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UCL

MEGA PROJECTS

EXECUTIVE SUMMARY

Lessons for Decision-makers: An Analysis of Selected International Large-scale Transport Infrastructure Projects

OMEGA Centre

Centre for Mega Projects in Transport and Development. A global Centre of Excellence in Future Urban Transport sponsored by Volvo Research and Educational Foundations (VREF)



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December 2012

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contents

SECTION [one]	Introduction	01
[two]	OMEGA Research Methodology and Case Studies	09
[three]	Key Lessons for MTP Planning, Appraisal and Delivery	13
LESSONS	1: MTPs as ‘Agents of Change’	16
	2: MTPs as ‘Open Systems’	18
	3: MTPs as ‘Organic’ Phenomena	20
	4: The Framing of MTPs	22
	5: The Power of Context	24
	6: Role of Sustainable Development Visions	26
	7: Engaging with MTP Stakeholders	28
	8: Institutional, Policy and Legislative Support	30
	9: Lesson Learning and Sharing	32

SECTION [four]	Conclusions	35
	References	44
	Photo and Map Credits	47
	Annex 1: OMEGA International Academic Partners	48
	Annex 2: Study Methodology	49
	Annex 3: Related Research	52

LIST OF FIGURES	Figure 1: The 30 OMEGA Case Studies	Figure 7: Study Relationship of Key Themes
	Figure 2: Study Methodology	Figure 8: Airport Rail Link, Hong-kong
	Figure 3: Channel Tunnel Rail Link, UK	Figure 9: Sydney Cross City Tunnel, Australia
	Figure 4: Millau Bridge, Millau, France	Figure 10: Meteor, Paris, France
	Figure 5: The Big Dig, Boston, USA	Figure 11: Kyushu Shinkansen, Hakata to Kagoshima-Chuo, Japan
	Figure 6: Øresund Link, Kastrup to Malmo, Sweden	

The OMEGA Centre

The OMEGA Centre is a global Centre of Excellence funded by the Volvo Research and Education Foundations (VREF) directed by Professor Harry T. Dimitriou and based at the Bartlett School of Planning at University College London (UCL).

Working with partner universities across the world, the centre's research focuses on achieving a better understanding of decision-making in the planning, appraisal and delivery of Mega Transport Projects (MTPs), based on thirty international case studies. The centre has as its overall mission the task of establishing what constitutes a 'successful' MTP for the 21st Century in light of the increasing risks and uncertainties that the future poses.

The research was supported by a Centre of Excellence grant from VREF. The Final Report was prepared by Prof. Harry T. Dimitriou, Philip G. Wright and Dr. E. John Ward with assistance from Robert Gallagher and June T. Taylor (the UCL OMEGA Team). Thanks are due to Roger Allport and Robin Hickman for their invaluable comments and suggestions on the final draft of this document.

Acknowledgements

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The team would like to take this opportunity to especially express its gratitude to its overseas Academic Partners at the University of Melbourne in Australia, Ecole Nationales Ponts et Chaussées in France, University of Thessaly in Greece, University of Hong Kong in the Special Administrative Region of the People's Republic of China, Tokyo Institute of Technology in Japan, University of Amsterdam in the Netherlands, Lund University in Sweden and New York University in the USA for their dedicated and focused efforts to complete case study work and for their assistance and support throughout the research (see Annex 1).

Finally, the UCL OMEGA Team is greatly indebted to the 300 or so project stakeholders from around the world who gave their valuable time to take part in interviews and who universally provided key insights into the way in which MTPs are planned, appraised and delivered. The team could not have successfully completed the research programme without the benefit of their in-depth knowledge and insightful responses to the questions investigated.

Disclaimer

Findings, views, and opinions expressed in this report are those of its authors and do not purport in any way to represent those of the VREF or other parties.

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introduction

[section one]

Introduction

This Executive Summary presents a selection of key findings from a five-year research study of Decision-Making in the Planning, Appraisal and Delivery of Mega Transport Projects (MTPs): Lessons for Decision-makers, hereafter referred as the OMEGA 2 Study.

The research was based on an international study of 30 selected MTPs completed post-1990 in Europe, USA, Australia and the Asia-Pacific region (Figure 1). The Final Report of this research programme was submitted to VREF in six volumes on 1 October 2011 (OMEGA Centre, 2011).

