly identified as either ‘project’ or ‘program’ and either ‘in-scope’ (available to the project) or out of scope (funder’s contingency is not viewed, as is often the case, as available budget). A strong governance structure is built around the process for allocating contingency which, combined with effective incentivisation at all levels, has instilled a culture of cost awareness and accountability. The achievement of cost and risk reductions at the delivery level frees contingency for reassignment within the programme, subject to justification and approval by the Government Olympic Executive (GOE). Success has in part been driven by the clarity of decision making and by the commitment to ensuring that the GOE was set up as an effective and properly empowered client organisation.” (1)

4.3. The Integrated Project Team

[4:22] Programmes should have a highly-effective, dedicated, core Integrated Programme Team.

[4:23] The Integrated Programme Team must be empowered to deliver the whole programme and must be led by a driven and charismatic leader who is able to build effective working relationships with the senior stakeholders.

[4:24] The Integrated Programme Team must be drawn from all the sponsors and may also come from stakeholders or specialist programme management organisations. It should bring together in one location the right people for the job with the right skills, experience and competence. However, it is important that they get on and work as a team.

[4:25] The team will require a balance of skills, capability and experience across the railway domain, and this must be blended with both hard and soft skills – because programmes are as much about people as they are about engineering, technology and assets. The team must be able to command the trust and respect of the operational railway.

[4:26] The team must include technical, operational, analysis and commercial skills and experience.

[4:27] There will be explicit effort (team building/break-through) directed towards forming and maintaining the team as a highly-effective team.

Box 4-7: IUK, “The Independent Project Analysis report “Productivity in the UK Engineering Construction Industry”, prepared for the Department for Business, Innovation and Skills in September 2009 mentions that the single most important defect in UK projects is the lack of key functions such as operations and construction management in the owners’ project teams.

This lack of technically competent in-house teams oblige the UK public authorities to spend more on legal, technical and financial external advisors than their counterparts in continental Europe.

For example, the Strategic Rail Authority (SRA) estimated that professional staff costs associated with project management, planning, design and legal issues were twenty five percent of the total Channel Tunnel Rail Link (CTRL) costs. By comparison, the total project planning and management costs for the Madrid-Lérida High-speed rail line were two to three percent of total scheme costs.”

...

“This is in line with the comparative study on metro systems, which noted that a small and technically competent team of public administration officials can contribute to important cost reductions in technical support, supervision and management. In the case of the Madrid Metro, the study mentions that “a small and highly experienced project management team of six Civil Engineers with full power both for technical and financial on-the spot decisions was key for reducing substantially management and administration costs... strong involvement and direct regular presence in the field of the client technical team allowed for direct knowledge of work progress, anticipation of problems and assessment of possible solutions in discussions with all parties involved... This saved time and avoided expenses for legal advice on contract interpretations and legal disputes” (10)

[4:28] The team will have to evolve over time, as the programme develops and also people move on. This evolution must be managed to retain the team’s values, effectiveness and knowledge.

[4:29] Overall, the competence, capability and effectiveness of the team is crucial, as without it no amount of governance, process, techniques or tools will be successful.

4.4. Whole-life Design Assurance

[4:30] Programmes must understand and manage how they will deliver the required outcomes and benefits, and optimise the effect they have on the rail system whole-life costs.

[4:31] Whole-life Design Assurance comprises the following essential elements:

- Analysing how the different projects, sub-projects and components of the solution will interact and evaluating the effect of different design options on the delivery of benefits and on the whole-life cost of the railway system.

- Demonstrating at each level of (progressively more detailed) design, that the design decisions taken are both sufficient to meet the requirements, and necessary; i.e. the design is not over engineered.
- Using objective whole-life cost analysis to challenge standards where creative and innovative design options exist that can add value to the railway.
- Rigorously and hierarchically structuring the requirements and interfaces, so that each project, sub-project and component of the programme is clear what is required, via which interface and why. Good practice is to support this with an architecture that maintains consistency and understanding.
- Managing the integration of the programme components from the start of the programme, with clear commissioning, acceptance and handover for each stage or tranche. The benefits realised by each stage (or configuration) must be defined and supported by progressively collected assurance.
- Instigating independent scrutiny of the progressive assurance.

[4:32] There is always uncertainty in ensuring programmes can deliver the required outcomes, especially if the programme involves new technology or operational concepts. Good practice is to reduce these risks progressively, through a **mixture of analysis, modelling, operational experimentation and off-network proving**, prior to deployment on the live network. Final delivery of the programme outcomes and benefits should be phased with progressively more stressing configurations that have been assured to be safe, reliable, operable and maintainable.

Box 4-8: London Underground have invested getting the requirements and systems architectures right for the Sub-surface lines re-signalling programme and expect significant benefits as a result. This programme involves replacing all of the signalling on the Circle, Hammersmith, Metropolitan and District lines (which includes some mechanical signal boxes dating back over 75 years) with a communication based train control system. The programme is one of the largest re-signalling programmes in the world. The traditional approach is to specify the performance requirements and a general raft of standards to be complied with. London Underground have adopted a new approach and invested more than a year of significant effort in developing detailed performance and reliability requirements and also targeting specific standards that are value adding and need complying with. They have also developed TRAK, an open source architecture framework, to aid re-use and communication between organisations. It will also support completeness and consistency of understanding, clearly attribute ownership of interfaces. As a result of retendering on this revised basis which is really a first in rail, it is envisaged that this real 'left shift' will de-risk the programme and thus enable the parties involved to share in the benefits of this and the greater likelihood of success.

[4:33] The whole-life cost of enhancements has traditionally been managed through standards, which have developed over time. However, where affordability and value for money is essential, heavy reliance on standards is unlikely to be optimal. In order to develop optimal designs, it will be necessary to change culture and behaviours to **design to the requirements** and as opposed to designing to specifications and standards.

Box 4-9: IUK, "Through effective incentivisation and the creation of a less risk averse culture, Anglian Water, over a period of six years, has successively reduced the cost of one particular water treatment asset from £73,000 to £27,900. Furthermore, by having the units manufactured as standard products, off-site performance has also been enhanced. Conversely, the UK rail lifts standard specification results in additional costs of £59,000 per unit over the cost of a non-rail equivalent asset." (1)

[4:34] To achieve this, the industry needs to much better understand the whole-life cost implications of programmes and use this to challenge standards. This will require investing much greater effort in the early stages of programmes and projects – a practice known as Front End Engineering Design (FEED) that is common place in other industries such as Aerospace, Oil & Gas, Defence and Power. In addition to design effort, this change needs detailed, accurate and configuration controlled asset information to be made available by asset managers. FEED is also

complimented with a front end commercial strategy that ensures contractual interfaces will not undermine technical aspirations.

[4:35] In tandem with more detailed design development, programmes should also develop more detailed Commissioning, Acceptance and Handover plans, linked directly to the requirements, agreed with stakeholders and used to drive the programme back from the end point. Thus assuring the handover and identifying the key decision dates – the latest point when key design decisions have to be made.

[4:36] In the near future, whole-life design assurance will be further complicated by the need to qualify and optimise both the construction embedded carbon and the impact of the programme whole-life carbon performance.

[4:37] Programmes should have a clear architecture to maintain consistency between different aspects of the programme, define the ownership of all elements/entities and interfaces, and facilitate understanding and debate within the team about the solution.

[4:38] Programmes should develop and maintain a hierarchy of requirements for each project and interface, which are linked to the overall benefits.

Box 4-10: IUK, “Rail Stations: Higher Design Specifications and Standards: The returned cost questionnaires allowed the comparison of a number of metro stations. Owing to the generally larger stations in the UK (to provide greater passenger capacity) the costs in the UK were unsurprisingly significantly higher, but when this was adjusted for size and capacity the differences became much smaller. However, by excluding the US benchmarks, UK stations are up to fifty percent more expensive than European and Asian comparators. The direct budget comparison example of a UK station that proposed by a private sector organisation for half the cost estimated by the public sector client demonstrates that costs can be significantly reduced without compromising size or quality of the finished product.” (10)

5. Case Studies

[5:1] The following case studies have been developed based on the limited discussions possible within the timescales of this study and publically available material. They are intended to be illustrative of good practice and improvement opportunities.

[5:2] We acknowledge that it has not been possible to undertake a comprehensive audit of these programmes and much of what is presented here represents the views of a small number of individuals. Therefore, these case studies must be validated before improvement plans are developed.

5.1. Thameslink

[5:3] Thameslink is a large (£5.5bn) goal orientated programme which will deliver significant benefits and result in many changes to the railway system along the existing Thameslink corridor.

[5:4] It was originally proposed by British Rail (BR) in the early 1990's building on the highly-successful restoration of north- south Thameslink services by BR in the 1980s. Progress in developing the scheme was delayed by the recession in the early 1990s with Railtrack first applying for TWA powers in November 1997. It has since undergone two public enquires and finally achieved planning and legal powers in December 2006. Following this decision Network Rail was funded to undertake further work to enable a more informed decision to be taken, resulting in the Secretary of State announcing approval to proceed with the programme in July 2007.

[5:5] The programme was delivered in two major stages, known as Key Output 1 and 2. The change in government and the economic downturn, combined cost escalation of £0.5bn, put Key Output 2 of the programme at risk. However, after the team worked hard to develop a robust and deliverable plan to achieve Key Output 2 without the £0.5bn escalation, the Secretary of State in November 2010 confirmed that the programme would proceed with no changes.

[5:6] The scope of Thameslink covers improved stations and access in London, new trains, longer platforms and a new timetable. The main projects in the programme are:

- New rolling stock;
- Reconstruction of Blackfriars, Farringdon and London Bridge – including the provision of two new tracks through London Bridge and a new viaduct over Borough Market (the new St Pancras platforms were delivered as part of the Channel Tunnel Rail Link (CTRL));
- Longer platforms;
- Upgraded signalling (including the provision of ETCS and ATO in the central section) and power supply;
- New timetable and franchise commitments; and
- New maintenance and stabling capacity.

5.1.1. Purpose

[5:7] It is clear that Thameslink shares the characteristics of many large publicly funded programmes with the gestation period taking many years. However, the purpose of Thameslink has been more or less consistent since British Rail first started to promote the scheme in the early 1990s.

[5:8] The stated reasons for the programme were (17):

- reduce overcrowding on Thameslink and other London commuter services;
- reduce overcrowding on the underground;
- reduce the need for interchange between mainline and underground train services;
- provide for the introduction of new cross-London services, so improving public transport accessibility in South-East England, including access to areas of expected demand growth

such as the London Bridge area, Docklands, King's Cross/St Pancras and London's airports; and

- facilitate the dispersal of passengers from London St Pancras following the completion of the Channel Tunnel Rail Link in due course.

[5:9] Thameslink also links to national benefits, including de-risking Crossrail, cascading rolling stock to other routes.

[5:10] The purpose originated from a nationalised industry viewpoint where investment was needed as a reaction to increased demand. Since this time the railway has undergone changes to its structure, governance and commercial outlook. As a result, the programme has suffered at times prior to 2005 from the lack of a clear sponsor, with a vision of the whole railway, as opposed to just changes to the infrastructure.

[5:11] As a result of this heritage, the headline statement that the programme will deliver "24 trains per hour" through the centre of London has become widely accepted as convenient shorthand. However, this does only reflect one aspect of the programme scope and is not solution independent. Initially, DfT struggled to set a whole-railway vision and purpose for the programme, which was heavily infrastructure biased. As a result the initial TWA did not include any provision for depots – a fact that has undoubtedly resulted in the project carrying greater risk and incurring development cost in relation to Hornsey Depot. All the senior sponsors now share a common whole-railway vision.

[5:12] The current Thameslink Infrastructure Programme states its objectives as:

- reduce overcrowding on Thameslink and other commuter services,
- reduce overcrowding on London Underground (LU),
- reduce the need for interchange between mainline and LU train services,
- provide for the introduction of new cross-London services, so improving public transport accessibility in south east England,
- facilitate the flow of passengers to and from St Pancras station following completion of the Channel Tunnel Rail Link,
- improve reliability of train services operating through the core route section.

5.1.2. Governance and Stakeholders

[5:13] The main stakeholders are:

- DfT
- Network Rail
- First Capital Connect
- Southern
- Southeastern
- ORR
- London Underground
- Freight operating companies

[5:14] Secondary stakeholders include (not an exhaustive list):

- Gatwick and Luton Airports
- London Boroughs
- County Councils
- Passenger focus
- Members of Parliament

[5:15] There are many stakeholders. To create and foster alignment a structured team and approach was taken. Franchise periods and end dates can be a constraint to achieving this alignment.

[5:16] A system migration plan (see Appendix C) has been produced by the Thameslink Systems Integration team which enables a structured view to be taken of the delivery of the benefits and for these to be communication to the stakeholders. The benefits start arriving before 2018 (phased delivery).

[5:17] One of the major success drivers for the governance and programme team on Thameslink is the relationships that the structure has fostered. The participants have developed trust and work together to resolve problems in pursuit of the overall vision.

5.1.3. Programme Team

[5:18] The overall programme is being sponsored by DfT, who retain responsibility for ensuring the overall project (including the infrastructure) is affordable, delivers value for money and realises the benefits by the specified dates. DfT has responsibility for the procurement of the new trains and the change in service level specification to be incorporated into the new Thameslink franchise and it retains the overall integration risk.

[5:19] Network Rail has been given the responsibility for management of the enhancements required to their infrastructure.

[5:20] A programme board meets to consider the overall programme and integration issues. It has representation from DfT, TOCs, NR, LUL and ORR. This is supported by a Programme Development Group, which meets more regularly to oversee and manage the whole programme.

[5:21] Following a realisation some two years ago that the overall programme (infrastructure, rolling stock and operations/franchises) needed to be integrated, it took six months for all to agree that Network Rail was best placed to lead the Thameslink Systems Integration team. The team was established in July 2009, reporting to the industry wide Systems Integration Authority (SIA). The philosophy is to identify the best person for the job (and not just employ NR staff). DfT and train operators are part of the team. Had this team been in place at the start of the Thameslink programme, it seems likely that it would have generated greater value, through identifying opportunities earlier and having greater influence.

[5:22] The Thameslink Systems Integration team, which is an example of good practice, has cross-industry support and the capability, experience and competence required manage the systems issues involved in this complex programme. However, neither the Thameslink Systems Integration team nor the Systems Integration Authority has direct commercial authority over the three principle delivery vehicles of the programme – the Network Rail infrastructure enhancement project, the rolling stock procurement project or the refranchising project.

[5:23] The System Integration Authority reviews scope changes and as a result has intercepted changes that have been implemented without fully considering the whole-system implications. For example, enhanced customer information systems were de-scoped in a value engineering exercise, without realising that they were critical to achieving the dwell time in the central section.

[5:24] There appears to be a common vision shared by those involved, driven by the desire to be involved in a successful programme. From our interviews we get the impression that the key stakeholders feel involved. An industry risk map showing the combined stakeholder view is discussed at the programme delivery group.

[5:25] One issue which does limit the openness of the TOCs in the information they provide is the IPR of their own financial models and business models. These are commercially sensitive and the data helps in the re-bidding of franchises.

5.1.4. Assurance

[5:26] The system migration plan is a powerful tool, which shows graphically a number of defined and controlled steps (configurations) of the system that will progressively deliver the benefits.

[5:27] The plan is supported by requirements, assurance, analysis and models that are being developed to provide confidence that the outputs delivered by each of the individual projects will combine in order to deliver the overall benefits. This approach is an example of good practice and during the recent Comprehensive Spending Review, the system migration plan was seen as instrumental in convincing the Treasury, via the Major Projects Review Group (MPRG), of the programme's overall deliverability.

[5:28] The Systems Integration team is also expending significant effort to ensure that the interfaces between the different projects – especially around the train-infrastructure interface – are robustly managed. They are using architecture diagrams of the proposed system to help stakeholders understand the proposed designed and identify problems and solutions early. This will support the smooth acceptance into service of each of the configuration stages.

[5:29] Cross acceptance has also been identified as an important value for money opportunity, as the programme is currently incurring acceptance costs for both London Underground and Network Rail. This is an ongoing challenge.

[5:30] It was suggested that if the system migration plan, and supporting analysis, were in existence earlier in the programme, it would have highlighted the lack of co-ordination between the infrastructure and rolling stock programmes. While it is difficult to make any concrete accretions, it is reasonable to assume that this greater understanding would have resulted in more informed earlier decisions that are likely to have resulted in increased value for money.

5.2. Crossrail

[5:31] Crossrail is a major (£15.9bn) goal orientated railway programme which will deliver a new railway capability linking east and west London through a 13 mile tunnel under central London providing direct access to the centre of London without change of mode. It will link to existing commuter routes from Maidenhead and Heathrow in the west to Shenfield and Abbey Wood in the east and provide new journey opportunities.

[5:32] An original bill was put before Parliament in 1991 by British Rail and London Underground but was rejected. In 2001 Cross London Rail Links was formed to further promote the scheme. The Crossrail Bill was enacted in July 2008 and provided the powers for the railway to be constructed, operated and maintained.

[5:33] The scope of the programme covers new trains, central tunnel section with new stations, connection to existing rail network to the east and west of London. The main projects in the programme are:

- Twin bore tunnel under central London
- 9 new sub-surface stations, 11 major station reconstructions and 28 stations upgraded
- New trains
- New operational concept and timetable
- Signalling and power works
- New maintenance and stabling capacity

[5:34] Initial construction was started in 2009 and the main construction commenced in 2010. Initial operations are due to commence in the tunnelled section in 2017.

5.2.1. Purpose

[5:35] The headline purpose for Crossrail is 'Delivering a world-class affordable railway safely through effective partnerships'.

[5:36] Crossrail will deliver substantial economic benefits in London, the South-East and across the UK. The estimated benefit of Crossrail to the UK economy, expressed as impact on GDP, is at least £42 billion (at 2002 prices) (18). It will bring an additional 1.5m people within 45 minutes commuting distance of London's key business districts.

[5:37] The key transport aims for Crossrail will support delivery of the objectives set outline the Crossrail Business Case (18), namely to:

- Support sustainable economic development and population growth by increasing transport capacity, reducing congestion on the transport network;
- Improve transport connectivity through journey time savings; and
- Bring wider benefits including: enhancing accessibility (including those with restricted mobility) thereby improving people's access to jobs, schools and other facilities; improving transport safety with reduced road accidents; and environmental improvements, including a reduction in CO2 emissions.

[5:38] However, evidence was not presented of a clear transport related high-level purpose, which would necessarily be supported by a small number of measurable benefits, defining the overall passenger carrying capacity across the day, the impact on existing networks (both London Underground and national networks either side of London), the impact on/capability for freight and the impact on the environment.

5.2.2. Governance and Stakeholders

[5:39] The Sponsors role for the programme is held jointly between DfT and TfL. Each Sponsor has two representatives on the Sponsor Board, which in an example of good practice, is responsible and accountable for the delivery of the whole railway system.

[5:40] Crossrail has the following main delivery partners:

- Crossrail
- Network Rail (On Network Project)
- London Underground
- Docklands Light Railway
- Canary Wharf Group
- Berkeley Homes

[5:41] Crossrail has a great number of stakeholders, who are actively managed by an integrated DfT/TfL Joint Sponsor Team. This team is under the authority of the Sponsor Board.

5.2.3. Programme Team

[5:42] Crossrail Limited is acting as the integrated programme team and has a wide range of expertise and capability covering all the components of a railway system. Transport for London's shadow operator (Rail for London) is works with Crossrail Ltd providing operational input. This team reports to the Joint Sponsor Team.

[5:43] Crossrail Ltd has partitioned the delivery of the programme into a number of packages. Each of the delivery partners has responsibility for one of the packages – for example Network Rail is responsible for the On-Networks package. Crossrail Ltd has retained responsibility for the delivery of the central tunnels and stations, where it is working with Network Rail and London Underground in the Infrastructure Manager role.

[5:44] Crossrail Ltd retains responsibility for the overall integration and performance of the railway system, including ensuring the new service will operate at 95% PPM and have no adverse affect of the existing services/operators.

[5:45] The Network Rail is one of the key delivery partners for Crossrail. Their On-Networks team also has responsibility for the major works in and around Reading station. Network Rail has established an integrated team to manage both the Crossrail On-Networks and Reading works. This team is integrated with staff seconded from the affected operators – including TOCs and FOCs.

[5:46] The Network Rail On-Networks Crossrail team have championed close operator involvement in the team. Operator involvement has grown over time as all have learned about the benefits and the relationship has grown. Operator staff are co-located with the project team. Some of the benefits are as follows:

- Christmas 2010 – in line with strategy to minimise closures and keep people on trains, agreed between Network Rail and the First Great Western directors, the initial plan included multiple weekend blockades running up to Christmas. First Great Western integrated team members quickly spotted a better solution for the Christmas blockade. Benefits were cash saving to programme (£5m), reduced risk, buy-in from First Great Western, and the team's agility in re-planning. The result was less Schedule 4 payments to First Great Western, but overall better for all in long run.
- Network Change approval for Reading re-signalling – complete in 30 days.
- First Great Western proposal for a new platform at Theale – during Christmas blockades this meant significant improvement for detained passengers and minimised impact on freight. This platform will provide savings (including for future blockades) in the region of £1m.

[5:47] Overall, it has been suggested that the integrated Network Rail team, which is around five full time equivalent operator staff have helped identify substantial savings across the Reading programme.

[5:48] In addition, the integrated team the played a major part in developing a proposal to slash the delivery schedule for Reading Station Area Redevelopment by a year and bringing back the substantial completion date from April 2016 to April 2015. This proposal is currently under consideration.

5.2.4. Assurance

[5:49] No evidence was presented of an overall Crossrail Ltd integration plan that demonstrated how each of the different Crossrail packages of work and components of the railway systems would come together to achieve the desired overall outcome and benefits. The approach to progressive assurance was described as based on peer and expert design review and co-ordinated millstones. This is a major concern, which was also raised by stakeholders.