For the purposes of this research, MTPs are defined as *land-based transport infrastructure investments within and connecting major urban areas and metropolitan regions in the form of bridges, tunnels, road and rail links, or combinations of these. They are projects that entail a construction cost of over US\$1 billion (at 1990 prices), completed since 1990 and are frequently perceived as critical to the 'success' of major urban, metropolitan, regional and/or national development.*

The overarching research question posed by the OMEGA 2 Study is: what constitutes a 'successful' MTP in light of the aims of such projects and the anticipated challenges presented by the 21st Century. This investigation goes well beyond the conventional project management concerns of completing such projects 'on time, on budget and within prescribed specifications', often referred to as 'Iron Triangle' considerations of project management (Barnes, 1969) important though these remain.

The OMEGA Centre contends that judgements of project 'success' also require consideration of a wider range of matters including:

- the projects' ability to meet objectives that emerge over time and which ultimately impact on project outcomes;
- changing societal, political and environmental values and priorities that evolve over time which further alter expectations of MTPs;
- changing 'visions' among different stakeholders involved in MTP development; and
- different values, priorities and expectations that prevail in different development and cultural contexts.

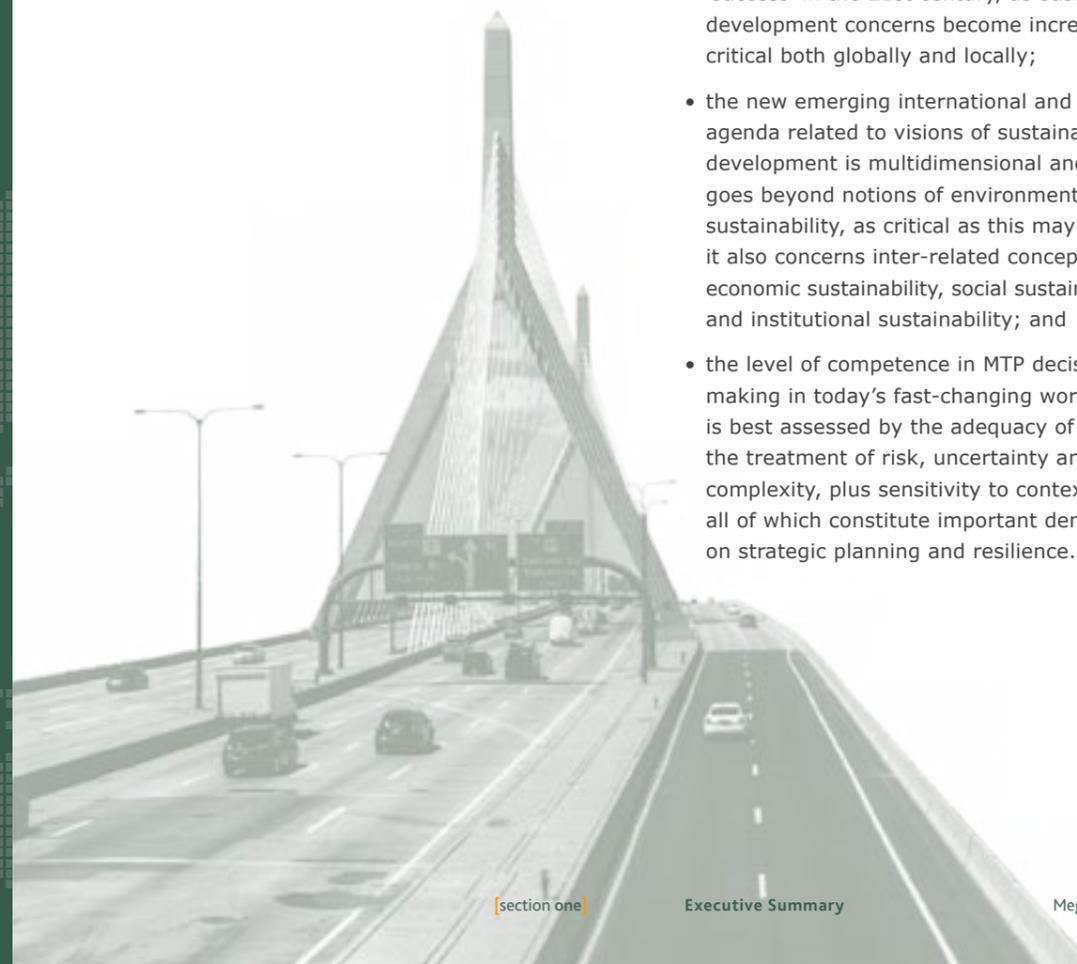
Complementing the overarching research question about establishing what constitutes project 'success' are two further key questions and three hypotheses which define the scope of the Study, as follows:

Further Research Questions

- how well has risk, uncertainty and complexity been treated in the planning, appraisal and delivery of MTPs?
- how important is context in making judgements regarding 'success' and the treatment of risk, uncertainty and complexity?