[5:50] As a result, no evidence was presented of analysis or modelling that supports the ongoing management of the Crossrail packages, such that impact of design decisions and trade-offs are understood in terms of the overall benefits.

[5:51] Some evidence was presented to suggest the Crossrail commissioning plans were not well developed or well communicated. The progressive assurance of the delivery of benefits must be supported by a clear commissioning and acceptance plan that is in lock-step with the assurance. The key decision dates in the programme should be identified working back from commissioning and handover, so it is essential that these details are defined and agreed early.

[5:52] Assurance of whole-life cost is also a particular challenge for Crossrail, as it has to seek the agreement of three different infrastructure managers: Network Rail, London Underground and Rail for London – all with their own standards. This is in the context of extreme pressure on the affordability of the initial build cost. Crossrail are seeking to mitigate the issue of multiple infrastructure managers by agreeing to that one will act on behalf of them all. However, this does not address the fundamental problem that, due to a lack of understanding of whole-life cost, rail infrastructure managers typically use standards to manage whole-life cost.

[5:53] Standards will typically assume a series of worst case scenarios, so their use is unlikely to be an optimum value solution. The challenge for the railway is to change culture and behaviours to design to the requirements, optimising initial and whole-life cost, rather than designing to the specifications defined by the standards.

5.3. GSM-R

[5:54] GSM-R, Global System for Mobile Communications - Railway or GSM-Railway is an international wireless communications standard for railway communication and applications. A sub-system of European Rail Traffic Management System (ERTMS), it is used for communication between train and railway regulation signalling centres.

[5:55] GSM-R is expected to bring qualitative benefits in the safety, quality and efficiency of train operation, and will deliver a significant improvement in the quality of voice and data communications across the entire network.

[5:56] Currently there are two radio communication systems in use across the rail network – Cab-Secure-Radio (CSR) and the National Radio Network (NRN), which is not secure. The frequency used by the existing NRN has been allocated to a different use and will be progressively switched off from December 2012.

[5:57] The scope of the GSM-R programme includes the delivery of the following:

- The installation of 1,000 fixed terminal systems (in signal boxes, signalling control centres, electrical control rooms and route control centres)
- The installation of 8,600 cab radios in vehicles operated by more than 40 train operators.
- The training of 32,000 operators including train drivers, other train crew, TOC/FOC maintainers and signallers
- The migration of more than 45,000 circuits from existing legacy infrastructure on to the new Fixed Telecommunications Network (FTN).
- The creation of two GSM-R switching centres (at Didcot and Stoke).
- The establishment of all necessary processes and systems for whole-life operation of GSM-R
- The recovery and disposal of train borne legacy radio equipment

[5:58] Approximately 15,000 kilometres of railway in Great Britain is affected by the GSM-R Programme, and the installation of masts and transmission equipment ‘nodes’ will result in 3,200 individual line side construction sites.

[5:59] The cost of the GSM-R Programme maybe broken down as follows:

- £1,650m for Network lineside infrastructure (£430m to go);
- £188m for GSM-R Cab fitment (£130m to go).

[5:60] The key milestones are:

- NRN switch off in the south of England (31st December 2012).
- Registration of the last GSM-R train cab radio (30th September, 2014).
- NRN switch off in the North of England, Scotland and Wales (31st December 2015).

5.3.1. Purpose

[5:61] The purpose can be divided into four main areas:

- Compliance with requirement to turn off NRN (frequency revoked by Ofcom). This provided the imperative to do something.
- Renewal of existing obsolete radios and fixed telecoms equipment

- Realisation of operational safety benefits
- Compliance with EU legislation, requiring TENs routes to have GSM-R

[5:62] The benefits of the programme are:

- Increased rail system performance, as a result of improved and secure communications;
- Reduced cost of maintenance, through the renewal of obsolete equipment; and
- Enhanced safety through as a result of improved communications (both to trains and track workers) and the provision of the 'red button' that will stop all trains in the local area.

[5:63] Therefore, the programme has been very driven by EU standards, the need to move away from NRN and the renewal of obsolete equipment. It has been suggested that this led the early programme to be defined by the solution – GSM-R – and perhaps missing the opportunity to provide the same service via a very different commercial route.

[5:64] Any alternative option would likely have had significant regulatory and standards challenges, but it might have avoided the need to invest £1bn in a national telecoms network that is deploying obsolete mobile technology, has no ability to generate 3rd party revenue and has required the development of a bespoke UK-specific in-cab radio costing perhaps ten times more than an off-the-shelf item.

[5:65] Had the purpose been debated, defined and reviewed, it has been suggested that a solution representing far greater value for money may have emerged. If not, the programme would almost certainly have avoided some of the costly delays that have reportedly, at least in part, been due to insufficient early understanding of operational implications and requirements.

5.3.2. Governance and Stakeholders

[5:66] The programme is run and governed as an infrastructure programme, with all the funds managed by Network Rail. This has led to tensions, as operating companies feel that at times, particularly early in the programme, Network Rail's governance is overly biased towards infrastructure issues.

[5:67] The Network Rail delivery organisation controlled the funds, which appears to represent poor governance, as benefits and costs were cross-industry. There is a strong view that the Network Rail delivery organisation was not best placed to balance risk and incentives to optimise the solution.

[5:68] Network Rail is managing the infrastructure programme through GRIP and a structured set of packages; this has been a major programme in itself. However, the coordination and integration of the infrastructure work with the in-cab fitment has been less well structured and at times this has led to problems and delays.

[5:69] Over time, Network Rail has been persuaded to take on responsibility for the development of a UK bespoke radio and for the more of procurement of the in-cab equipment. This has delivered savings, as a result of Network Rail's central buying power, which would otherwise not have been possible.

[5:70] Network change has been a significant challenge, which Network Rail has at times struggled to manage. There is a recurrent view that a more collaborative approach to Network Change and stakeholder management earlier in the programme would have reduced delays and delivered improved overall value for money.

5.3.3. Programme Team

[5:71] The evidence presented suggests that initially Network Rail ran this programme as an infrastructure project with some elements of in-cab equipment, which could be delegated to the operators to purchase and fit.

[5:72] Progressively, the programme has learned and developed and for a considerable number of years has an effective integrated programme team, with expertise having been drawn in from across the operating and rolling stock spectrum. The team now has the understanding to manage the programme as a whole.

[5:73] The team is co-located, with a combination of full-time and part-time members. There is now a positive attitude among the parties.

[5:74] However, the programme faces significant challenges, as the in-cab fitment is now on the critical path to achieve the first frequency switch in December 2012. It is suggested that this phase would have been easier had the integrated team been formed much earlier.

5.3.4. Assurance

[5:75] Assurance is about providing confidence that the benefits will be delivered and providing understanding of the effect the programme will have on the railway system whole-life costs and performance. The evidence suggests that some stakeholders have doubts about the GSM-R – what benefits it will deliver and what affect it will have on the railway. This suggests that the assurance could have been improved.

[5:76] A methodical approach to assurance would have flagged very early in the programme the concerns about the EU standards, the functionality required by some operators that was not in the EU standards, and the challenges of commissioning, acceptance and handover.

[5:77] The early development of commissioning, acceptance and handover plans that were linked to the requirements would have allowed the identification of decision dates, which would most likely have reduced some of the delays suffered.

5.4. London 2012 Olympic and Paralympic Games

[5:78] In July 2005 London won the bid to stage the 2012 Olympic and Paralympic Games. The London 2012 Games will involve:

- more than 200 countries
- over 10,500 Olympic athletes
- more than 4,200 Paralympic athletes
- over 14,000 officials
- 26 Olympic sports taking place in 34 venues
- 20 Paralympic sports taking place in 21 venues

[5:79] The Olympic Delivery Authority (ODA) is the public body responsible for developing and building the new venues and infrastructure for the London 2012 Games and their use after 2012.

[5:80] One of the key responsibilities of the ODA is building the Olympic Park, where much of the action in 2012 will take place.

[5:81] The ODA is also responsible for:

- Building new permanent venues
- Building arenas that will be relocated after the Games: Water Polo, Basketball Arena, Paralympic Tennis and Archery, Greenwich Arena and the indoor Shooting hall
- Permanent works to existing sports venues, like Eton Dorney and Weymouth and Portland
- Planning and delivery on both transport infrastructure and services to support the 2012 Games projects
- Converting the Olympic Park for long-term use after the Games
- Making sure the project sets new standards for sustainable development.

[5:82] The ODA is planning Games-time and long-term use together to make sure the area will be regenerated, leaving housing, schools and health facilities for the local community after 2012, alongside world class sports facilities.

[5:83] As a Non-Departmental Public Body (NDPB), the ODA is accountable to Government for its work. Government Olympic Executive (GOE), which is part of the Department for Culture Media and Sport (DCMS), oversees the entire London 2012 project. The GOE supervise £9.3 billion of public sector funding which comes from a variety of sources including central Government, London authorities and the National Lottery.

[5:84] The ODA's work is underpinned by six priority themes: design and accessibility, employment and skills, equality and inclusion, health, safety and security, sustainability, and legacy.

[5:85] A delivery partner has been appointed to work with the ODA to project manage the venues and infrastructure programme for the Games.

Box 5-1: IUK, "Successfully managed projects, such as the Olympics, tend to share common characteristics including: the funder's clear commitment to expenditure; a clear and fixed timescale; accountable, knowledgeable and incentivised leadership; single-point responsibility for delivery to budget and a strong culture and incentives to reduce costs; and effective placement and control of contingency and risk budgets." (1)

5.4.1. Purpose

[5:86] The purpose of the programme is to develop and build the new venues and infrastructure for the 2012 Games and to serve the long-term legacy. This purpose, in an example of good practice, is underpinned by the six priority themes. These themes have measurable targets/benefits that are cascaded down to those delivering the projects that comprise the overall programme; such as the stadium, aquatic centre, utilities, etc. The objectives are very clear, they are reported regularly and achievement is actively celebrated, thus ensuring everyone in the supply chain understands the purpose and the value of their contribution.

5.4.2. Governance and Stakeholder Management

[5:87] The ODA is a thin client that employs a delivery partner (CML). The governance and control follows the Treasury Green Book stages and is tightly enforced and is an example of good practice. Hard financial thresholds are in place to control approvals and change, with all changes having to be approved by the ODA change board.

[5:88] Significant effort is expended on developing collaborative behaviour and partnerships, with all tier-1 suppliers actively involved in a number of non-commercial boards and initiatives. These are used to share best practice and measurement is used to create peer pressure to improve. For example, the learning legacy initiative is encouraging the collation and dissemination of good practice from the ODA's construction programme for the benefit of industry, clients and academia.

[5:89] The ODA employ a range of different commercial models, including PPP, target cost and emerging cost contracts to procure services. NEC contracts are employed as standard to encourage an active and collaborative approach to risk. The approach taken to maximise flexibility and value, is to identify the latest date when decisions/actions are required for each package. The necessary design for these packages is developed and frozen at these latest points, and changes from that point are rigorously evaluated and challenged.

5.4.3. Programme Team

[5:90] The ODA's directors are the Senior Responsible Officers (SROs) who are responsible and accountable for delivery. The ODA and their delivery partner are responsible for planning risk and for managing project to project interface risks. Their approach is to provide clarity of purpose to each project team.

[5:91] The whole programme is encouraged to have a one-team approach and, in an example of good practice, this is largely successful. This is significantly enabled by the hierarchy of measures and celebration of successes based on projects and tranches of work that are sensibly packaged into elements of reasonable human endeavour.

[5:92] In addition, the clarity of purpose, benefits and process is rigorously maintained; for example, ensuring that every change in the organisation is clearly communicated. Thus everyone is clear who is responsible for what. This is supported by information sharing and common IT. Ensuring one has the right balance of skill and experience at the right time is also important. In the early stage of a programme the right experience and creativity can derive significant value from change; in the later stages of any programme you need skill and judgement to orchestrate the finale. However, in the delivery phase you need drive and constancy of purpose.

[5:93] The tight governance controls and collaborative approaches encourage innovation, particularly in the attitude to risk. When managed proactively risks can be flipped into opportunities that deliver value.

[5:94] For example, the Enabling Works Project delivered a Programme Approach the Land Remediation of the Olympic Park, delivering the platform on which the Venues and Infrastructure could be implemented. The project integrated elements of what are called the 'Follow on Projects' into a holistic solution to remediation not only for the construction stages and Games, but beyond that into Legacy. This holistic approach meant that one enabling works project had to integrate the requirements of other follow on projects with regard to works in relation to the land form and the earthworks. As an example, the methods of work, approach to excavation and soil handling in follow on projects had to be undertaken with the programme requirements, the permissions and commitments made within the governance structures around the enabling works project.

[5:95] The ODA identified the risk that the follow on projects could generate their own approach to the issue unless the programme approach could be maintained post the enabling works – potentially impacting on the planning approvals obtained for the Park. To address this risk, the ODA decided to implement and operate a Soil Handling Facility – thereby maintaining consistency of the technical quality of the works to the satisfaction of and third party regulators and meeting the requirements of the follow on projects. In implementing this reasonably simple, yet innovative, approach to risk management, the ODA enabled the supply chain to manufacture engineering soils from the follow on contractors' spoil, with resulting cost, time and environmental benefits resulting for the resulting reduced demand for imported fill materials.

5.4.4. Assurance

[5:96] The venues and infrastructure programme for the London 2012 Games is managed through the commonly used RIBA design lifecycle. A wide range of performance metrics are collected via dashboards and aggregated to allow the ODA to track and report on it process.

[5:97] In terms of whole life costing the ODA recognises that it is delivering Venues and Infrastructure that will be owned/adopted by the likes of Utility Companies, Statutory Bodies, and the Olympic Park Legacy Company (and as a precursor to that the LDA). The ODA is managing whole-life cost by design; projects are required to work to standards developed by the end user, and the whole-life maintenance requirements therein. This approach is assured through formal review and adoption.

5.5. Strategic Freight Network

[5:98] The route plans and Route Utilisation Strategy (RUS) were the genesis for the Strategic Freight Network (SFN) (19). The SFN came from the 2007 Freight RUS and was signed off by all parties (including the rail freight companies).

[5:99] The Freight RUS is based on future projected growth in demand. It is subject not only to economic fluctuations but also the UK energy strategy will have an impact. For example, the balance between coal and gas powered power stations has a significant effect on the bulk freight (coal) market.

5.5.1. Purpose

[5:100] From the Network Rail SFN paper of April 2008 (20) the purpose is stated as to, “Complement, and be integrated with, the existing rail network. It would provide an enhanced core trunk network capable of accommodating more and longer freight trains, with a selective ability to handle wagons with higher axle loads and greater loading gauge”.

[5:101] The freight industry wants to grow in a very competitive market (both within rail and with road hauliers). The strategy looked at transport as a whole, not just rail. The main aim for freight is to be able to provide certainty and affordability to its clients.

[5:102] The rail freight market is controlled by a small number of competitive yet stable parties. Despite the competition, this provides a long term business outlook, which leads to collaboration around a long term strategy, unlike the rail passenger market.

5.5.2. Governance and Stakeholders

[5:103] A Strategic Freight Network Steering Group (SFNSG) has been established to agree and prioritise the projects to be undertaken within the CP4 £200million settlement. The SFNSG is chaired by Network Rail with representatives from DfT, ORR and the freight operating companies.

[5:104] The SFNSG, in an example of good practice, has collaborated very effectively. The mature relationship enables mature discussions to take place about trade-offs and looks to achieve the best value for the freight industry as a whole with the available funding. Despite the fierce competition between companies, the group shares a common stable objective of promoting and enabling freight over the network as they all take a long term view – in contrast to the passenger operators, where franchises are time limited. As a result the programme has delivered real benefits and value for money.

5.5.3. Programme Team

[5:105] In the case of the Strategic Freight Network, the focus of collaboration is the Strategic Freight Network Steering Group. The projects are all infrastructure projects that require minimal operational/organisational change to be implemented by the freight companies (a new chord, passing loops and gauge clearance). These projects have been successfully delivered by Network Rail’s own infrastructure project teams.

5.6. HS1

[5:106] The Channel Tunnel Rail Link Act (1996) provided the authority to build the railway, with the Government as customer and funder. A delivery framework was established and the funding mechanisms considered. Political commitment, combined with a belief by both major political parties that the project should go ahead, helped to carry the programme forward (21).

5.6.1. Purpose

[5:107] The purpose of the programme:

- A new direct link connecting the Channel Tunnel to London and cities to the North, to avoid potential congestion on the existing network through Kent.
- The regeneration of poor and less developed land areas in East London and North Kent. Regeneration was to be encouraged by faster domestic train services in North and East Kent, enabling easier access to and from London.
- To gain the assets at an affordable and predictable cost and to transfer risk to the private sector.

Box 5-2: IUK, “Following the cost study undertaken by the HS2 team, cost data was collected by Infrastructure UK for five international high speed rail projects, covering the countries: France, Germany, Italy and Spain; and the two sections of High Speed 1 (HS1) which were treated as separate projects.

A comparable average construction cost from the European projects considered (not total project cost) was £19.3m/km compared to HS1 Section 1 at £24.2m/km. Based on this measure the UK is twenty four percent more expensive.

A comparable average total project cost from the European projects considered was £21.2m/km compared to £26.7m/km for HS1 Section 1. Based on this measure the UK is twenty six percent above the average.” (10)

5.6.2. Governance and Stakeholders

[5:108] The Department of Transport (DfT) had oversight of the project and handled the procurement of the concession, which went to London & Continental Railways (LCR). London & Continental Stations & Property provided the services for acquisition of rights of way and the land required for the railway. Union Railways handled the conceptual engineering, developed the specification and alignments, and managed the finances for the actual construction. Rail Link Engineering (RLE), a joint-venture consortium made up of Arup, Bechtel, Halcrow and Systra, provided the project management.

[5:109] The form of contract used was NEC2 (New Engineering Contract 2), which provided important features, such as visibility of cost at all times. The importance of having a clear, approved programme is stressed. An important clause which was added specifically into the contracts was the contractual ability to take scope from one contractor and give it to another in the event of non-performance. The importance of detailed technical schedules was also emphasised – for instance details of the testing and commissioning process were included from the outset.

5.6.3. Programme Team

[5:110] From the outset the aim was to weld these organisations into one, removing the usual interfaces present on a major project in order to improve communications and trust, and in the process encourage the joint utilisation of talent, fast decision making, innovation and efficient operation.

[5:111] The project structure, a clear delineation of responsibilities, a dedicated client organisation, and the right team members were essential to the success of the project.

[5:112] The formation of an experienced management team with the ability to work together across the range of disciplines needed to deliver the project contributed to the successful outcome.

[5:113] LCR’s subsidiary, Union Railways, took primary responsibility for supervising the integration of the project teams throughout the programme, handling key interfaces and managing the client’s interests.

5.6.4. Assurance

[5:114] Overall, the project posed a vast array of challenges to which the integrated RLE team produced innovative solutions in the engineering and construction techniques employed. Examples include: the successful push launch of the Medway Bridge (one of a total of 144 new bridges); tunnelling methods, in which the key to success was the specification of the tunnel boring machines; and the rejuvenation of St Pancras station, which was a major project in its own right.

[5:115] Many projects experience a ‘mid-life’ crisis during their life cycle, and HS1 was no exception. A thorough review was carried out, the cost and programme re-assessed and strategies developed.

[5:116] Having an appropriate balance between autonomy and governance, with the freedom to take difficult decisions, was crucial to success, as was the commitment of all parties to deliver as a team.

[5:117] Two years before the end of the project the decision was made not to accept any further changes unless they were safety critical, or critical for the opening on 14 November 2007.

[5:118] The importance of commercial and technical integration and the provision of detailed technical schedules was also emphasised as a success factor. A specific and pertinent example is that details of the testing and commissioning process were included from the outset.

6. Assessment of GB Rail

[6:1] Drawing on the information collated from interviews, reports and papers, it has been possible to make a high-level assessment of GB rail programme management maturity. It should be stressed that this is a whole-industry assessment, which necessarily takes a broader view than just infrastructure, where GRIP is recognised as a standard staged project approach.

[6:2] The assessment has looked at maturity using two alternate viewpoints. The first approach employs the OGC P3M3® Programme Management level overview statements and compares them with the evidence found (22).

[6:3] The second approach is based on identifying trends in the evidence collated through this study and relating these trends to the pillars identified in our model of whole system programme management.

6.1. High-level OGC P3M3® Assessment

[6:4] The assessment is detailed in the right hand column of the table below, which in the left hand columns reproduces the level summaries published by the OGC as a summary of their Programme Management Maturity Model (PgM3) (22; 23). References to organisation in the model have been read to mean GB rail industry.

Maturity Level	OGC Programme Management Maturity Model (PgM3®)	GB Rail Assessment
Level 1 – awareness of process	Does the organization recognize programmes and run them differently from projects? (Programmes may be run informally with no standard process or tracking system.)	We found no consistent understanding of the fundamental differences between programmes and projects.
Level 2 – repeatable process	Does the organization ensure that each programme is run with its own processes and procedures to a minimum specified standard? (There may be limited consistency or coordination between programmes.)	Publicly funded programmes are all governed by Treasury rules and the OGC Gateway process. However, no consistency in the implementation of this, or MSP™, was evident.
Level 3 – defined process	Does the organization have its own centrally controlled programme processes and can individual programmes flex within these processes to suit the particular programme?	Publicly funded programmes are all governed by Treasury rules and the OGC Gateway process. However, no consistency in the implementation of this, or MSP™, was evident.
Level 4 – managed process	Does the organization obtain and retain specific measurements on its programme management performance and run a quality management organization to better predict future performance?	ORR and NR collect information about infrastructure enhancement performance and DfT collates lessons learned and overall benefits realisation assessments of major programmes. But it is not clear how this leads to industry-wide learning.
Level 5 – optimized process	Does the organization undertake continuous process improvement with proactive problem and technology management for programmes in order to improve its ability to depict performance over time and optimize processes?	The lack of a common approach and shared performance information dictates that this is not possible.

[6:5] Our overall assessment of maturity against this model is that it is currently at Level 1, although the lack of understanding of the difference between programme and project management means that the industry as a whole has some work to do to achieve a solid Level 1 assessment.

6.2. Whole System Programme Management Assessment

[6:6] The evidence collated through this study has been analysed in order to identify industry trends that relate to the pillars identified in our model of whole system programme management. These trends have been interpreted in terms of the emerging maturity assessment tool, which is detailed in the next section.

[6:7] Overall this assessment confirms that the previous high-level conclusion that the industry's programme management maturity level is Level 1.

6.2.1. Purpose

[6:8] The most significant barrier experienced when considering this pillar is the generally poor appreciation of the difference between a project and a programme. Therefore, while all programmes recognise the importance of having some clear mission statement, most do not articulate a transportation purpose in terms of the outcomes and benefits required from the programme.

[6:9] The purpose should be positioned below and be aligned with the overall political, economic and societal policy and strategy. This requires government and the industry leadership to provide a stable long-term direction and purpose for the industry, which is currently lacking.

[6:10] Good practice is for the purpose to be deliberately solution independent. This is a particular challenge in the rail industry, where it is common for programmes to be defined very early in terms of an element of the solution; examples being Evergreen 3, Thameslink and IEP. In addition, it is good practice to support the purpose statement with a small number of measurable objectives or benefits capturing the major requirements or the sponsors; a practice that appears to be very uncommon.

6.2.2. Governance and Stakeholders

[6:11] This evidence presented to this study suggests that governance is inconsistent. There is a range of different funding and delivery mechanisms that in many cases are not consistent across all of the different projects or rail components that comprise a programme. This causes tension within programmes and acts as a barrier to industry learning – as there is no consistent terminology and approach.

[6:12] While all programmes have governance arrangements, the roles of Funder, Sponsor and Delivery Agent are not consistently applied – and there is confusion about the use of the term client, which is widely used in the wider construction industry. For example, is the client the passenger, the train operator, or the funder, which in many cases is a government agency? In some cases the governance arrangements appeared not to offer all the Sponsors board level influence.

[6:13] There are particular conflicts for Network Rail where it is effectively Funder (funding agreed via the Periodic Review), and then acts as Sponsor and Delivery Agent for cross-industry programmes.

[6:14] Major goal oriented rail programmes by their nature have a wide spectrum of stakeholders and overall management of the stakeholders is one of the principle roles of the Sponsors board. There is mixed evidence of successful stakeholder management, with some programmes clearly excelling. Where stakeholders are managed well at all levels, the successes are plain to see, with normal flashpoints, such as Network Change, navigated smoothly.

6.2.3. Integrated Programme Team

[6:15] There does not appear to be a consistent approach when it comes to establishing an integrated programme team.

[6:16] Many factors seem to influence the genesis of such teams. These include:

- the time the programme takes to get to the equivalent of initial gate
- client organisation
- funding arrangements

[6:17] What we would expect to see is a core team structure applied to all programmes which could be tailored to suit the needs of the programme as it progresses through the life cycle stages. This would enable the industry to have a level of maturity which would enable programmes to start with a strong programme team with a clear view of its roles and responsibilities.

[6:18] We have observed pockets of good practice in this area. However, this has been almost on the job learning and development. The team should not evolve from first principles each time; rather the structure should be right at the start. This would provide more opportunity to influence the solution and the potential value available in the early stages.

6.2.4. Whole-Life Design Assurance

[6:19] Very little evidence was presented to demonstrate that programmes have analysis that provides assurance that the constituent projects will combine to deliver the desired overall outcomes and benefits.

[6:20] The industry still largely relies on peer and expert review approaches to assurance, and typically employs standards to manage whole-life costs. There was little evidence presented of programmes understanding the current or future whole-life cost, or actively managing this as an outcome.

[6:21] The approaches found to commissioning, acceptance and handover were not consistently good, resulting in confusion in some programmes about this crucial phase.

[6:22] There were some pockets of good practice in terms of the management of solution architectures, requirements and interfaces and their linkage to benefits. However, this is not widely adopted.

7. Implementation

[7:1] Overall it is clear from the high-level assessment performed that there is significant scope for improvement in programme management. This section sets out some practical approaches that will reduce all aspects of costs associated with delivering major enhancements within GB rail.

[7:2] Drawing from the analysis and assessment, we first present an outline of a maturity model that can be developed and used to guide the improvement journey that is required. This tool can be used for both short term tactical gains and to support long-term deep routed improvements.

[7:3] Aided by the maturity tool we have identified a number of key enablers that are barriers to improvement, which are described. Based on this, a number of specific improvement approaches are presented – these include both short-term tactical improvements and possible long-term, strategic organisation changes.

7.1. Whole System Programme Management Maturity Model

[7:4] The work has identified a number of key pillars – based on the areas where improvement in GB Rail programmes can deliver the greatest improvement in value for money.

[7:5] This maturity model represents a fusion of MSP’s organisational transformation principles with the whole system-engineering good practice, aimed at helping existing programmes develop improvement plans that will enable them to deliver better value.

[7:6] The maturity model uses the same structure as the P3M3® model (22), developed and published by OGC. However, the P3M3 model is more aimed at organisations than individual programmes. The P3M3® model comprises three individual maturity models, focused on Portfolios, Programmes and Projects (hence ‘3P’); each employs the same five maturity levels and the same eight perspectives. Within each perspective the five levels are differentiated by attributes that describe the behaviours and processes that are expected of an organisation at that level.

[7:7] This hierarchical arrangement of characteristics does not imply that all organisations should achieve level five in all perspectives. The tool is also not intended to be a ‘one-moment-in-time’ assessment; much greater benefit will come from using the tool to plan a strategic improvement journey. Organisations should assess what level is optimal for them and implement plans to mature as necessary, thus reducing overall risk and improving the quality of the programmes they run. However, in tandem with this strategic approach, it is recognised that the use of a maturity assessment will highlight short-term improvements that can deliver rapid returns.

[7:8] Our approach is to augment the existing P3M3® perspectives with the key pillars from our model; identifying the specific attributes a programme should exhibit at each level of maturity. Due to the compressed nature of this study, it has only been possible to identify attributes at three of the five levels.

[7:9] The completed pillars and attributes should not be taken to imply a complete statement of the requirements for good practice in Programme Management. Good practice comprises appropriate focus on all of the pillars identified in the strawman model (see Appendix E) in addition to use of frameworks such as MSP.

	Level 1 Awareness	Repeatable	Level 3 Defined	Managed	Level 5 Optimised
Impelling Purpose	<ul style="list-style-type: none"> The programme's purpose is not a shared common view throughout the integrated team. 		<ul style="list-style-type: none"> The programme has a clear and succinct impelling purpose. The purpose is agreed by 		<ul style="list-style-type: none"> The impelling purpose is clearly, succinctly communicated and reinforced.

© Crown copyright, 2011

	Level 1 Awareness	Repeatable	Level 3 Defined	Managed	Level 5 Optimised
	<ul style="list-style-type: none"> The purpose does not align with the governmental/ economic/societal outcomes and context. The purpose does not link to specific measurable benefits. The purpose is not solution independent. There is no clear linkage between the purpose/benefits and the requirements placed on the programme's individual projects. 		<ul style="list-style-type: none"> all Sponsors and is a common view throughout the integrated team. The purpose is broadly understood (if not agreed) by wider stakeholders. The purpose is aligned with the governmental/ economic/societal outcomes and context, and is expressed in transport terms – moving goods/people. The purpose is solution independent. The purpose links to specific measurable benefits. 		<ul style="list-style-type: none"> The programme leadership explicitly employs the purpose in order to optimise value for money. The purpose enables innovation and creative thinking. The requirements placed on the programme's individual projects are linked to the purpose. And all level 3 attributes.
Governance and Stakeholder Management	<ul style="list-style-type: none"> The programme has a Sponsors board to provide governance and direction. The programme has a governance lifecycle model, recognising distinct phases with decision making gates. Project lifecycle and stage gates are appropriately coordinated with programme stage gates. The programme has a through-life Stakeholder Management plan. Stakeholder needs and influence is identified and stakeholders and classified accordingly. 		<ul style="list-style-type: none"> Sponsors board is empowered and active in providing strategic direction and governance to the programme. Sponsors board owns and is involved in senior stakeholder management. Sponsors board controls programme level risk/contingency budget. And all level 1 attributes. 		<ul style="list-style-type: none"> Risk and opportunity is shared and traded between sponsors to maximise value. Programmes independently regulated at stage gates. Sponsors willing to collaboratively invest in programmes with the expectation that some will fail to pass early stage gates. Stakeholders collaborate with programmes to reduce risk and maximise opportunities. And all level 3 attributes.
Integrated Programme Team	<ul style="list-style-type: none"> The programme has a team that includes competencies, experience and skills representing all of the major components of the programme required to deliver the purpose. The team is not empowered to deliver the programme as a whole. The team is not accountable for the overall purpose and benefits. Key team members change frequently (i.e. less than two years) leading to lost knowledge and changed direction 		<ul style="list-style-type: none"> There is an identified integrated programme team that has all of the necessary technical, operational, analysis and commercial skills and experience. The team is collocated The team has representation from all the Sponsors and key Stakeholders. The team is lead by a strong charismatic leader. There is explicit effort (team building/break-through) on forming and maintaining the team as a highly-effective team. The team is empowered to deliver the programme as a whole and is accountable for the overall purpose and benefits. The evolution of the team is managed to retain knowledge 		<ul style="list-style-type: none"> The integrated programme team has been optimised to have the right balance of Capability, Competence and Experience – blending with hard and soft skills. The team is collocated and it is hard to identify who is from which organisation The team creates value through sharing and trading risk and opportunity across the programme. The team has a clear set of shared values and challenges inconsistent behaviour. The team regularly reviews its effectiveness and undertakes continuous improvement And all level 3 attributes.

	Level 1 Awareness	Repeatable Level 3 Defined	Managed Level 5 Optimised
Whole-life Design Assurance	<ul style="list-style-type: none"> The programme has an understanding (based on analysis) of how and when the constituent projects integrate to deliver the overall benefits. The programme understands the current and future whole-life cost and how it plans to manage them. The programme maintains an overall architecture of the solution, which defines the ownership of all elements/entities and all interfaces. The programme has commissioning, acceptance and handover (verification and validation) strategies and plans agreed with stakeholders during the concept phase. The programme develops and maintains requirements for each project and interface, which are linked to the overall benefits. The programme employs a process of expert and peer review of project integration at defined and agreed milestones. 	<ul style="list-style-type: none"> The programme understands (based on analysis) how and when the certainty of achieving the overall benefits increases over time. The programme employs whole-life cost analysis (including whole-life carbon costs) to challenge standards during design. The programme has a clear architecture to maintain consistency between different aspects of the programme. The programme regularly challenges standards using the whole-life cost analysis and architecture The programme works with stakeholders to minimise costs through cross-acceptance. The programme collects assurance information progressively through the design, build and commissioning. The programme employs analysis, modelling and simulation to support and inform peer/expert reviews. And all level 1 attributes. 	<ul style="list-style-type: none"> The programme team make decisions based on an understanding of the impact on cost, time, quality and the certainty of achieving the overall benefits. The programme is designed to meet the requirements in a whole-life optimised way, with minimal recourse to standards other than for interoperability. The benefits are delivered in stages through a set of defined and managed configurations or milestones – each one have a commissioning, acceptance and handover plan supported by justification for safety, reliability, maintainability and operability. And all level 3 attributes.

7.2. Improvement Enablers and Barriers

[7:10] The following enablers and barriers have been identified, which in some cases have potential implications for other Value for Money work packages.

7.2.1. Programme vs. Project

[7:11] A significant barrier we found was a lack of understanding of the difference between programmes and projects. In many cases in the rail industry it seems that programmes are simply seen as large or complicated projects. The key distinguishing factors have to be clearly communicated and recognised and the industry must take steps to raise programme management competence.

Major Goal Oriented Programmes:

- Deliver outcomes, as opposed to outputs;
- Are inherently dealing with an initially fuzzy scope and changing environment, requiring agility and flexibility to maximise the opportunities and manage risk; and
- Integrate projects so that the whole is greater than the sum of the parts.

7.2.2. Long-term Industry Strategy

[7:12] The current industry structure appears to be a barrier to the consistent and clear statement of purpose. All of the best practice in respect of Asset Management (5) and Managing Successful

Programmes (13) is centred on the need for programmes to have clear purpose that is aligned to *the organisation's* strategy and objectives.

[7:13] In the context of this study *the organisation* is essentially the whole industry. Therefore, successfully delivering value for money programme management is predicated on having clear and consistent, long-term industry strategy.

7.2.3. Governance and Lifecycle

[7:14] The fragmented nature of the industry is frustrating the adoption of consistent whole programme lifecycle thinking. There is evidence of moves to adopt better whole system approaches, such as the Thameslink System Integration team. However, it is normal for different elements of a programme to be delivered, funded and governed separately – for example, IEP. As a result, benefits are limited as teams are constrained to only have partial responsibility and authority.

[7:15] Whole system approaches are also frustrated by mismatched re-franchising timescales, control periods and a lack of long-term strategy, which puts projects and stakeholders in cross-industry programmes under different and sometimes conflicting pressures. For example, the periodic review process forces funding decisions about programmes based on a fixed five year cycle, which in some cases results in decisions with insufficient analysis and design.

[7:16] This is further exasperated by the fact that in CP4 Network Rail has been allocated £50m to support the development of enhancements to a level to support the PR13 investment decision – this is less than 1% of the CP4 enhancements budget. In order to realise value for money the industry needs to recognise that it must spend 10-15% of capital budgets to get to main gate – authority to invest, and it must be prepared to spend this on some programmes that will fail at main gate.

[7:17] The industry structure needs to allow major cross-industry programmes to be funded and governed as a whole, such that whole-life and whole system trade-offs can be employed to maximise value for money; for example, an approach similar to the model used for Crossrail Ltd. where the Project Development Agreement (24) provides the overarching governance framework.

7.2.4. Accountability and Authority

[7:18] The industry structure must also allow delegation of clear and unobstructed authority to run major cross-industry programmes, without undue interference from stakeholders. Stakeholders must be fully consulted and engaged, and there is evidence to show the rail industry can do this well. However, programmes require sufficient authority to ensure stakeholders can't change their requirements once they have been agreed, without consequences to them. With this authority, it is possible to make programme accountable for the outcomes sought.

[7:19] Network Change is cited as a barrier to value for money in some cases, but this is not consistent. The evidence suggests it is not a root cause, but a symptom of the perverse incentives locked into the current structure. There is evidence that the Network Change process can be managed effectively and efficiently, from programmes such as the Strategic Freight Network and Reading Station.

7.2.5. Integrated Programme Teams

[7:20] We have found evidence of good practice of stakeholder engagement which is an enabler. Programmes are putting together integrated teams with membership of key stakeholders; for example, GSM-R and Thameslink. However, this has been arrived at over time and not implemented from the beginning of the programme. Therefore the benefit of such partnering approaches have not been fully realised and steps need to be taken to ensure an integrated approach right at the start of any programme.

7.2.6. Assurance of Outcomes

[7:21] The evidence presented suggests that most programmes only measure and track ‘inputs’, such as progress, milestones and earned value measures. In order to ensure that programme constituent parts will integrate to deliver the required outcomes, it is necessary to undertake analysis. This will enable programmes to manage to the outcomes – as opposed to managing the consequences of the outcomes.

[7:22] The railway is a network and care is needed in assessing the implications of changes in one area or aspect of the overall capability, which might have an implication in another seemingly unconnected area.

[7:23] Therefore, the railway industry needs the capability to authoritatively evaluate the whole system implications of proposed solutions. The industry has a managed and authoritative source of safety assessment in RSSB and has seen significant and coordinate improvement – we suggest these facts are linked.

7.2.7. Whole-life Design Assurance

[7:24] The railway is currently largely designed to standards and specification, as opposed to being designed to the requirements. As a result many aspects of the designs are over engineered for the specific duty required – increasing cost and reducing innovation. This is a barrier to achieving value for money.

[7:25] The industry needs to much better understand the whole-life cost implications of programmes and use this to challenge standards and change culture and behaviours to design to the requirements. This will require much greater effort being invested in the early stages of programmes and project – a practice known as Front End Engineering Design (FEED) that is common place in other industries such as Oil&Gas and Power. This will require much better asset information and configuration control by asset managers, and a willingness to invest time and money. However, it will release significant value.

Box 7-1: IUK, “Poor asset records and condition data can lead to inefficiencies in the transfer of risk for its upkeep and replacement. This is manifest in the high costs of external due diligence required to update and compile asset data prior to putting work out to external competition, and in the risk premium placed by the supply chain on work where asset data is incomplete or unwarranted. This also applies to the provision of utilities asset data, the absence or inaccuracy of which is a frequent cause of variations and cost overruns.” (1)

[7:26] In the near future, whole-life design assurance will be further complicated by the need to qualify and optimise both the construction embedded carbon and the impact of the programme whole-life carbon performance.

7.3. Tactical Improvement Plans

[7:27] There are a number of current GB Rail goal oriented programmes at different stages of their lifecycle, some of which have taken part in this study. Given the accelerated nature of this study it has not been possible to undertake an audit of these programmes. However, based on the evidence collected we have concluded that it will be possible to reduce costs and overruns by undertaking maturity audits of existing programmes and developing specific improvement plans as a result.

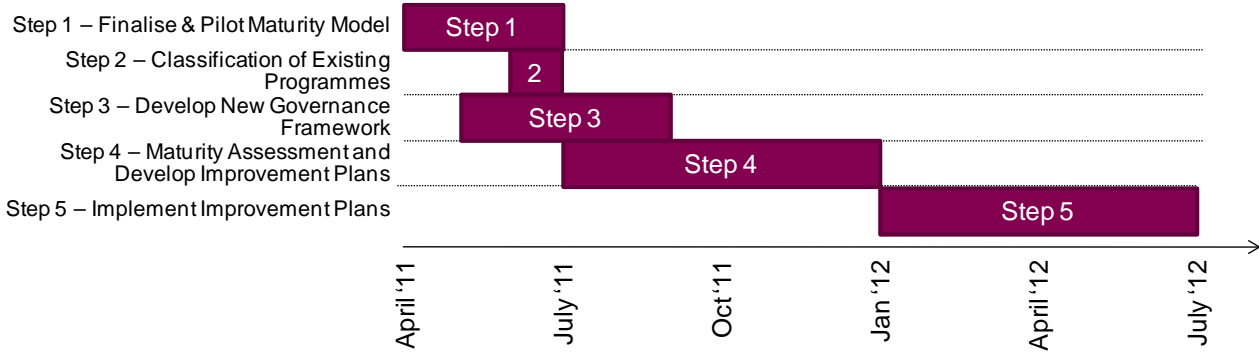


Figure 7-1: Tactical Improvement Plan

[7:28] It is proposed that this assessment should comprise the following five steps, as shown in Figure 7-1:

1. **Pilot and finalise the maturity model**, detailed in Section 7.1. We propose that a programme such as the Danish national ERTMS programme is used as a pilot, as it is being run entirely on an MSP™ and PRINCE2™ basis.
2. In parallel to this activity, a **classification of existing programmes** should be made, by plotting total capital value, lifecycle phase and spend to date on the Cost Influence Curve (shown indicatively in Figure 7-2). This will allow selection of those programmes where the maturity assessment and improvement plans will have the greatest influence.
3. Establish the **new governance framework**, including the new programme management lifecycle, sponsors board term of reference and any necessary supporting models or tools.
4. Undertake a **maturity assessment** of current goal oriented programmes, analyse the results, identify the appropriate levels for each programme and **develop improvement plans**.
5. **Implement the improvement plans** and reassess the maturity to demonstrate and celebrate success.

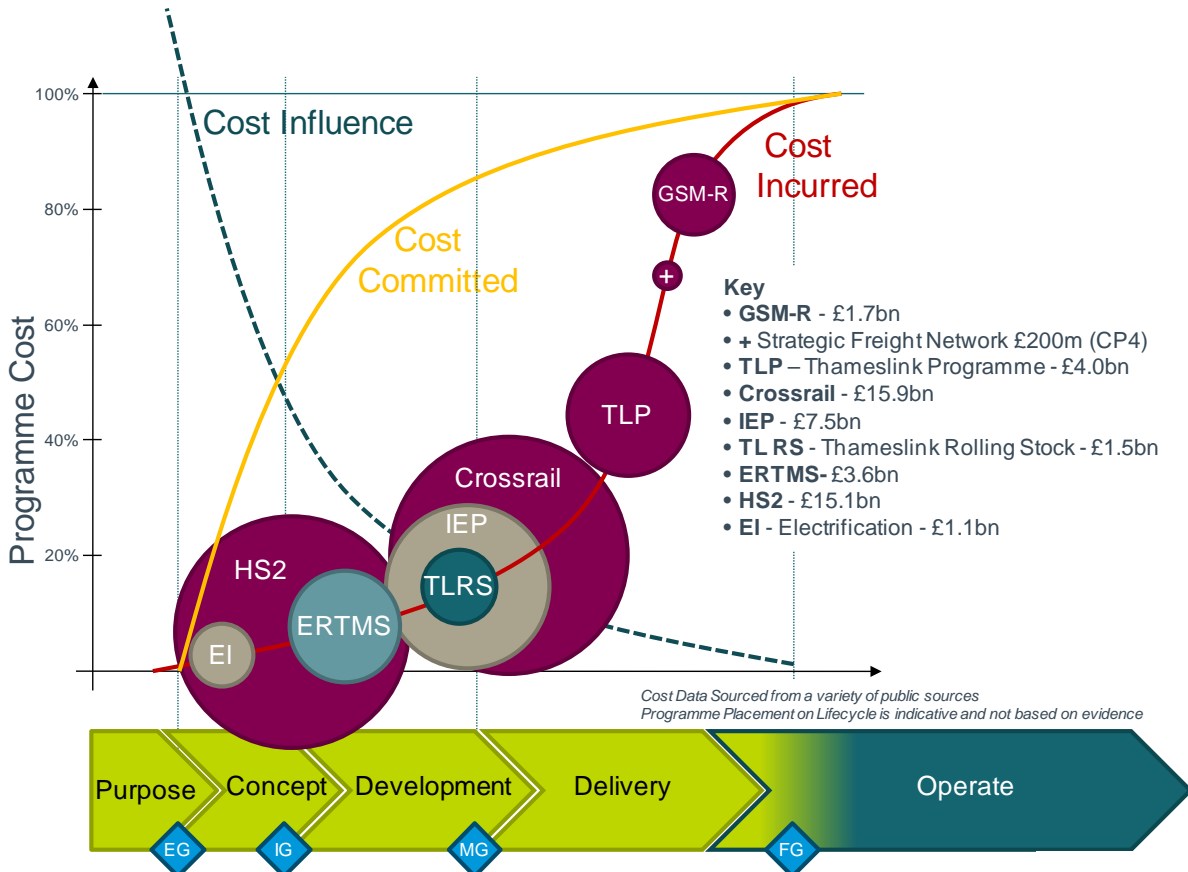


Figure 7-2: Indicative Cost Influence Curve

© Crown copyright, 2011

[7:29] Steps 1-2 should be undertaken by a central industry wide team, with steps 3-5 undertaken by the programme teams themselves (supported by a central team). The whole improvement should be managed as a transformation programme in its own right, with a stakeholder group comprising key industry representatives from NR, ATOC, RIA and DfT, chaired by a senior industry figure.