Research Hypotheses

- traditional criteria relating to cost overruns, completion dates, generation of travel time savings for project users and rates of returns to investors are inadequate measures of 'success' in the 21st century, as sustainable development concerns become increasingly critical both globally and locally;
- the new emerging international and local agenda related to visions of sustainable development is multidimensional and goes beyond notions of environmental sustainability, as critical as this may be - it also concerns inter-related concepts of economic sustainability, social sustainability and institutional sustainability; and
- the level of competence in MTP decision-making in today's fast-changing world is best assessed by the adequacy of the treatment of risk, uncertainty and complexity, plus sensitivity to context(s) - all of which constitute important demands on strategic planning and resilience.



**Figure 1:
The 30 OMEGA Case Studies¹**

Country	Mega Transport Project	Completion Date ²	Final Costs US\$ (billions) ³	Project Type
UK	Channel Tunnel Rail Link (CTRL)	2007	9.6	High speed rail
	Jubilee Line Extension	1999	6.8	Metro rail (subway)
	M6 Toll Road	2007	1.7	Inter-urban toll motorway
France	Météor Rail: Saint Lazare – Olympiades, Paris	1998	1.8	Metro rail (subway)
	TGV Med: Valence – Marseille	2001	6.6	High speed rail
	Millau Viaduct: Millau, South France	2004	0.5 ⁴	Road bridge (on motorway)
Greece	Rion-Antirion Bridge: Rion – Antirion	2004	1.3	Road bridge
	Athens Metro: Sepolia – Dafni & Monastiraki – Ethniki Amyna, Athens	2003	4.6	Metro rail (subway)
	Attiki Odos, Athens	2004	5.4	Inter-urban toll motorway
Germany	Neubaustrecke: Cologne-Rhine/Main	2004	8.6	High speed rail
	Tiergarten Tunnel: Berlin	2006	9.0	Urban motorway and rail tunnel
	BAB20 Motorway: Brandenburg, to Schleswig-Holstein	2005	2.7	Motorway
Netherlands	HSL Zuid	2009	9.8	High speed rail
	Randstadrail	2007	1.6	Light rail and bus
	Beneluxlijn	2002	1.0	Metro rail (subway)
Sweden	Oresund Road, Rail, Bridge/Tunnel Link: Malmo-Copenhagen	2000	4.1	Road and rail, bridge and tunnel
	Sodra Lanken Road Tunnel: Stockholm	2004	1.3	Urban motorway tunnel
	Arlanda Rail Link: Stockholm Airport to Stockholm	1999	1.1	Airport express rail link
USA	Airtrain: JFK Airport: New York City	2003	2.2	Light rail airport link
	Alameda Rail Link: Los Angeles (Port – downtown)	2002	2.8	Freight rail line
	Big Dig Road and Tunnel Links: Boston	2007	15.5	Urban road tunnel and bridges
Australia	City Link, Melbourne	2000	2.5	Urban toll motorway (with tunnels and elevated sections)
	Metro Rail, Perth	2007	1.7	Inter-urban rail line
	Cross City Tunnel, Sydney	2005	1.1	Tolled urban road tunnel
Hong Kong	Western Harbour Crossing: Hong Kong Island – Kowloon	1997	0.9 ⁵	Tolled urban road tunnel
	Airport Rail Links: HK Central – Chek Lap Kok Airport	1998	4.4	Airport express rail link
	KCRC West Rail Link: Tsuen Wan – Yeung Long	2003	5.9	Urban rail line
Japan	Metropolitan Expressway: Nishishinjuku Junction – Kumanochi Junction, Tokyo	2007	5.5	Tolled urban road tunnel
	Shinkansen High Speed Rail Link: Kagoshima – Chuo – Nakata	2004	7.5	High speed rail
	Oedo Metro: Hokomae – Hikarigaoka, Tokyo	2000	11.4	Metro rail (subway)

¹See http://www.omegacentre.bartlett.ucl.ac.uk/studies/by_place_2.php

²It should be noted that whilst many of these projects were completed relatively recently, their planning and conception took place considerably earlier (1970s to early 1990s). Much of the discussion in this document thus refers to the often lengthy gestation periods that the case study projects experienced.