[7:30] This tactical approach will deliver savings as a result of addressing the following identified barriers. It will be able to:

- Improve understanding of the difference between projects and programmes, and drive up the competence in programme management;
- Ensure programmes have a clear, solution independent purpose and creatively consider a wide range of solution options;
- Embed integrated programme teams early in the programme lifecycle; and
- Develop approaches to the whole-life design assurance of outcomes.

[7:31] However, the tactical improvement plans alone are unlikely to be able to address the issues around stability of long-term strategy or direction; or the governance, lifecycle, accountability or authority barriers. These will require support from more strategic and industry-wide structural interventions.

7.4. Strategic Improvement Plans

[7:32] The Secretary of State, The Rail Value for Money study and the Coalition Government's Franchising Review are promising significant change to the structure of GB Rail, in order to deliver a step change in the value provided to passengers and tax payers (25).

[7:33] This study looks at major enhancement projects and the enhancements spend over the next two decades is going to be significant, based on the indicative analysis shown in Figure 7-2; taking IEP, Crossrail, HS2, ERTMS and Electrification, the total major enhancements spend in the next twenty years may be as much as £40bn, compared with total railway maintenance, renewals and operational costs of around £200bn (at today's costs). Whilst these programmes should be part of the tactical improvement discussed above, the impact of misalignment between these programmes and the long term rail strategy is significant.

[7:34] Therefore, there is an opportunity to make substantial and sustainable savings in the enhancement expenditure. To achieve long-term savings this study suggests that the following principle barriers must be addressed:

- Investigate how industry structure can best facilitate the provision of clear, long-term strategy and direction for the industry ;
- Allow major cross-industry programmes to be funded and governed as a whole, such that whole-life and whole system trade-offs can be employed to maximise value for money; and
- Empower programmes with the clear and unobstructed authority to deliver major cross-industry programmes, without undue interference from stakeholders.

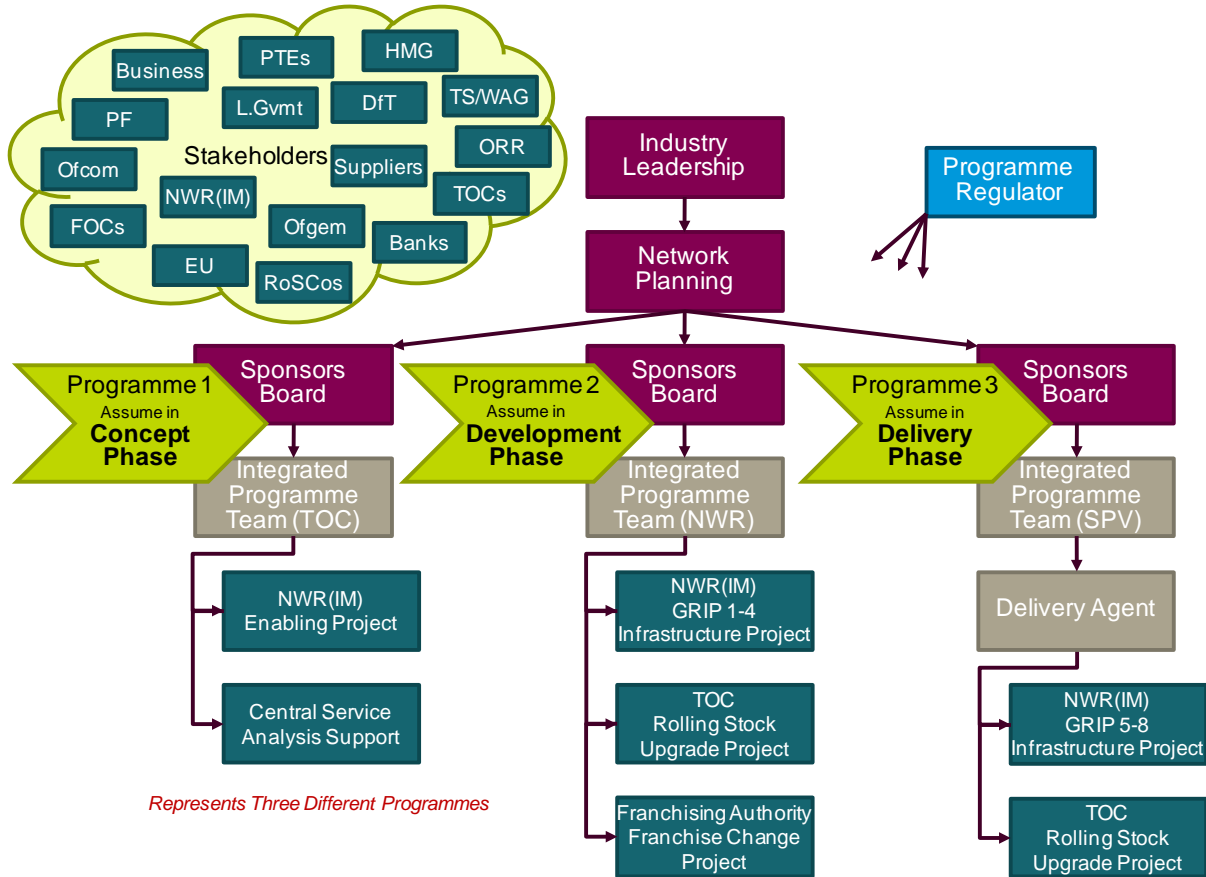


Figure 7-3: A Simplified Representation of the Proposed Concepts/Roles relating to Three Hypothetical Programmes.

7.5. Implementation Outline Option

[7:35] It is outside the scope of this study to consider the overall industry and commercial structures that would achieve this. However, based on the good practice described in MSP™ and the practice observed, the following outline is proposed as an enabling piece of the overall solution. Figure 7-3 is a simplified representation of the concepts or roles described below, showing how they might be realised for three hypothetical programmes that are at different stages of the lifecycle.

[7:36] Programme governance and authority stem from a correctly structured, well led and empowered Sponsors Boards. It is suggested that this should become a feature of programmes, with boards having significant freedom to pursue programmes in the most technically and commercially cost effective manner. This freedom should explicitly include the option to contest the provision of any of the service (including the Integrated Programme Team) required to deliver the programme, following the Entry Gate.

Box 7-2: IUK, “The research has indicated that public procurement in the UK is more likely to use the competition paths of the OJEU process, whereas negotiated procedures are more widely used in Europe.” (10)

[7:37] The Sponsors Board should be incentivised to deliver value for money, assessed as a lowest whole-life cost vs. affordability trade-off. Boards would be held to account for their actions by an independent Programme Regulator, who would have powers over all GB Rail programmes and would have to approve progress through a standard set of programme stage gates. If the regulator is not satisfied that the selected technical and commercial solution represents best value for money it should have the power to mandate an alternative approach (26).

[7:38] The proposed gate structure (shown in Figure 7-4) is consistent with Treasury and OGC stage gates, and should be designed to allow a single gate review to meet all the requirements, thus avoiding *gate-fatigue*.

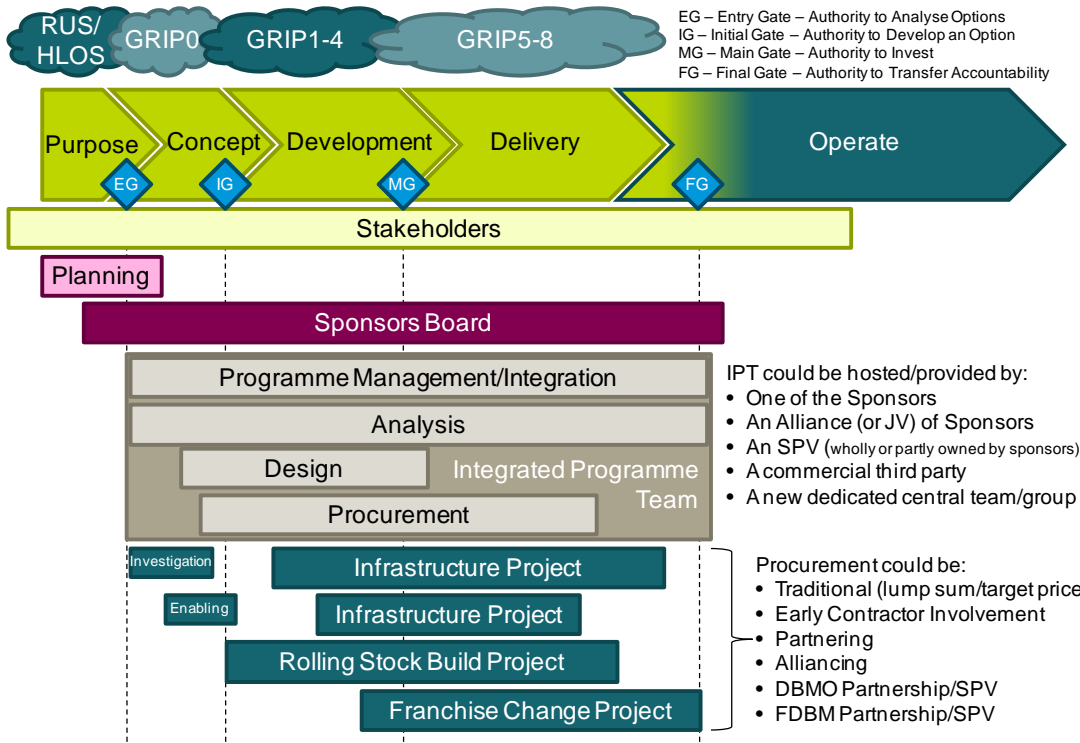


Figure 7-4: An Indicative Future Programme

[7:39] It is recognised that there needs to be some central network planning function, which is involved in the initial assessment of needs and retains a role in co-ordinating the portfolio of programmes. For example, programmes such as IEP, Crossrail and HS2 share a critical interface at Old Oak Common, and there is a need for an arbitrating, controlling mind to ensure a sensible overall compromise.

[7:40] Assuming there is a central network planning function, any stakeholder should be able to approach them with a programme idea or proposal for a statement of purpose. The first stage is to work with the stakeholder and assess if the statement of purpose is strategically aligned and if there are a reasonable number of potential solution options available. This is analogous to the existing RUS process, but that just looks at gaps in capacity. It is suggested that this process would also be the route for vision or policy based initiatives, as well as regulatory compliance based programmes.

Box 7-3: The Ministry of Defence (MoD) implemented Smart Acquisition, between 1998 and 2001, in response to poor programme management performance. MOD programmes are initiated to capability gaps identified by military planners and passed to specialist programme management staff in Integrated Programme Teams (IPTs). The IPT is responsible for evaluating alternative ways of filling the capability gap and selects the most cost effective way of meeting the need. The IPT also ensures that all elements needed to fill the capability gap are considered – including equipment, process changes and training and development.

[7:41] The central planning function could effectively co-ordinate the route strategies and rolling programme of central government investment, with other programmes looking to exploit more flexible sources of funds. The role of the central function would be to confirm strategic fit and establish that a reasonable number of potential solution options available. The planning function might also sensibly maintain the portfolio (of programmes) management role for the network.

[7:42] The stakeholders would have to agree to form a Sponsors Board, which would have representation of the funder(s), those stakeholders who will be directly involved in changes necessary to deliver the outcomes, and at least one TOC or FOC, to ensure every board has a passenger/freight customer facing voice. The industry would need some standard terms for a Sponsors Board to ensure reasonable consistency.

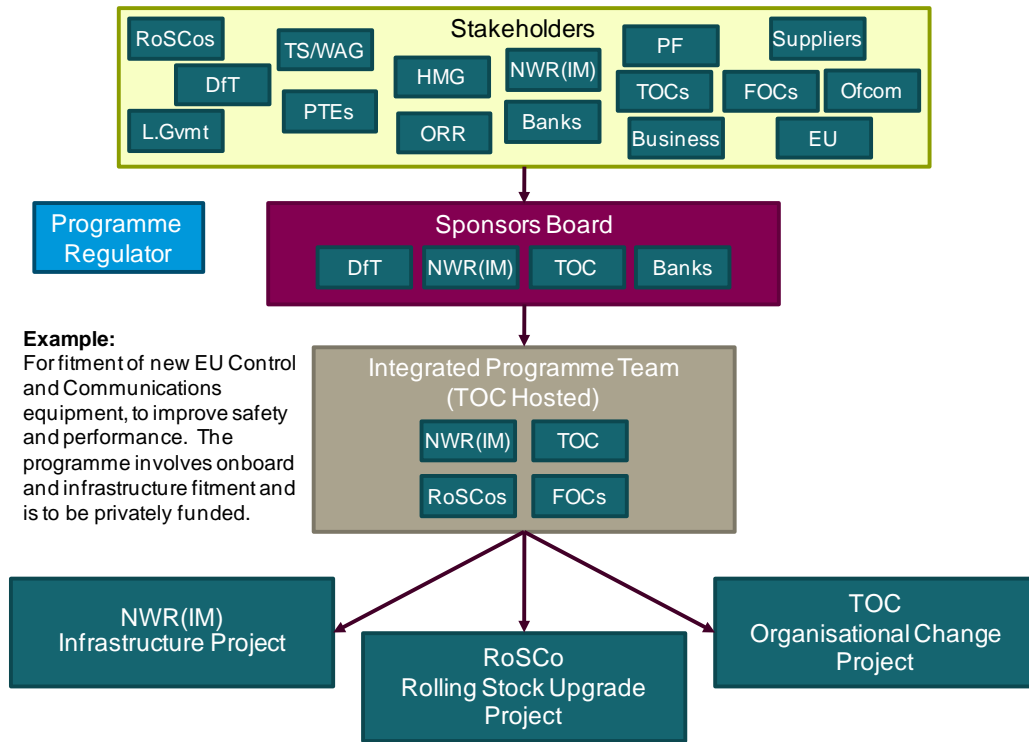


Figure 7-5: An Indicative Future Programme Team Structure

[7:43] All programmes should have to have an Integrated Programme Team, which will be responsible and accountable for the programme delivery, performance and outcomes from the Entry Gate until the Final Gate. All programmes will be expected to instigate formal team building and maintenance activity, to ensure the teams perform well.

[7:44] The IPT will be initially responsible for the analysis of solution options, in preparation for the Initial Gate, at which the concept solution will be confirmed. The IPT may undertake the analysis itself – perhaps drawing on a central GB rail modelling and analysis service – and it may sub-contract elements of analysis, enabling works and investigations. The IPT will also need to have the capability to manage the procurement of these services and the procurement of the major projects during the next phase.

[7:45] The work of the IPT in this phase will most likely obviate the need for GRIP 0 in future projects, as the IPT will have defined a clear brief and have the Sponsors Board approval for this, prior to passing the Initial Gate.

[7:46] Once the Initial Gate is passed, the IPT will move to develop the design for the selected solution, based on a set of agreed packages or projects. This is equivalent to applying GRIP1-3 stages to the whole railway system, and will most likely be carried out by one of more of the Sponsors – employing an appropriate commercial structure.

[7:47] In order to pass the Main Gate, the IPT will have to demonstrate a robust understanding of the initial costs and the whole-life costs of the programme. During the delivery stage the IPT will hold the projects to account, and manage the overall programme and integration. The IPT will hold all programme level risk and contingency. The Sponsors Board will be required to ensure there is a strong cost driven change control process.

[7:48] In order to stimulate creativity, innovation and value for money through contestability, it is suggested that the Sponsors Board should be free to choose:

- how it forms the Integrated Programme Team;
- how the IPT is incentivised and what risk/procurement responsibility it carries; and
- the procurement and commercial model used to select and contract the IPT.

[7:49] The host or facilitating organisation would need to demonstrate it can provide the necessary support facilities and programme management maturity. Regardless of the host organisation, the integrated team will be drawn from a cross-section of the stakeholders.

[7:50] The IPT host/facilitator could be:

- One of the Sponsors;
- An Alliance (or JV) of Sponsors;
- An SPV (wholly or partly owned by sponsors);
- A commercial third party; or
- A new dedicated GB Rail central team/group.

[7:51] The IPT should remain relatively consistent throughout the programme, so it will be important to consider the whole-life of the programme when selecting the IPT host.

[7:52] The skills and competence of the IPT will need to change through the programme, so it will be necessary for the IPT to buy in services and skills are required. For example, an IPT may bring a delivery partner during the delivery stage of the programme.

[7:53] Figure 7-5 provides an indicative team structure, showing one possible instance of how this approach be realised.

8. Conclusions

[8:1] The results of this – albeit accelerated – study confirmed that, while there are noteworthy pockets of good practice, the GB Rail industry has significant scope to improve in whole system programme management. The study suggests that the industry has the drive and capability to make these improvements and that they will substantially improve value for money.

[8:2] The study suggests that overall the GB Rail industry is at level 1 of a five step whole system programme management maturity model – where level 1 is ‘awareness’ (the lowest level) and level 5 is ‘optimised’ (the highest level). This assessment applies a single organisation model to the whole industry and is specifically directed at ‘programme management’, as distinct and different to ‘project management’. In the case of the later, while this has not been the focus of this study, the evidence would indicate a much high-level of cross-industry maturity.

[8:3] The nature of major goal oriented programmes is that they last many years, so this study has developed a two tier approach to improvement. This comprises tactical steps that should be taken to gain benefits in the short to medium term, and strategic plans, which will secure longer-term, sustainable savings.

[8:4] The principle **tactical improvement recommendations** are:

- Create an improvement programme and cross-industry implementation team under the guidance of a cross-industry Sponsors Board. The implementation team should finalise and pilot the maturity model, and classify all existing major cross-industry programmes in order to identify those which present the greatest opportunity and capability to improve and deliver benefits.
- Establish the new governance framework, including the new programme management lifecycle, sponsors board terms of reference and any necessary supporting models or tools.
- The selected programmes should undertake the maturity assessment, develop and implement improvement plans, under the governance of the Sponsors Board and supported by the implementation team.

[8:5] These tactical recommendations should be complete and realising benefits within 12 months.

[8:6] The principle **strategic improvement recommendations** are:

- Investigate how industry structure can best facilitate the provision of clear, long-term strategy and direction for the industry;
- Allow major cross-industry programmes to be funded and governed as a whole, such that whole-life and whole system trade-offs can be employed to maximise value for money; and
- Empower programmes with the clear and unobstructed authority to deliver major cross-industry programmes, without undue interference from stakeholders.

[8:7] It is outside the scope of this study to consider the overall industry and commercial structures that would achieve this. However, based on the good practice described in MSP and the practice observed, the following outline of the essential roles proposed as an enabling piece of the overall solution:

- **Industry Leadership** – setting a long-term, stable strategy and objectives that provide direction and purpose for the industry, against which decisions and programmes can be aligned.
- **Programme Regulator** – to provide independent scrutiny of the quality, effectiveness, efficiency and value for money of programmes, holding Sponsors Boards to account, controlling progress through programme stage gates and with the ability to mandate an alternative approach.

- **Network Planner** – co-ordinates and owns route strategies, manages the portfolio (of programmes) for the network and supports stakeholders and sponsors in the Purpose phase of programmes, prior to Entry Gate.
- **Sponsors Boards** – empowered with significant freedom to pursue programmes in the most technically and commercially cost effective manner, including the option to contest the provision of any of the service following the Entry Gate. Sponsors Boards will also fulfil the vital senior stakeholder management role.
- **Integrated Programme Teams** – dedicated, multi-disciplined, multi-stakeholder, co-located teams, formed and managed as high-performance teams, responsible and accountable for the programme delivery, performance and outcomes from the Entry Gate until the Final Gate.

8.1. Potential for Savings

[8:8] The previous Atkins' study estimated that savings in the range of 6-18% were possible, as a result of improvements in whole system programme management. This study confirms that significant savings can be achieved, provides more detail on how, and brings together more evidence to support the estimate of savings.

[8:9] The Infrastructure UK Cost Review (1) estimates that infrastructure programmes across the UK can save at least 15% of capital cost, through adopting a range of good practice – all of which is consistent with the recommendations of this study:

Box 8-1: IUK, "There is no single overriding factor driving higher costs. However, the investigation has identified that higher costs are mainly generated in the early project formulation and pre-construction phases and provided evidence of a number of contributing factors including:

- stop-start investment programmes and the lack of a visible and continuous pipeline of forward work;
- lack of clarity and direction, particularly in the public sector, over key decisions at inception and during design. Projects are started before the design is sufficiently complete. The roles of client, funder and delivery agent become blurred in many public sector governance structures;
- the management of large infrastructure projects and programmes within a quoted budget, rather than aiming at lowest cost for the required performance. If the budget includes contingencies, the higher total becomes the available budget;
- over-specification and the tendency, more prevalent in some sectors than others, to apply unnecessary standards, and use bespoke solutions when off-the-shelf designs would suffice;
- interpretation and use of competition processes not always being effective in producing lowest outturn costs, with public sector clients in particular being more risk averse to the cost and time implications of potential legal challenges;
- companies in the supply chain typically investing tactically for the next project, rather than strategically for the market as a whole; and
- lack of targeted investment by industry in key skills and capability limiting the drive to improve productivity performance." (1)

[8:10] The data supporting our estimate of potential cost savings is summarised in Figure 8-1. This chart summarises the reported cost savings or potential cost savings, based on an estimate of the programme lifecycle phase when they can be realised. The data sources are:

- Infrastructure UK Cost Review found that the Channel Tunnel Rail Link (CTRL) construction cost was at least 23 per cent higher than comparable lines in Europe.
- Infrastructure UK Cost Review found that UK stations are on average 50% more expensive than those built in the EU – albeit they note that UK stations serve a significantly higher peak passenger demand (up to 2.7 times in certain cases).

- GSM-R – evidence was presented suggesting that savings of 10-50% might have been possible had a more whole-life, whole system approach been taken, although it is recognised that service and regulatory implications of alternative approaches would have had to be carefully considered.
- International Council for Systems Engineering data shows that effective early investment on clarity of objectives and evaluation of options can lead a reduction in cost of up to 20% and an increase in on-time delivery of 50% (8).
- Maui B Oil Platform – costs were reduced by 66% (from \$1.2bn to \$400m) through the application of whole system principles, consistent with the recommendations of this study (27)
- Over a small sample of similar projects TOCs, which typically have a more output and value focused project approach, are 73% efficient at capital investment and Network Rail is 58% efficient (7). In other words, TOCs spend 15% more of every pound they invest on assets on the ground.
- Carillion have demonstrated up to 5% savings in cost, in addition to valuable time savings (2)
- Network Rail IPT have saved 2-6% as a direct result of their integrated team.

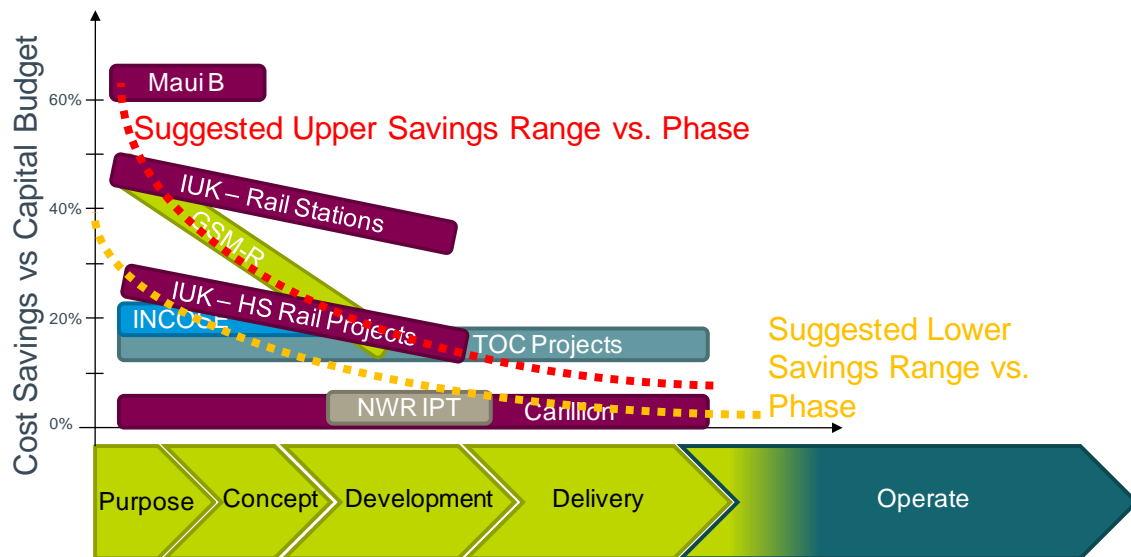


Figure 8-1: Reported Capital Cost Savings vs. Lifecycle Phase

[8:11] Atkins' assessment is that the range of most likely potential savings is:

- 15-30% in the Concept Phase;
- falling to 8-16% during Development; and
- 4-9% during Delivery.

[8:12] In addition, the following data supports the assertion that improvements in whole system programme management will reduce overruns – resulting in cost (or scope cut) avoidance:

- Bernard Gray (12) reports that Smart Acquisition, which incorporated whole system approaches and integrated programme teams, led to a reduction in average cost overruns from 53% to 25%;
- Kuldeep Gharatya, Head of Systems Integration at London Underground, reports that spending of 8% of a programmes budget on Systems Engineering has been shown through a number of international studies and surveys to significantly reduce, if not remove, cost and programme overruns (28). This evidence has been successfully used to develop a business case which takes a more whole system approach to programme and project management within London Underground.
- Over the past decade Honour (29) has undertaken academically based research which supports benefits of systems engineering, and its success in reducing overruns.

[8:13] Therefore, the implementation of these recommendations will also result in significant cost (or scope cut) avoidance, as indicated in Figure 8-2.

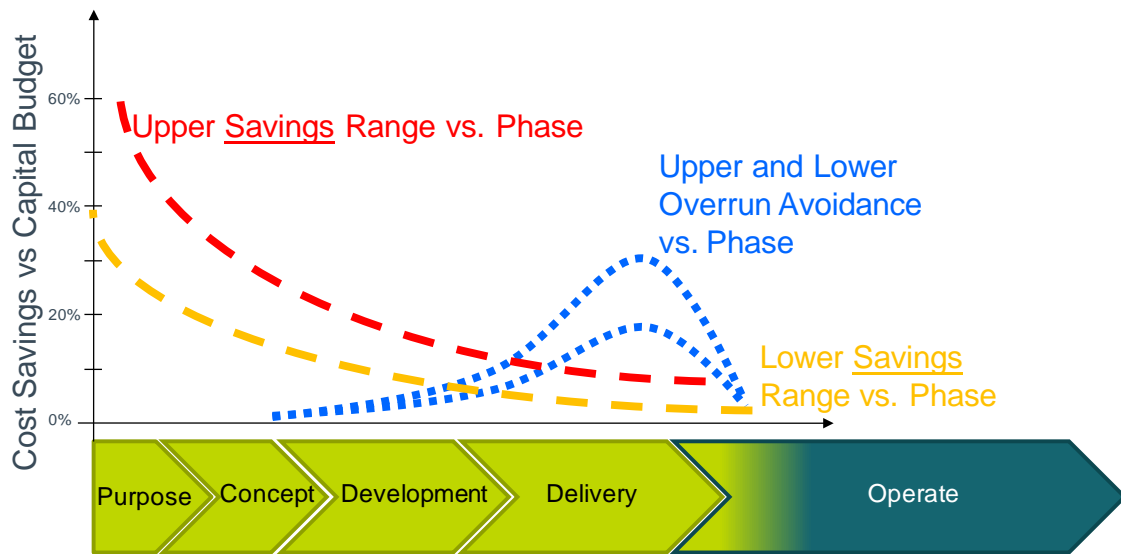


Figure 8-2: Potential Savings and Overrun Avoidance vs. Programme Phase

[8:14] To value the potential savings, it is necessary to make an estimate of the potential future capital spend. Looking 20 years ahead it is possible to make an estimate of some of the major spend items (these estimates are drawn from a variety of public sources – and are shown in Figure 7-2):

- HS2 £15.13bn
- Electrification £1.1bn
- IEP £7.5bn
- Crossrail £15.9bn
- ERTMS £3.6bn

[8:15] These total a little over £40bn for major enhancements, to which the ongoing enhancements and rolling stock replacement costs must be added; based on CP4 and rolling stock estimates it seems likely this will represent a further £1bn pa. Therefore, the total GB Rail enhancements expenditure in the next 20 years might be in the region of £50-60bn.

[8:16] Given that a large proportion of this investment is linked to programmes that to some extent are already in progress (as indicated in Figure 7-2), savings at the top end of the range indicated for the purpose and concept lifecycle phases are unlikely to be achievable. Therefore, our judgement is that the savings and cost avoidance estimate previously indicated by Atkins (2) are validated by this study.

[8:17] Extrapolating these savings, based on an assumed major GB Rail enhancements expenditure in the next 20 years of £40bn, of which £20bn is already in the delivery phase, gives (note: the reduced overspend may not be added to the savings, as this is a cost or scope cut avoidance):

- Savings in capital cost of 6-18%: £4bn (±£1.6bn)
- Reduced overspend of 17-30%: £9bn (±£2bn)

[8:18] We recommend that the findings of this study should be considered against, and validated with, the findings of the wider Value for Money Study and other relevant work. We note that great caution should be exercised in combining these potential savings with those from other work streams, as there is likely to be a large degree of overlap.

9. Appendices

Appendix A.	References	58
Appendix B.	Interview Programme	60
Appendix C.	Thameslink System Migration Plan	61
Appendix D.	Programme Management Background	63
D.1.	Managing Successful Programmes	64
Appendix E.	Our Approach and Incremental Models	68
E.1.	Model Evolution	69
E.2.	Whole System Programme Management Wooden Man Model	72
E.3.	Whole System Programme Management Straw Man Model	81

Appendix A. References

1. **Infrastructure UK.** *Infrastructure Cost Review.* London : HM Treasury, Dec 2010.
2. **Atkins.** *Asset Management and Supply Chain Management Assessment of GB Rail.* London : Rail Value for Money Study, 2010.
3. **Rail Value for Money Study.** Rail value for money scoping study report. [Online] March 2010. <http://www.dft.gov.uk/>.
4. —. Interim Submission to Secretary of State. [Online] Dec 2010. <http://www.dft.gov.uk/>.
5. **British Standards Institute.** *Part 1: Specification for the optimized management of physical assets.* 2008. PAS 55-1:2008.
6. **Foster, Sir Andrew.** A Review of the Intercity Express Programme. *Department for Transport.* [Online] June 2010. <http://www.dft.gov.uk/>.
7. **Nichols Group.** *Comparison of railway enhancement costs in Great Britain and barriers preventing delivery of station projects by train operators.* London : Office of Rail Regulation, 2010.
8. **INCOSE UK Ltd.** Guide Z3: How Systems Engineering Can Save your Business Money? Issue 3.0. [Online] March 2009. <http://www.incoseonline.org.uk/>.
9. —. Guide Z2: Enabling Systems Engineering. Issue 2.0. [Online] March 2009. <http://www.incoseonline.org.uk/>.
10. **Infrastructure UK.** *Infrastructure Cost Review: Technical Report.* London : HM Treasury, December 2010.
11. **Halcrow Group Ltd.** *Updated Optimism Bias Study. Iss 01. Draft.* London : Department for Transport, May 2010.
12. **Gray, Bernard.** *Review of Acquisition for the Secretary of State for Defence.* London : Ministry of Defence., 2009.
13. **The Office of Government Commerce.** *Managing Successful Programmes.* London : TSO, 2007. ISBN 978-0-11-331040-1.
14. **Pellegrinelli, S.** Programme Management: Organising Project Based Change. *International Journal of Project Management.* 1997, Vol. 15, No. 3, pp. 141-149.
15. **Godfrey, Partick and Blockley, David.** *Doing It Differently: Systems for Rethinking Construction.* London : Thomas Telford Limited, 2000. 0-7277-2748-6.
16. **The Royal Academy of Engineering.** *Creating systems that work: Principles of engineering systems for the 21st century.* 2007. 1-903496-34-9.
17. **Network Rail .** Thameslink 2000 Closures – Statement of Reasons October. [Online] 2005 . <http://webarchive.nationalarchives.gov.uk/dft.gov.uk/pgr/rail/pi/tl2000/eslinkstatementofreasons2005.pdf>.
18. **Transport for London.** Crossrail Business Case – Summary Report. [Online] July 2010. <http://tfl.gov.uk/assets/downloads/corporate/Crossrail-business-case-2010.pdf>.
19. **Network Rail.** *Freight Route Utilisation Strategy.* 2007.
20. —. Strategic Business Plan update - Strategic Freight Network. [Online] April 2008. <http://www.networkrail.co.uk/browse%20documents/StrategicBusinessPlan/Update/Strategic%20Freight%20Network%20paper.pdf>.
21. **Major Projects Association.** Delivering High Speed 1: the successes and the lessons. Seminar 139 held at Savoy Place, London. [Online] 7th February 2008. <http://www.majorprojects.org/pdf/seminarsummaries/139summarydeliveringHS1.pdf>.
22. **The Office of Government Commerce.** *Introduction and Guide to P3M3®.* 2010.
23. —. *P3M3® – Programme Model.* 2010.
24. **Ashurst.** *Crossrail Project Development Agreement.* 2008.
25. **Department for Transport.** Government targets £1bn savings from rail industry reform. *News Distribution Service.* [Online] 7 December 2010. <http://nds.coi.gov.uk/>.
26. **Office of Rail Regulation.** *Options for increasing competition in the Great Britain rail market: on-rail competition on the passenger rail market and contestability in rail infrastructure investment.* May 29, 2010.
27. *Systems Thinking about Mega Construction Projects.* **Godfrey, Patrick.** Bristol Group Meeting : INCOSE UK Ltd, 26 September 2007.
28. *What does Systems Integration do?* **Gharatya, Kulpeep.** London Rail Interest Group : INCOSE UK Ltd, November 2010.

29. —. **Honour, Eric**. International Symposium, Chicago : INCOSE, 2010.
30. **Software Engineering Institute**. *Capability Maturity Model (CMM)*.
31. **Office of Government Commerce**. *Portfolio, Programme and Project Management Maturity Model. P3M3 public consultation draft v2.0*.
32. **Network Rail**. Guide to Railway Investment Project (GRIP). [Online] <http://www.networkrail.co.uk/asp/4171.aspx>.
33. **Sillitto, Mr Hillary**. Design principles for Ultra-Large-Scale (ULS) Systems. *INCOSE UK Ltd. Autumn Systems Engineering Conference*. 2010.
34. **The Office of Government Commerce**. *Managing Public Sector Procurement*. CP0094/06/05.
35. **Highways Agency**. *Procurement Strategy*. 2009.
36. **INCOSE UK Ltd**. Guide Z7: What is Systems Thinking? . [Online] March 2010. <http://www.incoseonline.org.uk/>.
37. —. Guide Z1: What is Systems Engineering? Issue 3.0. [Online] March 2009. <http://www.incoseonline.org.uk/>.

Appendix B. Interview Programme

The following table details the interviews and workshops we have completed.

Subject	Interviewee
Atkins Interview - Evergreen	Fraser Greenwood
Atkins Interview - Proof House Junction (WCRM)	Richard Molloy
Atkins Interview - Programme Management	Douglas Chisholm
Atkins Interview - Defence	Karen Sparks, John D Taylor
Atkins Interview - T5/Rethinking Construction	Prof. Patrick Godfrey (Bristol University)
Atkins Interview - Crossrail	Bob Eves
External Interview - NR Input	Paul Plumber (NR)
Atkins Interview - Power	John Pritchard
External Interview - Crossrail/Reading/Western	Robbie Burns (NR)
External Interview - NR Input	David Higgins (NR)
External Interview - Crossrail/Reading/Western	Dick McIlhattan (Bechtel)
External Interview - GSM-R	Peter Wallace (ATOC)
External Interview - GSM-R	Euan Smith (Angel Trains)
External Interview - Major Projects Association	Malcolm Noyce (Major Projects Association)
External Interview - Strategic Freight Network	Nick Gibbons (DBSchenker)
Atkins Interview - London Olympics	Mike McNicholas
External Interview - Strategic Freight Network	Julie Rickard (NR)
External Interview - GSM-R	Steve Lamey (Angel Trains)
External Interview - Kings Cross	Ian Fry (NR)
External Interview - DfT View	Lucy Chadwick (DfT), Michael Hurn (DfT)
External Interview - Strategic Freight Network	Lindsay Durham (Freightliner)
Atkins Interview - Heathrow Express	Ben Harding
External Interview - RAB and Value for Money Measures	John Larkinson (ORR)
External Interview - Thameslink	Neal Lawson (First Group)
External Interview - RoSCo	Tim Gilbert (Porter Brook)
External Interview - NR GRIP Prospective	Martin Arter (NR)
External Interview - NR Input	Ian Ballentine (NR)
External Interview - Thameslink	Simon Blanchflower (NR), Giles Thomas (NR)
Atkins Review Workshop	All Internal
External Interview – Oil and Gas	Vi Patel (Bechtel)
External Review Workshop	All External
External Interview - Crossrail	Patricia Moore (Cost Manager) & Julian Bartlett (Programme Controls) (Crossrail Ltd)

Appendix C. Thameslink System Migration Plan

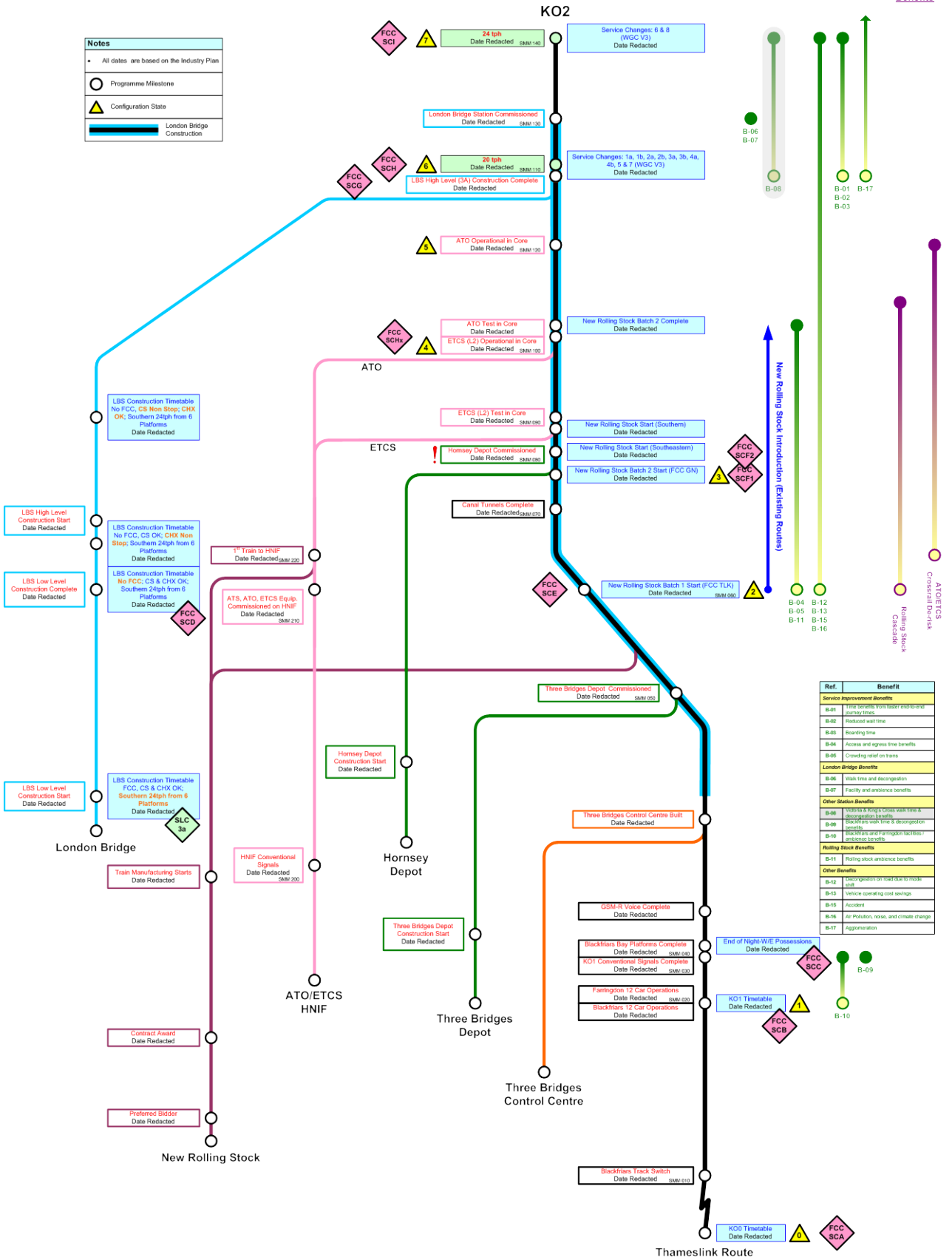
Provided by Network Rail and included as an example of good practice.

SYSTEM MIGRATION PLAN

N414-01000-NRT-PLN-EG-000002

Notes

- All dates are based on the Industry Plan
- Programme Milestone
- Configuration State
- London Bridge Construction



Ref.	Benefit
Service Improvement Benefits	
B-01	1 min savings from faster end-to-end journey times
B-02	Reduce wait time
B-03	Boarding time
B-04	Access and egress time benefits
B-05	Crowding relief on trains
London Bridge Benefits	
B-06	Walk time and disorientation
B-07	Facility and amenity benefits
Other Station Benefits	
B-08	Walking & Tring's times walk time & disorientation benefits
B-09	Shorter walk time & disorientation benefits
B-10	Shorter and Farningham facilities & amenity benefits
Rolling Stock Benefits	
B-11	Rolling stock amenity benefits
Other Benefits	
B-12	Integration on road due to mode shift
B-13	Vehicle operating cost savings
B-15	Accident
B-16	Air Pollution, noise, and climate change
B-17	Agglomeration

Appendix D. Programme Management Background

[D:1] Programme Management is a much used term in organisations today, with examples ranging from product development programmes to the co-ordination of a series of existing related projects, and from asset renewal programmes to a major route capability upgrade. To help understand this plethora of programmes we have developed the conceptual classification, shown in Figure D-1. This classification is developed from the work of Pellegrinelli (14).

[D:2] All four types of programme are necessary in the pursuit of optimally and sustainably managed assets and the achievement of strategic plans. The key ingredient of all programmes is to ensure that the purpose of the programme, or the coordinated projects, is clear and aligned with the corporate strategy through the asset management plans, as shown in Figure 2-1.

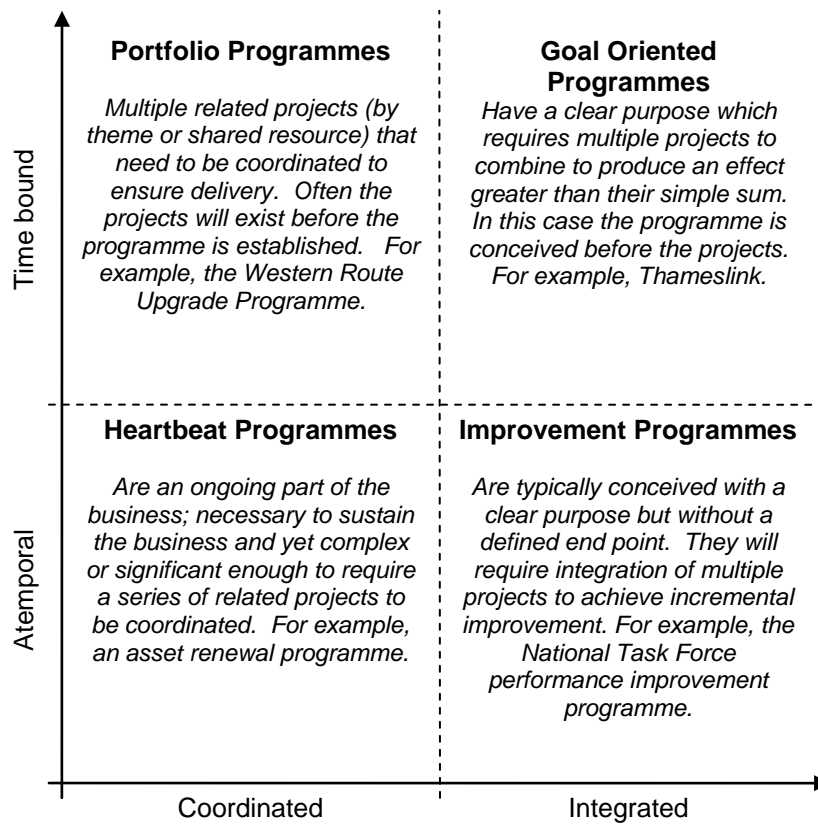


Figure D-1: Conceptual Programme Classification

[D:3] The scope of this study is specifically limited to goal oriented programme management, where the goal is a major cross-industry, enhancement of rail capability, as depicted in Figure D-2.

[D:4] It is clear from the analysis that this boundary excludes a significant proportion of programmes. However, based on the evidence collected in the previous study (2), which suggested that cross-industry, enhancement programmes presented a value opportunity, and given the time scales of this study, the scope is believed to be both justified and necessary.

[D:5] The programme management model developed by this study will need to be further developed, as it is matured for implementation within goal oriented, cross-industry, enhancement programmes. There is every reason to expect that, with further study, it will be possible show that wider application across different types of programme will liberate additional value.

D.1. Managing Successful Programmes

[D:6] MSP asserts that programme management aligns the following three critical organisational elements:

- Corporate strategy,
- Delivery mechanisms for change, and
- Business-as-usual environment.

[D:7] Programme management is a framework for delivering transformational change. The MSP approach deals explicitly with the challenges of changes in culture, style and character of an organisation. A key part of the approach is the concept of “tranches”, which allows a programme to be broken down into a series of manageable implementation steps, with assurance and transition managed at each step.

[D:8] Emphasis is placed on the people aspects of the change, and managing the transition of the solutions developed by projects into the business organisation, whilst maintaining performance and effectiveness.

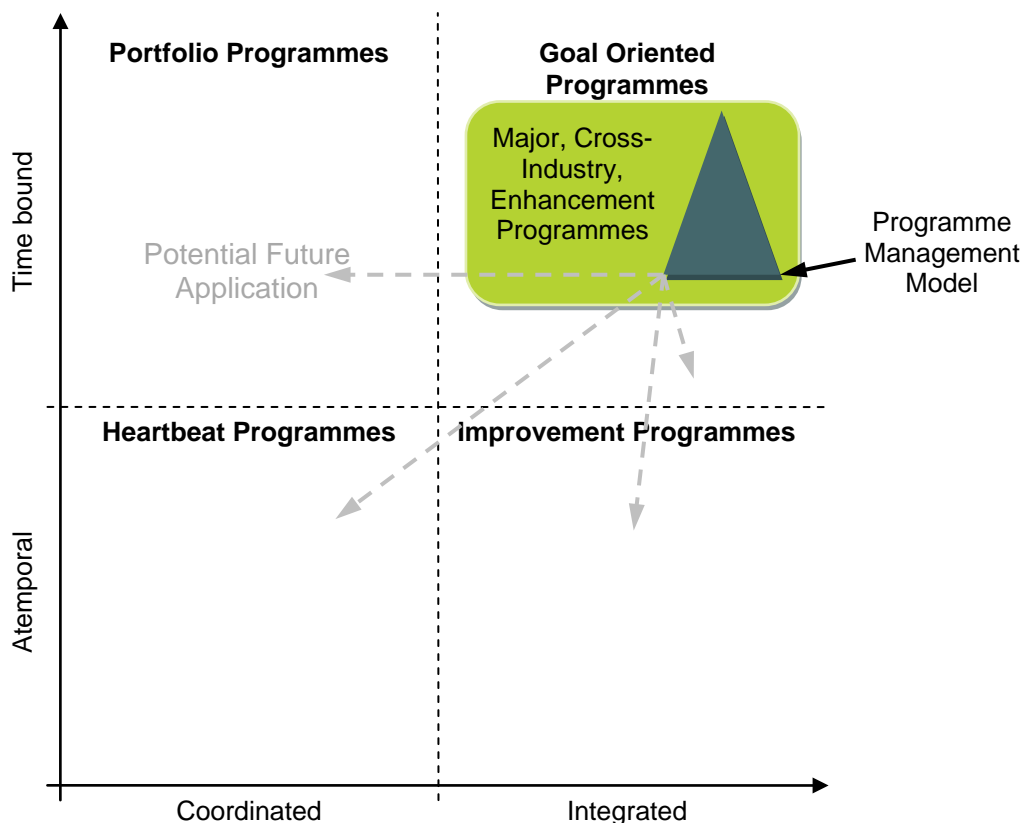


Figure D-2: Rail Value for Money Study Programme Management Scope

[D:9] The MSP framework comprises seven principles, nine themes and a transformational flow; these are shown in the outer ring, the second ring and the centre of Figure D-3, respectively.

[D:10] The **programme vision** is a pivotal element, as it is a customer focused description of a better future, which forms the basis for the outcomes and delivered benefits of the programme. The vision is an outward-facing description of the future, following successful programme delivery.

[D:11] The vision is then developed into a **blueprint**, which is a solution-independent representation of the entities (people, systems, organisations, etc.) and relationships that are affected by the vision. It is an abstract description that helps ensure all aspects of the solution are fully considered.

[D:12] The approach to blueprint delivery is selected, through the ‘defining a programme’ transitional flow stage, by identifying, evaluating and optimising the solution options. Different combinations of projects, project outputs and project phasing will be capable of delivering the same overall result – albeit for different cost, risk and performance. Each must be formally and fairly evaluated to select the best overall option. This work must be carried out iteratively with the benefits realisation management, and the development of the overall programme business case.

[D:13] The result of this stage is the creation of a **project dossier** that contains a summary description of all of the projects that together, through their combined outputs, will deliver the required future state(s) as described in the blueprint. The **programme plan** presents the constituent projects and the tranches of benefit realisation.

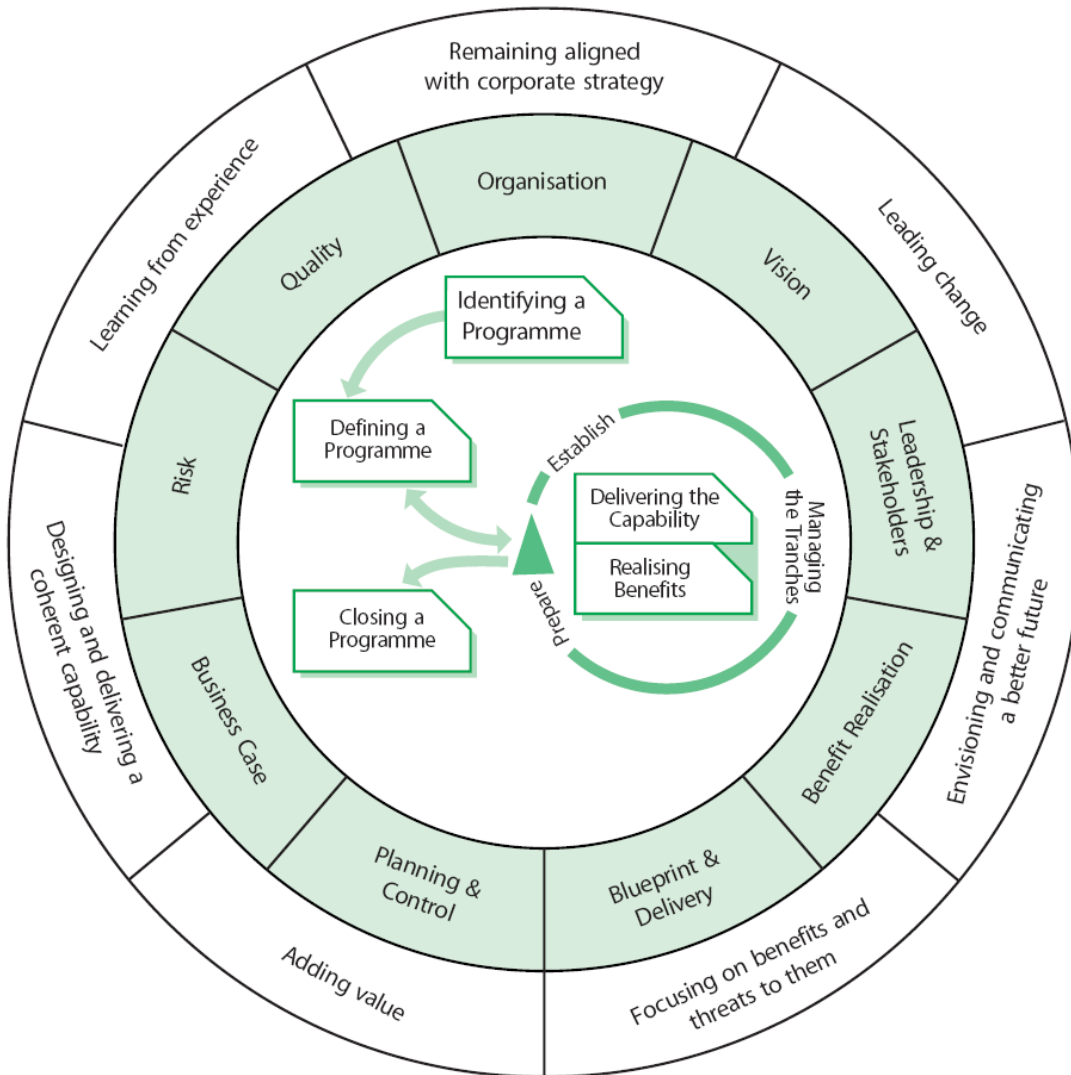


Figure D-3: MSP Framework (Crown Copyright)

[D:14] The roots of MSP are in IT lead organisational change/transformation, and on occasions it has not entirely shed this heritage. In the development of the project dossier and programme plan, while the framework includes all the right principles, there are no examples of programmes trading-off alternative technical solutions. For major infrastructure projects, the decisions made at this early stage are crucial; for example, increased capacity could be achieved by increasing the infrastructure’s capacity to carry more trains, increasing the trains’ capacity to carry more passengers, or changing the ticket pricing or car parking to spread the peak. The decisions about the concept solution which feed into the project dossier will typically fix 70-80% of the whole-life cost.

Example 3-1: An airport on a holiday island was doing so well, it was running out of runway capacity. The first reaction was to decide that extra runway and extensions to terminal and

aprons should be built at great cost. Traffic came mainly from the USA with tourists keen to arrive between 3:00 p.m. and 6:00 p.m. so that they could enjoy their cocktails before dinner. A systems approach was suggested and used. The result was that, instead of providing extra capacity for those hours at great cost, a new landing fee structure was worked out. The scheme rewarded those who could land outside of the three-hour period most in demand. The solution redistributed the demand. The result was that the revenues into the airport were doubled at no significant cost. (15)

[D:15] The OGC Gateway™ Review Process (Figure D-4) is applied in concert with MSP to many major, cross-industry rail enhancement programmes. However, this approach fails to single out the **'defining a programme'** phase of the programme transitional flow. As with MSP, the gateway process appears to afford more attention to the 'managing the tranches' phase, with specific gateway reviews for a series of project lifecycle stages, with just one generic strategic assessment applied at the programme level.

[D:16] MSP includes very little guidance on the integration of a commercial/supply chain strategy with the project dossier, programme plan and business case. The experience and evidence from previous work (2), suggests that careful consideration of the sources of funding and the commercial approach to procuring elements of the solution is a vital element of successful programmes. The commercial/supply chain strategy should be aligned with the proposed conceptual solution.

[D:17] MSP recognises the importance of strategic alignment with an organisation's overall strategy, policies and targets. Any programme will represent a significant undertaking for an organisation and therefore it is vital for the organisation that this alignment is clear. This is consistent with asset management good practice.

[D:18] It is equally important that strategic alignment is maintained, and it is acknowledged that organisational strategy is subject to change as a result, for example, of changes in legislation, technology, market conditions, the environment, customers, etc. MSP is described as being highly suitable for managing business transformation programmes and political and societal change programmes, as it is designed to accommodate high levels of complexity, ambiguity and risk, where porous boundaries lead to a flux in scope. However, despite these claims, the detail of the MSP framework has been observed to be somewhat prescriptive and in many cases its application is formulaic.

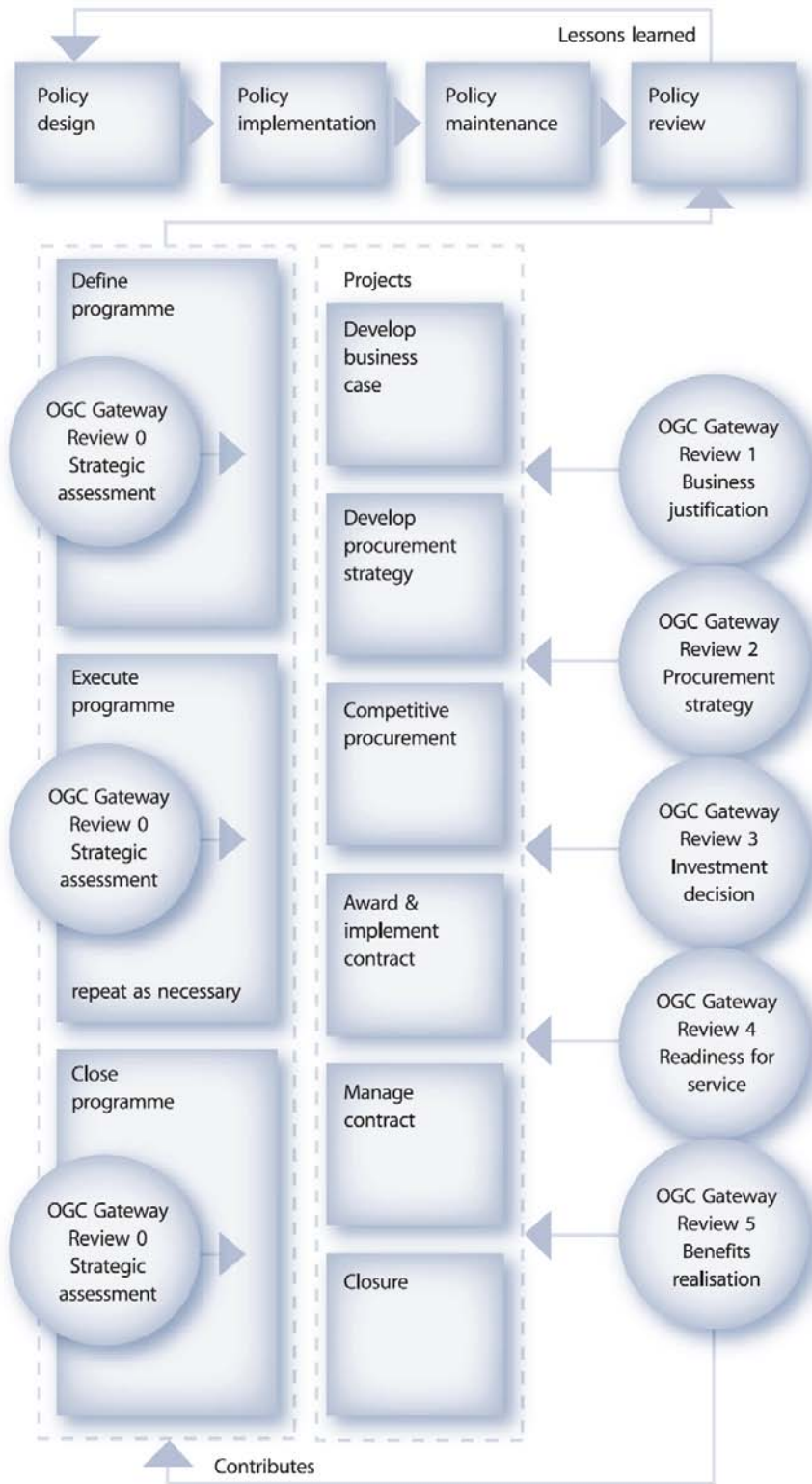


Figure D-4: OGC Gateway™ Review Process (Crown Copyright)

Appendix E. Our Approach and Incremental Models

[E:1] We have developed a streamlined and robust approach to develop and assess a Whole System Programme Management model, which will deliver value within the timescales set for the study.

[E:2] Our approach is to develop the four layers of the model through a three phase process, as shown in the Figure E-1, below. This iterative process is designed to mitigate the risk of being drawn to deeply into the detail of one or more areas, thus neglecting other possibilities. It ensures we are prioritising and quickly focusing on the most important, value-releasing elements. We are capturing the elements (or pillars) of each model layer and then conducting a relative assessment based on:

- the **current state** of best practice in the industry,
- the potential **benefits and value** that will be released, and
- the implementation **barriers and costs**.

[E:3] This appraisal is being conducted through workshops and interviews, with an increasing focus on quantitative (as opposed to qualitative) assessment. As the model develops through each phase, the assessment results are used to select the most value-adding pillars to be further developed, leaving the others for future attention. This rigorous prioritisation maximises the benefits derived by this initial work.

[E:4] The **Whole System Programme Management Model** is being explored using rail and non-rail scenarios and examples, drawn from Atkins' and stakeholder experience.

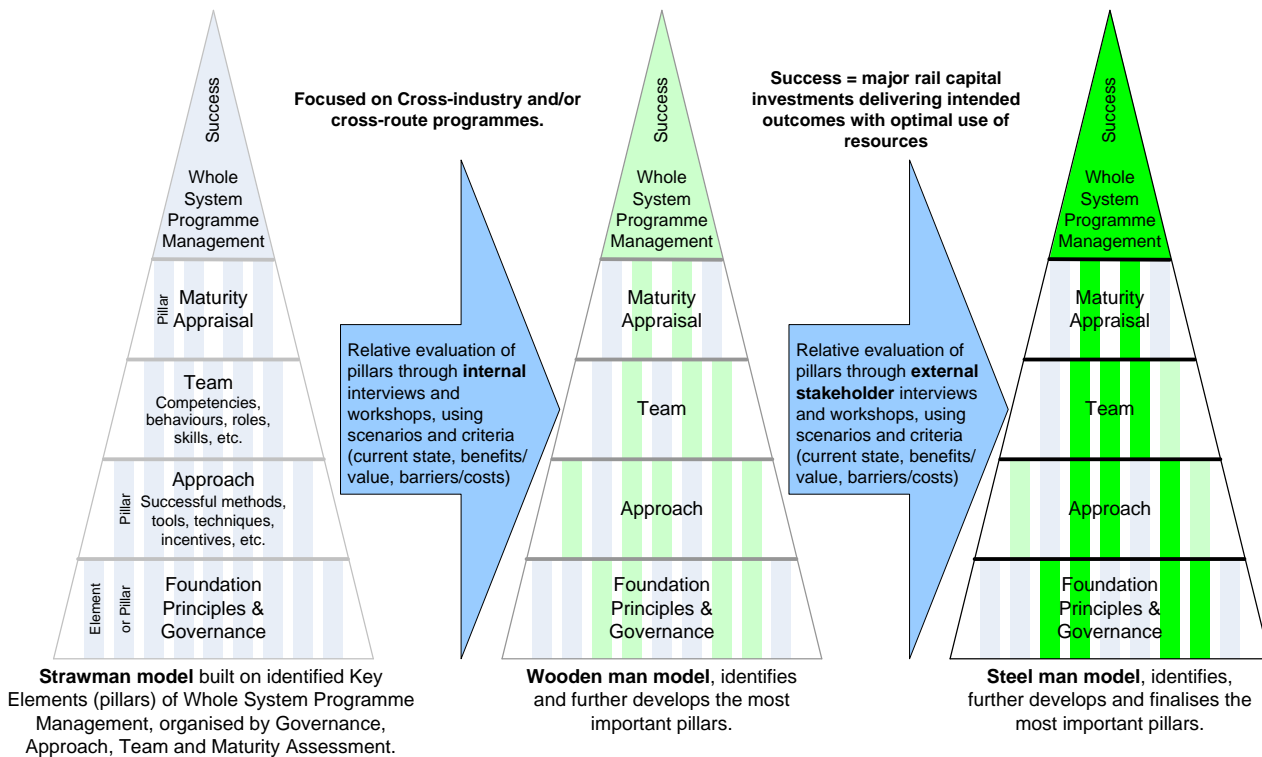


Figure E-1: Whole System Programme Management Model

The following three tables contain the details of the three layers of the strawman programme management model included in the Inception Report.

- Foundation Principles and Governance Layer
- Approach Layer
- Integrated Programme Team Layer

[E:5] The Whole System Programme Management model being developed by this study comprises three layers, which underpin the success of any programme. These layers are:

- **Foundation Principles and Governance**,
- **Approach**, including successful methods, tools, techniques, incentives, etc., and
- **Team**, including competencies, behaviours, roles, skills, etc.

[E:6] Each layer comprises a number of pillars, which represent the different aspects of what is required within that layer to support successful programme delivery. This is shown graphically in Figure E-1.




[E:7] The process of the study is to progressively select the most important pillars, leaving the others for future development. The study will also develop a maturity assessment against those pillars selected to be in the final model, providing levelling statements against which programmes can be assessed for each pillar. It is envisaged that we will use a maturity scale of 5 levels, as used by the Carnegie-Melon Capability Maturity Model (CMM) (30),, and the OGC’s 3P3M model (31).

[E:8] The strawman model, as presented in our Inception Report, is included in Section E3 for reference. This has been developed, through a series of interviews with Atkins’ experts and senior members of Network Rail. The resulting wooden man model has concentrated on the pillars which our work has highlighted as providing the most initial value.

E.1. Model Evolution

[E:9] We have considered each of the pillars of the strawman and prioritised those which warrant translation into the next phase of development.








[E:10] The mapping from strawman to wooden man is captured in the following tables.

Strawman Pillar	Wooden Man Pillar	Rationale
Foundation Principles and Governance		
G0 – Clear purpose 	Pillar 1 – Purpose	Clarity of purpose is critical in providing the programmes reason to exist.
G1 – Industry sponsorship 		Further consideration of this pillar within this study will be within pillar 4.
G2 – Stage Gates 	Pillar 2 – Programme Lifecycle	Having a clearly distributed programme lifecycle, with stage gates employed to delegate authority and control quality is seen as important.

Strawman Pillar	Wooden Man Pillar	Rationale
Foundation Principles and Governance		
G3 – Programme classification	Pillar 3 – Risk	Programme classification recognises the different origins of purpose and the levels of risk and uncertainty which this brings. Attitude and approach to risk is a critical success factor.
G4 – Stakeholder management	Pillar 4 – Stakeholders	It is vital to ensure a programme has industry support and to continually manage stakeholders throughout the lifecycle.
G5 – Performance indicators	Pillar 5 – Measurement	Measurement of leading and lagging indicators of performance is vital. Also included is the monetisation of benefits.
G6 – Requirement management		Further consideration of this pillar within this study will be within pillar 7.
G7 – Level of information		Level of information is considered to be a lower order activity.

Straw man Pillar	Wooden Man Pillar	Rationale
Approach		
A1 – Integrate strategy with purpose	Pillar 6 – Whole System Framework	We believe the development of approaches that encourage early consideration of the whole railway system is a significant opportunity.
A2 - Optimum solution		Determining which potential solution offers the best optimum solution (best value) is vital. Further consideration of this pillar within this study will be within pillar 6.

Straw man Pillar	Wooden Man Pillar	Rationale
Approach		
A3 – Requirements definition	Pillar 7 – Assurance	Work to date suggests it is vital to have rigorous approaches to the decomposition of programmes, flow down of requirements and management of interfaces, which provide progressive assurance of final whole system benefits. This includes considering carefully the final demonstration of benefits and handover.
A4 – Cost management		Cost Management is vital to efficient and value for money programmes, but in this context further consideration was left to later studies, as the opportunity for improvement is less than other areas
A5 – Manage change	Pillar 8 – Change	Change is inevitable and the impact and management of change must be considered.
A6 – Procurement strategy	Pillar 9 – Procurement/ Commercial	Procurement strategy of the optimum solution sets the behaviours and incentives which drive the stakeholders and contract parties to work for the benefit of the programme.
A7 – Increase competition		Further consideration of this pillar within this study will be within pillar 9.
A8 – Shared understanding		Further consideration of this pillar within this study will be within pillar 9.
A9 – Asset information		Asset Information is vital to value for money programmes, but in this context further consideration was left to later studies, as the opportunity for improvement is less than other areas.
A10 – Breaking silos		Further consideration of this pillar within this study will be within pillar 9 and 10.

Straw man Pillar	Wooden Man Pillar	Rationale
Team		
T1 – Team structure	 Pillar 10 – Integrated Programme Teams	IPTs are a key enabler and their make up must evolve to reflect the differing stages of the programme throughout its lifecycle.
T2 – Team competencies	 Pillar 11 – Competence	Competencies and characteristics of the key team members is a vital part of delivering a successful programme.
T3 – Culture & behaviours		Further consideration of this pillar within this study will be within pillar 9 and 10.
T4 – Accountability & Authority	 Pillar 12 – Accountability and Authority	Clear accountability and authority is a key component of successful programme teams.
T5 – Team – stakeholder membership		The inclusion of stakeholders within the team structure will be considered under Pillar 10.
T6 – IPT formation		The inclusion of IPT formation is considered to be integral to team structure. This will now form part of Pillar 10.
T7 – Continuity of team members		The continuity theme is considered to be integral to team structure. This will now form part of Pillar 10,

E.2. Whole System Programme Management Wooden Man Model

[E:11] The following sections detail the development of each of the pillars of the wooden man model. This model was used in our interim report issued on 20th December 2010 and has been further developed into our final steel man model following the comments received from our interim report, further interviews, workshops and further assessment.

E.2.1. Foundation Principles and Governance

[E:12] The foundation principles and governance layer of the model is designed to provide the bedrock and compelling vision for a transformation in industry programme management. It is essential that it is it straightforward, flexible and that it enables a change in culture and behaviour; in other words it must symbolise empowerment and partnering, as opposed to command and control.

Pillar 1 – Purpose

[E:13] Purpose underpins the whole reason for the programme existing, it answers the simple question ‘Why’.

“I keep six honest serving men, (They taught me all I knew). Their names are What and Why and When, And How and Where and Who”, Rudyard Kipling, Just So Stories, 1902

[E:14] The impelling purpose drives the behaviour, direction and value assessment throughout the programme’s life. The purpose does not define the solution, nor does it define the requirements; defining these in the purpose will limit solution options and therefore present a barrier to arriving at the optimum solution.

[E:15] The programme’s purpose is the question posed by the sponsoring organisation in response to a strategic assessment of the current capability against the future desired capability of the UK railway. Therefore, the impelling purpose requires clarity of industry strategy and it must remain consistent to that strategy throughout the programme lifecycle.

IEP Review: “The examples of strategic shift most commonly given were twofold: the (widely welcomed) decision announced in July last year to electrify the route from London to Bristol, Cardiff and Swansea, and the line between Manchester and Liverpool; and the commitment announced in December to proceed with the development of a new high speed rail network. Questions arose in people’s minds about the extent to which these developments, running in a different direction to the 2007 White Paper, interact with IEP and whether their impact has been fully assessed. With electrification in particular, the question was asked: has the remit of the programme been adequately rescoped?” (6)

[E:16] It is suggested that there are three idealised purpose types:

- **Vision** led purpose, which is driven by a vision to achieve transform a service or capability,
- **Need** led purpose, where there is a specific and defined need for additional capability, and
- **Compliance** led purpose, which is in response to a legislative or regulatory requirement.

[E:17] For example, Crossrail and Evergreen 3 are vision led; Thameslink and Southern Capacity Package are needs led; and GSM-R is compliance led. In practice, the purpose of real programmes will be a blend of all three, combining some proportion of vision, need and compliance, as shown in Figure E-2.

[E:18] The reason for drawing this distinction is that the purpose type is likely to affect the nature of the business case and this is likely to dictate the sources of funding. This will be further developed, as it has been suggested that the sources of funds and implications of funding can have a profound, typically fragmenting effect on the objectives and scope of the programmes.

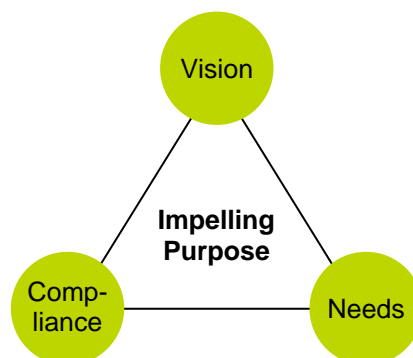


Figure E-2: Programme Purpose Types

Pillar 2 – Programme Lifecycle

[E:19] Evidence collected to date is suggesting that the lack of an explicit programme lifecycle is a barrier to successful and value for money programmes. Establishing a standard lifecycle for programmes (similar to GRIP (32) or RIBA for projects) would provide a common language,

encourage better decision making, drive better solutions and facilitate improved understanding and learning.

[E:20] To achieve these benefits the lifecycle needs to be simple and flexible, focusing on the unequivocal fundamentals of all programmes and avoiding procedural minutiae. We suggest the following lifecycle (depicted in Figure E-3 and E-4), that will be critiqued and developed through the remainder of the study:

- Promotion
 - The initial phase of the programme, which starts when the purpose of the programme is raised by the sponsoring organisation.
 - This is the phase where creativity and holistic thinking is required to develop and evaluate conceptual solutions involving all industry stakeholders.



Figure E-3: Proposed Programme Lifecycle

- An outline business case will be developed for the evolving solutions, focusing on trade-offs and with an emphasis on investment in early risk reduction work.
- Outline procurement strategies will be developed for different conceptual solutions, to ensure the implications of practical, commercial, delivery and funding options are considered.
- Outline commissioning and transition plans will be developed to ensure proper consideration has been given to acceptance and handover of the final capability into operation.
- The phase will close with the successful completion of an Initial Gate review at which one of the conceptual options will be selected for development. The conceptual option will define the strategic approach to the solution and its principal elements or projects, supported by sufficient outline design to assure delivery of the overall benefits and mitigate significant risks.
- Development
 - This is a key phase in which further work to de-risk the overall programme is undertaken, through the initiation of a number of the key projects.
 - All of the aspects of the solution will be developed further – including the commercial strategy, commissioning and transition plans, technical solution and programme business case.
 - The stage will close with the successful completion of a Main Gate review, which represents the investment decision, based on single conceptual option and project hierarchy (in MSP, the project dossier) with defined performance, time and cost boundaries.
- Delivery
 - Delivery of the new/enhanced capability is undertaken during this stage. Only when the programme has passed Main Gate can commitments be made to the delivery of the solution.
 - The delivery of the capability will be staged, to deliver the capability in tranches.
- Operation
 - Operation is when all the components of capability have been delivered, or delivered to an extent agreed to enable an initial capability, are in place for the capability to operate in the way envisaged in the programme's purpose.
- Disposal
 - Disposal of assets within all of the components of capability over the programme's lifecycle.

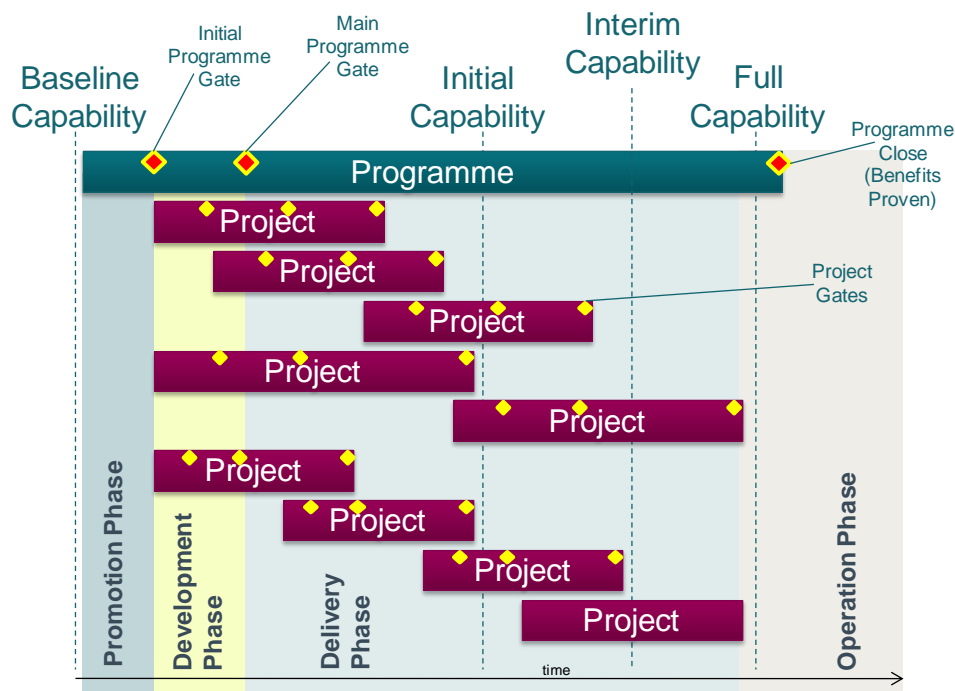


Figure E-4: Typical Programme Lifecycle

[E:21] There are two critical gates in this proposal:

- **Initial Programme Gate** – selection of a conceptual solution to move to development, assuring that the full range of conceptual options and trade-offs have been considered, appropriate investment has been made in early risk reduction, and that the necessary cross-industry support is in place for an agreed whole lifecycle plan (including commissioning and handover).
- **Main Programme Gate** – is the main programme investment decision, based on single conceptual option and project hierarchy with defined performance, time and cost boundaries.

Pillar 3 – Risk

[E:22] Our hypothesis is that the understanding and treatment of risk is a very significant driver in the poor performance of programmes. It is believed that in many cases the rail industry's approach is both procedural and highly commercial and MSP also has a rather procedural approach to risk. This pillar will promote a more mature approach to the understanding and management of risk.

[E:23] While some financial losses may be offset commercially, risk is introduced in a range of different ways, many of which are outside the scope of client/supplier contracts and the overall risk remains with the customer due to the reputational impact of failure. In this respect the treatment of risk is closely linked to partnering and commercial strategies, as a more mature approach to the allocation and management of risk, where the party who can best manage a risk does so on behalf of all stakeholders, can deliver significant value.

[E:24] When a client perceives a significant risk of claims, as there is a tendency to put all his effort into a watertight contract. However, often this is at a stage when he is uncertain what he wants in detail and in the face of risks that he has not understood. The result is usually a contact that limits innovation and increase cost.

[E:25] Another important risk consideration is how we view uncertainty. It has been observed that valuable insights can be derived from surfacing the incompleteness of our understanding. As individuals and teams we view the world through our own unique perspective and can be comfortable reaching conclusions with differing amounts of incomplete information. Therefore, risks remain hidden.

[E:26] We believe an important aspect of this pillar is to identify what measures programmes have in place to identify and manage the incompleteness of information.

[E:27] “We need the wisdom to know what we do not know.” Plato. Alternatively, companies such as Thales are exploring techniques that challenge team members to graphically represent the weight of information/data they have that supports a decision, the weight of information/data they have that refutes a decision, and the weight of relevant information/data that is unknown (33). These techniques are particularly important in the Promotion and Development Phases of a programme, where this is significant uncertainty.

Pillar 4 – Stakeholders

[E:28] The delivery of the new/changed capability can only be achieved effectively by gaining the support of the industry stakeholders from the start of the Promotion phase. They have the detailed knowledge of the industry, the whole railway system environment within which programmes will be implemented, and what changes will be required to behaviours and operational processes. This knowledge enables the programme to have a broad perspective of what is valuable and desirable.

IEP Review: “The DfT’s strategic positions have appeared to some in the industry as susceptible to change and unpredictable. Questions are asked about the coherence of IEP, extended electrification, high speed rail and overall strategy. The real issue here, I believe, is that there has been insufficient communication between the Department and the industry, including communication about IEP, and this has opened the way for significant negativity to develop. This is a key area for attention and further improvement.” (6)

Pillar 5 – Measurement

[E:29] Performance indicators provide invaluable information about the progress of a programme. Successful programmes use both lagging and leading indicators to inform management decisions. It is also necessary to have consistency, for example in the monetisation of benefits.

[E:30] Good practice is to employ range of measurements to track the programme delivery process (internal), and the **confidence of achieving the required programme benefits (outcomes)**. Given the uncertainty that is inherent at the start of a programme, it is expected that outcome measures will be predicted with a confidence interval; this confidence interval should narrow as the programme matures. Therefore, over time the programme should be able to predict with greater certainty what benefits it will actually deliver.

[E:31] There is a tendency for programmes not to fully appreciate the significance of the interaction between constituent projects. Where programmes focus more on the coordination of projects rather than on their integration, this can lead to rework and additional cost as a result of reacting to integration problems. It is the process of **integration of projects that ensures that the whole programme is greater than the sum of its constituent projects**. This principle is referred to as emergence (16). It is essential that programmes consciously model, track and manage their progress towards achieving integrated outcomes and benefits.

[E:32] In other words, programmes should measure and manage to the required outcomes; as opposed to managing the consequences of the outcomes.

E.2.2. Approach

[5:33] The approach layers comprises the techniques, processes, activities and tools which can be deployed to achieve successful outcomes at the different stages of the programme’s lifecycle.

Pillar 6 – Whole System Framework

[E:34] Good practice in whole system programme management suggests the use of frameworks can help ensure that all the components or aspects of a problem are considered when a programme team is: understanding the problem; developing solution options; and planning the programme hierarchy (in MSP, the project dossier and programme plan). The whole system framework is an abstract model of the whole railway, which is closely related to the MSP blueprint.

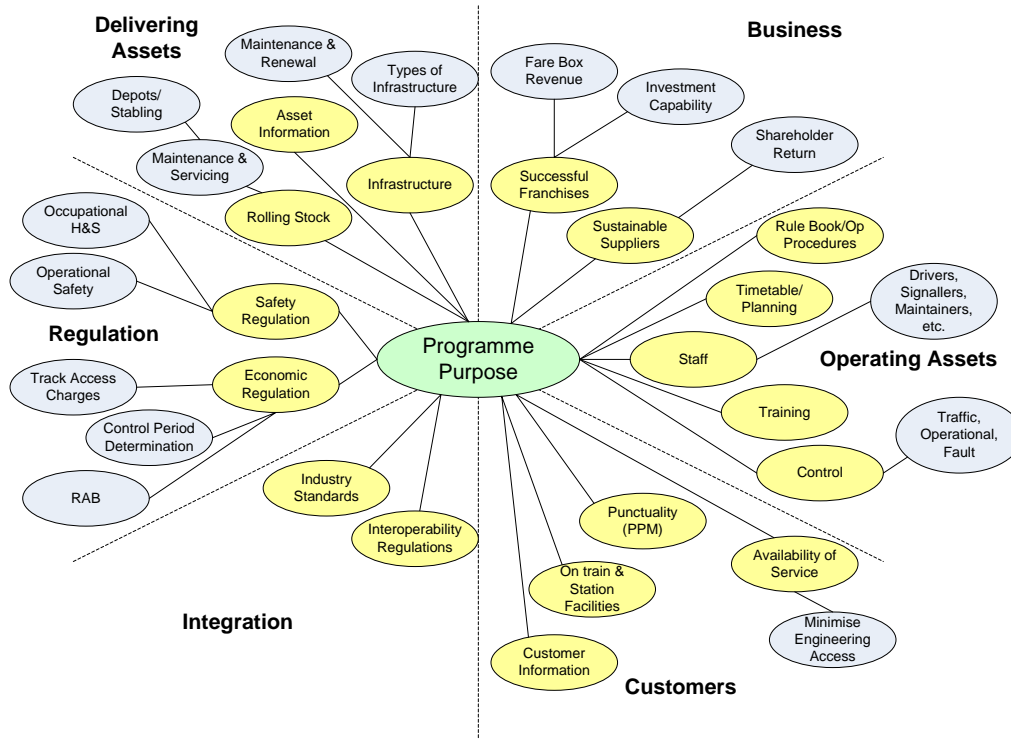


Figure E-5: Proposed Whole System Framework

[E:35] Based on the research and feedback received so far, the study is not aware of a generic and widely used rail industry framework, so we have developed a proposal for discussion. The framework is hierarchical and flexible, based on the following six components:

- Delivering assets
- Operating assets
- Customers
- Business
- Regulation
- Integration

[E:36] We have constructed two diagrams, as shown in Figure E-5 and Figure E-6, to illustrate how these 6 components may be expanded to encompass all railway programmes.

[E:37] Figure E-5 shows these six components arranged around the central Programme Purpose. The second tier of elements (shown in light blue) is included as examples of possible sub-elements. This hierarchy would need to be developed for any practical use, and is included to provide some indication of the sort of entities that might be found in each component.

[E:38] Figure E-6 shows the same component and indicative element breakdown as a programme timeline, indicating how all the components of the railway have to be integrated to deliver a change in rail capability.

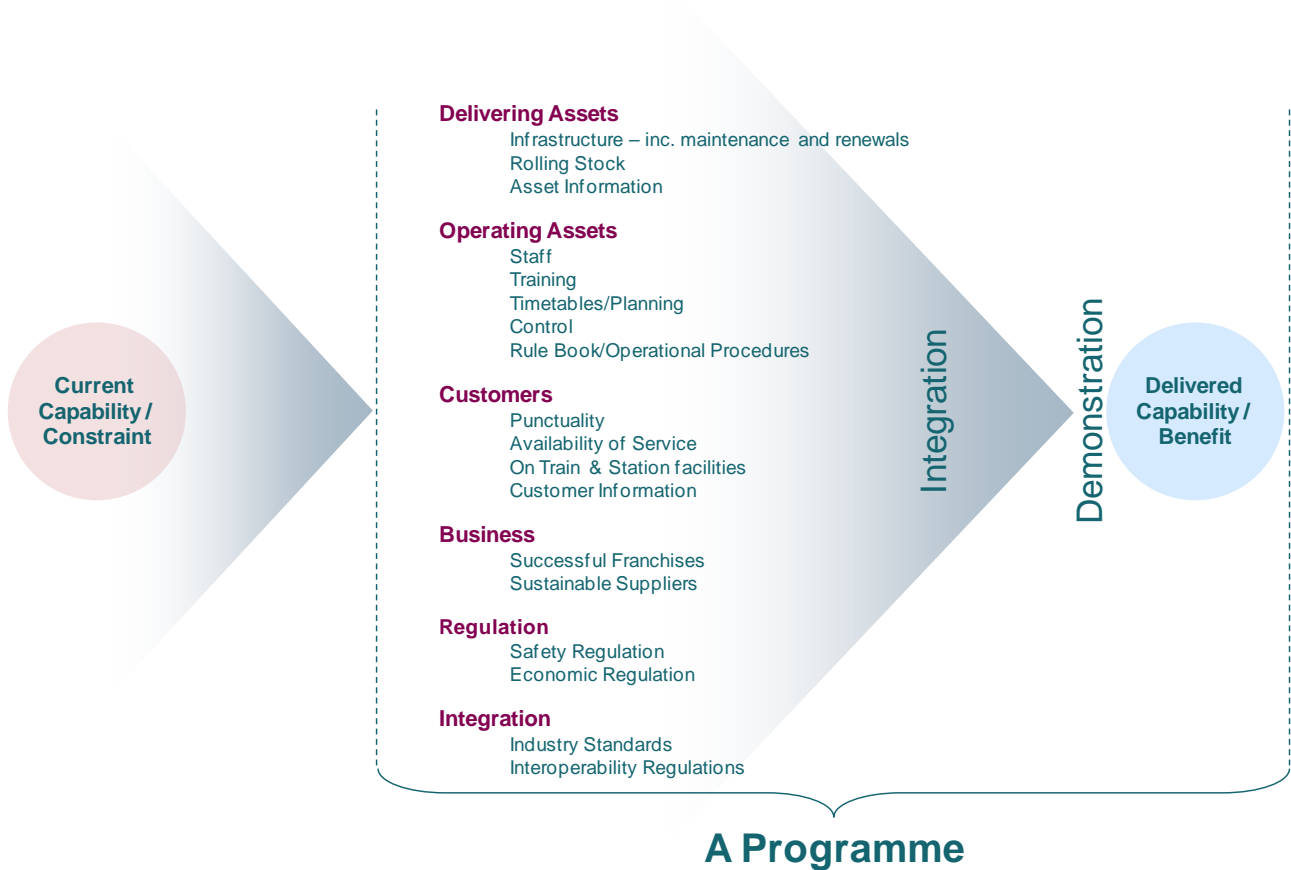


Figure E-6: Proposed Whole System Framework – Alternative View

Pillar 7 – Assurance

[E:39] This pillar is closely linked with Pillar 5 – Measurement, and will be developed to include practical tools, techniques and methods that can be employed to provide progressive assurance throughout the programme that the outputs and benefits will be delivered.

[E:40] The approaches are likely to include:

- Modelling to understand how all the projects will interact.
- Flexible approaches to manage the flow down of requirements from the programme to the projects and the interfaces between projects. Traditional approaches often seek to tightly define requirements and interfaces – seeking to prohibit or very tightly manage change. However, it is suggested that in a programme environment where there is uncertainty, such approaches will often provide false-comfort and unnecessarily restrict flexibility and limit value. A more appropriate approach for a programme may be to define clearly the latest point in time when key decisions have to be fixed, and why.
- Planning a phased (or tranche-based in MSP) delivery of benefits, in order to provide progressive confidence in the capability being delivered.
- Careful and inclusive (with all stakeholders) planning of the commissioning, acceptance, transition and handover of each tranche of capability.
- Collection and collation of explicit assurance information from projects as they progress through their lifecycles, recording the known information and surfacing what is not known, and thus providing an evidence based judgement for the likelihood of achieving outcomes.

[E:41] Good practice is to collate the assurance information at a programme level to provide evidence based assurance of the performance, operability, maintainability and safety for each tranche.

Pillar 8 – Change

[E:42] Change in any programme is inevitable; it is the way a programme manages these changes which differentiates a successful programme from a failing programme.

[E:43] The key indicator seems to be a programme's philosophy about change; all change is seen by some programmes as a bad thing – something to be managed out. It is suggested that this is a project management approach to change.

[E:44] At a programme level change is necessary and inevitable due to the political, economic, strategic and organisational influences on most programmes. A programme's approach to change needs to be flexible and appropriate for the lifecycle phase. Change in the promotion phase is good, as it will encourage creativity and innovation; at this stage it can deliver significant value. Once in the delivery phase, change needs to be managed intelligently and coherently.

[E:45] Firstly, different projects will be at different stages of their lifecycle, so it is important to understand and communicate what scope each project has to change, what is fixed and when key decisions have to be made – and why! The concept of allowing design freedom until a point at which a decision has to be made is an important value enabler.

[E:46] In concert with this approach, the programme will need a change board with the experience, expertise and authority to resolve changes that do occur. Programmes need discipline to ensure that no change (to a fixed decision) is made without the approval of the change board and once a change is agreed it is effectively communicated.

[E:47] Finally, it is necessary to have approaches that encourage the open and timely sharing of information between stakeholders about possible changes.

Pillar 9 – Procurement/Commercial

[E:48] The procurement strategy is as important as the development of the best solution, as it defines how the solution will be delivered. There is evidence of programmes taking a disjointed approach to the solution, the procurement and funding of the solution, which is likely to lead to fragmentation of the scope, benefits and outcomes.

[E:49] The procurement and contracting strategy defines the behaviours and incentives, which drive the stakeholders and contract parties to work for the benefit of the programme.

[E:50] Typically we would expect to find many major cross-industry programmes are operating in the high risk and high value segment of the OGC's procurement model (34), shown in Figure E-7. Therefore, the approach to negotiation, partnering and early contractor involvement is critical in the success of programmes and should be informed by the risk profile of the solution selected.

segmentation model

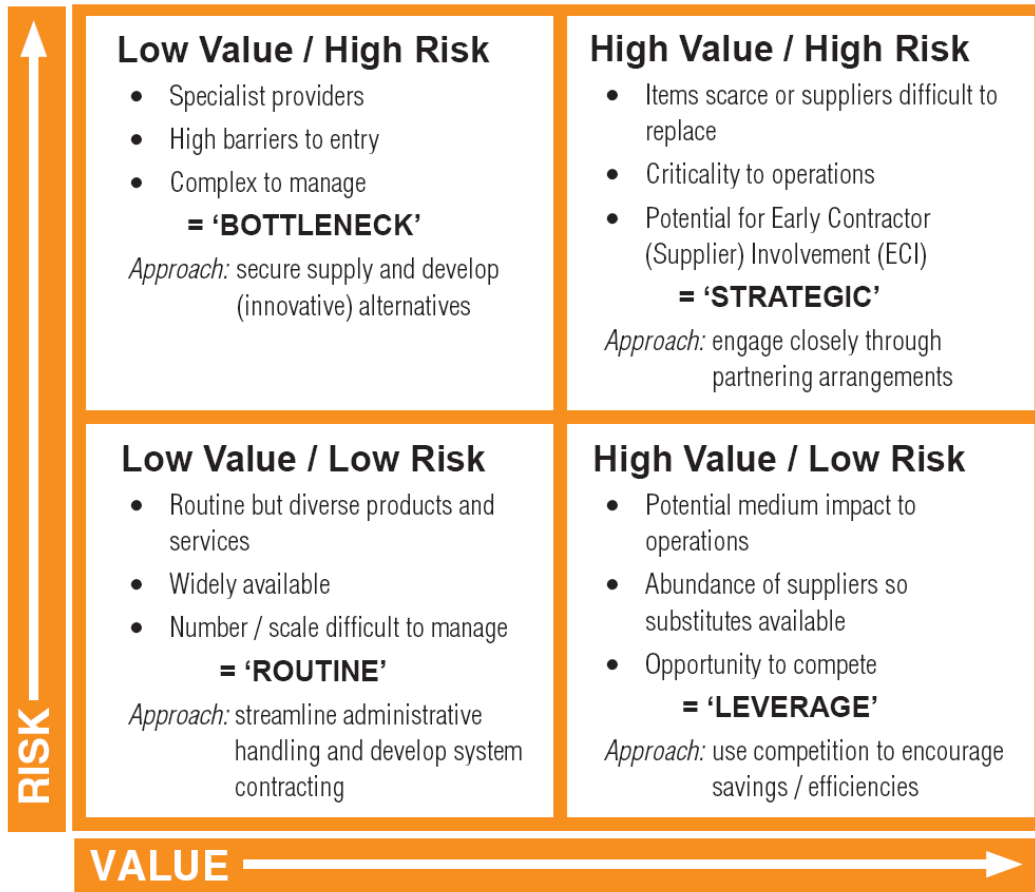


Figure E-7: OGC/HA Managing Public Sector Procurement (Crown Copyright) (35)

[E:51] In the high risk, high value segment for complex projects with substantial incompleteness of knowledge at the outset both parties need to be incentivised to honestly collaborate to get reasonable symmetry of information as the incompleteness of information is reduced; thus achieving an efficient and sustainable outcome. To put a third party (e.g. a management consultant) in between just fogs the complexity further and eliminates most of the opportunity for innovation that will balance the risk.

E.2.3. Team

[E:52] The Team is the third layer of the model and it contains descriptions of the organisation, responsibilities, accountabilities and characteristics of the Integrated Programme Teams (IPTs) required to deliver successful programmes.

Pillar 10 – Integrated Programme Teams

[E:53] Evidence suggests that the IPT should be co-located, as vital success factors are team spirit, engendering a shared ethos and the conscious removal of communication barriers.

[E:54] A single IPT leader with a broad understanding of the whole railway system (as defined by the whole system framework) is pivotal in the programme delivering its successful outcomes. Typically an IPT leader will combine this breadth of understanding with expertise (depth of knowledge) in at least two of the vertical specialist disciplines.

[E:55] The IPT leader will be complemented by a small number of experts, who combined will possess expertise across the whole railway system (as defined by the whole system framework).

[E:56] The IPT structure will change to reflect the competence, skills and experience required to in different phases of the programme lifecycle.

[E:57] The IPT must include members of the key stakeholder groups and avoid bias towards any one stakeholder.

[E:58] We have found evidence of multi-stakeholder integrated programme teams being formed and operating effectively in a number of railway programmes, albeit in some cases programmes have individually expended time and effort realising their benefit.

Pillar 11 – Competence

[E:59] As with the IPT structure, the competencies of the IPT members will change in line with the priorities and challenges the different programme phases bring.

[E:60] Our thinking on these competencies is still emerging and we will describe these in more detail in the final report.

Pillar 12 – Accountability and Authority

[E:61] The integrated programme team (IPT) will be responsible and accountable for the delivery of the programme outcomes, and will have delegated authority to run the programme. The team need to have the means to drive the programme forward without frequent reporting upwards and waiting for authority to proceed.

[E:62] Currently a key barrier we see is the lack of a body with the capability to delegate this authority for major cross-industry programmes.

E.3. Whole System Programme Management Straw Man Model

[E:63] The original Strawman Model, as developed and issued in the Inception Report on the 3rd December 2010 is included on the next three pages. This model was significantly developed through the progress of the work.

Foundation Principles and Governance Layer

<p>Governance is the foundation of the change required; it is essential that it is straightforward, flexible and that it brings about a change in culture and behaviour. It must provide a compelling vision for change and identify short term wins that demonstrate benefits for all stakeholders; in other words it must symbolise empowerment and partnering, as opposed to command and controlling.</p>	<p>Draft Questionnaire</p>
<p>G0 Criteria to ensure that programme has clear purpose - a statement of the problem/opportunity - defined in terms of the capabilities it will deliver or enhance, and how all the necessary rail capability components will be addressed.</p>	<p>G0.1 Right at the top level, what is the purpose of the Programme? G0.2 Who is the client, who benefits and how? G0.3 Is there a clear statement of the desired capability? G0.4 Is it stated in a way that does not pre-determine a solution? G0.5 How is the rail system boundary defined? G0.6 What components of the rail system are considered? G0.7 How have potential benefits for other stakeholders been integrated in a way that provides an optimal whole-life proposition? G0.8 How are constraints defined and managed? G0.9 How is change managed?</p>
<p>G1 Criteria to ensure that the overall purpose or strategic needs to be addressed by programmes have suitable industry sponsorship.</p>	<p>G1.1 How supportive and committed are industry stakeholders? G1.2 How is support achieved/maintained?</p>
<p>G2 A clear and simple stage gate process, designed to ensure that the right whole-system thinking and assessment of options and risks has completed at each stage of a programme.</p>	<p>G2.1 Who is responsible for managing the overall programme? G2.2 Is there a programme governance/stage gate process? G2.3 How is/was the conceptual solution selected - based on what analysis/data? G2.4 How was the structure/hierarchy of projects optimised/agreed? What alternatives were evaluated? G2.5 How is the overall "programme level" investment decision made? G2.6 How does the programme gain assurance that the projects will deliver outputs that will combine to deliver the overall capability and deliver the benefits? G2.7 How does the programme exercise governance (financial, etc.) on the projects?</p>
<p>G3 An intuitive programme classification system, designed to ensure appropriate tailoring of the Whole System Programme Management model</p>	<p>G3.1 What is the programme budget and duration? G3.2 What assessment was done of the complexity and risk of the programme in respect of: - the number of lines of development affected? - the readiness of any technology? - the readiness of required integration (technology and organisational)?</p>
<p>G4 Measures to ensure that programmes have effective through-life stakeholder management and buy-in.</p>	<p>G4.1 What measures are in place to manage stakeholders throughout the life of the programme? G4.2 How are stakeholder issues/concerns logged and dealt with?</p>
<p>G5 A definition of Value for Money and guidance on the on programme incentives, performance indicators and the level of authority/autonomy necessary for success.</p>	<p>G5.1 Against what measure is the programme's value for money evaluated? BCR/NATA/Best Value/etc.? G5.2 Does the programme have an Affordability limit/constraint? G5.3 What are the projects key performance indicators? G5.4 How is the whole-life cost of the programme managed? G5.5 What whole-life cost models are used and how are they validated? G5.6 How are impacts (savings) on Maint&Renewal budgets accommodated?</p>
<p>G6 Requirements to ensure the overall purpose or needs are systematically flowed down through the project and package structure or hierarchy, with the necessary management of interfaces and interaction.</p>	<p>G6.1 How are the programme outcomes broken down into requirements for the projects' outputs - such that the whole sum of parts? G6.2 How are interfaces between projects specified and managed?</p>

Approach Layer

	Draft Questionnaire
<p>Approach is the second tier of the model and will contain details of the techniques, processes, activities and tools that may be deployed to achieve success, at different stages of the programme lifecycle.</p> <p>A1 Approaches to support the identification of the overall purpose or strategic needs and how this is integrated with the national technical strategy and major strategic renewals (fleet or infrastructure). In other words – ensuring we solve the right problem.</p>	<p>A1.1 What tools/techniques/approaches are/were used to define the capability requirement and develop the programme to the point it is a programme (concept stage)?</p> <p>A1.2 What tools/techniques/approaches are/were used to consider the rail capability components?</p> <p>A1.3 How is the programme concept integrated with National Technical Strategy and Major Strategic Renewals?</p>
<p>A2 Approaches to ensure early and full exploration of a wide range of options and trade-offs, with an emphasis on early risk reduction work – selecting the right solution.</p>	<p>A2.1 What techniques and approaches are used to identify the optimum conceptual solution (project hierarchy) for a required capability - considering all the rail capability components and constraints?</p> <p>A2.2 How is whole-life safety and performance assured?</p>
<p>A3 Techniques to support the engineering and management of requirements and interfaces – ensuring we get the requirements right.</p>	<p>A3.1 What techniques and approaches are used to map the programme outcomes to requirements for the projects' outputs?</p> <p>A3.2 What techniques and approaches are used to identify and manage project-project and external interfaces?</p>
<p>A4 Approaches to Cost Management – that support early assurance of affordability</p>	<p>A4.1 What cost forecasting and management techniques are used?</p> <p>A4.2 How is contingency and risk managed across the programme?</p>
<p>A5 Approaches to managing change and configuration to ensure major programmes remain integrated with national technical strategy and major strategic renewals.</p>	<p>A5.1 How is change managed to programme and project requirements?</p> <p>A5.2 How is interface change managed?</p> <p>A5.3 Are there defined stages of capability deployment?</p> <p>A5.4 How is capability delivery assured?</p>
<p>A6 Procurement strategy characteristics that may be tailored to suit the individual needs and risks of a programme. This will include consideration of different commercial options (JVs, partnering, principled negotiation, etc.) and how they can be best integrated to deliver better outcomes.</p>	<p>A6.1 What commercial strategies have been considered, what was selected for this programme and why?</p>
<p>A7 Approaches to facilitate increased competition in the development, design or delivery of major programmes; for example, through introducing competitive challenge between Network Rail, train operators or construction consortiums.</p>	
<p>A8 Approaches to facilitate win-win client-supplier relationships that are based on a shared understanding of the objectives and risks – information symmetry.</p>	<p>A8.1 How open and honest are parties when sharing information and what enables/prevents this?</p> <p>A8.2 What approaches have supported better information sharing?</p>
<p>A9 Asset information management and modelling approaches that consider the whole-life asset management implications and how these can be used to deliver value through better whole-life decision making.</p>	<p>A9.1 What quality and quantity of existing asset data was collected in the early stages?</p> <p>A9.2 How was this used?</p> <p>A9.3 How much in enough data?</p>
<p>A10 Approaches that challenge traditional siloed processes and ways of working, with the objective of better optimising the whole programme; for example, by understanding the last possible time when change can be accommodated.</p>	<p>A10.1 Is the programme structure dominated by engineering or other traditional "silos"?</p>

Integrated Programme Team Layer



	Draft Questionnaire
<p>Team is the third layer of the model and will contain descriptions of the organisation, responsibilities, accountabilities and characteristics of the Integrated Programme Teams (PTs) required to deliver successful programmes.</p>	
<p>T1 Descriptions of the roles, functions and processes of successful IPTs, including how they change through a programme's life and how they interface with the industry.</p>	<p>T1.1 How do you manage/resource the programme management team? T1.2 What are the key roles/functions in the programme team? T1.3 How have/do these roles/functions change over the life of the programme?</p>
<p>T2 Details of the team member characteristics and competences, drawing out how they differ in different lifecycle phases – particularly in respect of the solution agnostic, conceptual stages.</p>	<p>T2.1 Who are the key members of the programme team? T2.2 What beneficial characteristics to they possess?</p>
<p>T3 An explanation of the culture and behaviours required within the IPT and in all the stakeholder organisations.</p>	<p>T3.1 Describe the culture of the programme team? What behaviours to they encourage?</p>
<p>T4 An outline of the authority, responsibility and accountability required by successful IPTs.</p>	<p>T4.1 What authority does the programme management team have to deliver the programme? T4.2 Who (if anyone) has power of veto over the programme team?</p>
<p>T5 Approaches to winning team design, including the integration (back-filling) of IPTs into existing organisations and team member selection.</p>	<p>T5.1 Is the team representative of the different stakeholders? T5.2 Are programme team members full-time?</p>
<p>T6 Approaches to the secure the formation and introduction of IPTs designed to deliver the required changes behaviour and results.</p>	
<p>T7 Approaches to minimise, manage and value (in risk and cost) churn in team members.</p>	<p>T7.1 How are the programme's aims protected if key members leave? Particularly the early concept and assessment stages? T7.2 How are replacement team members selected?</p>

Notice

This document has been produced by Atkins for the Rail Value for Money Study Team, the Department for Transport and the Office of Rail Regulation (the Client) solely for the purpose of the supplying a report to the Rail Value for Money Team in respect of the Further Development of Whole System Programme Management improvements in GB Rail (DfT Contract Number: RVFM10004).

This Report is for the benefit only of the Client and the other parties that we have agreed in writing to treat as addressees of the Report (together the Beneficiaries).

Nothing in this Report constitutes a valuation or legal advice. We have not verified the reliability or accuracy of any information obtained in the course of our work, other than in the limited circumstances set out in the Report.

Any review activity, including this study, is based upon the use of sampling techniques and, as such, there is the possibility that issues will remain unidentified during an assessment.

This Report is not suitable to be relied on by any party wishing to acquire rights against Atkins or its sub contractors (other than the Beneficiaries) for any purpose or in any context. Any party other than the Beneficiaries that obtains access to this Report or a copy (under the Freedom of Information Act 2000 or otherwise) and chooses to rely on this Report (or any part of it) does so at its own risk. To the fullest extent permitted by law, Atkins and its sub-contractors do not assume any responsibility and will not accept any liability in respect of this Report to any party other than the Beneficiaries, and then only to the extent reflected in the terms of the signed contract or signed agreement related to the provision of this Report.

Atkins gratefully acknowledges the significant contribution made by a number of organisations (listed in Appendix B) who shared their time, wisdom and information in support of this work.

Document History

JOB NUMBER: 5099300			DOCUMENT REF: 5099300-ATK-51-0090			
Revision	Purpose Description	Originated	Checked	Reviewed	Authorised	Date
A	Initial Draft	JRE				
1.0	Draft Issue - Internal	JRE/JC	NM/RM	RM		25-01-11
1.1	Draft Issue for Stakeholder Review	JRE	JRE	RM	RM	26-01-11
1.2	Draft Issue following Stakeholder Review	JRE	JC	RM	RM	14-02-11
1.3	Draft issue following RVfM Stakeholder Meeting	JRE	JRE	RM	RM	23-02-11
1.4	Final Issue	JRE	JRE	RM	RM	25-05-11

Jon Elphick
Managing Consultant
Rail Consult
Atkins Limited
Northern House
7-9 Rougier Street
York, YO1 6HZ

Email: rail@atkinsglobal.com