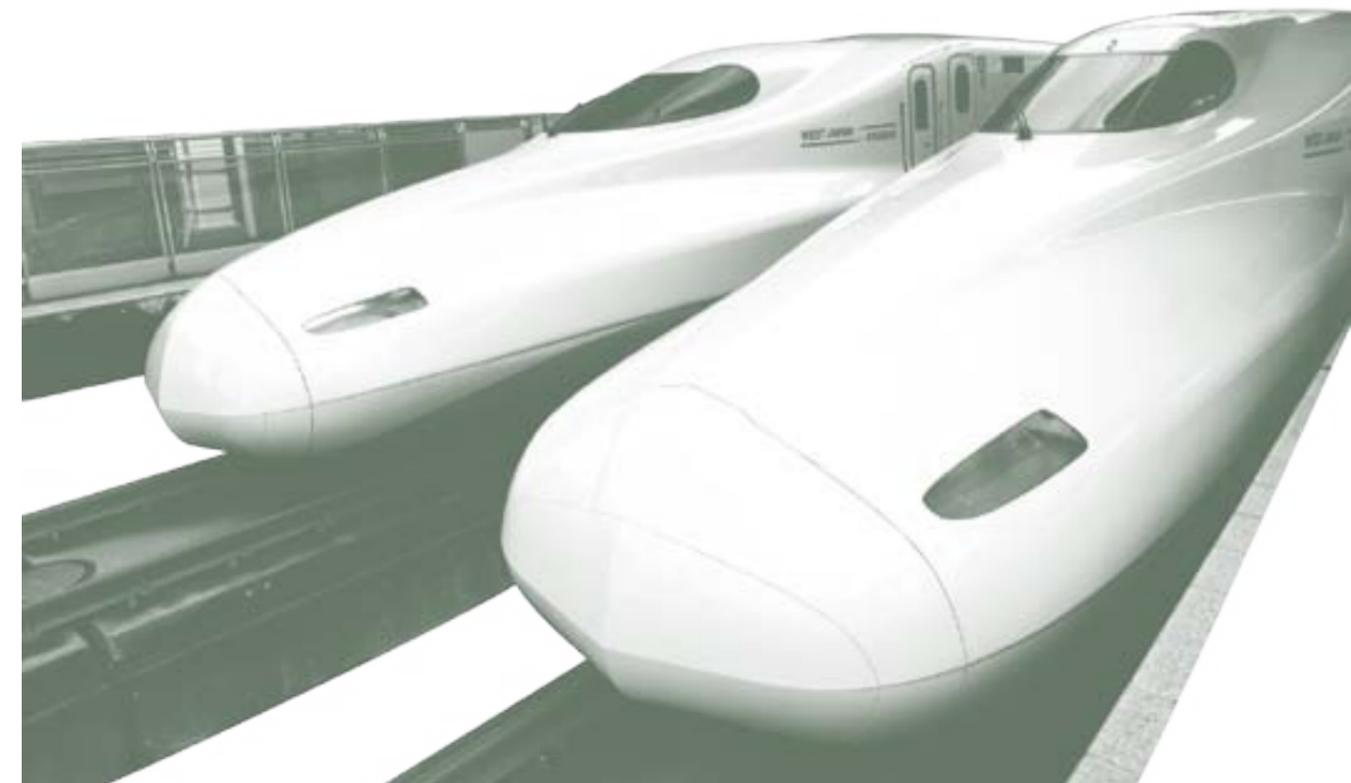
³Adjusted to 2010 Prices

⁴Whilst this project did not meet OMEGA's cost criteria it was included in view of its iconic status and range of key impacts.

⁵Whilst this project did not strictly meet the minimum cost criteria set, it was considered to be close enough to be included, on the grounds that it represented a critical piece of infrastructure for the territory.

In response to the above key research questions and hypotheses, the OMEGA 2 Study yielded a number of significant contributions to the field of MTP development, presented here in section 3, which move significantly beyond the traditional concerns associated with project performance. These contributions take the form of lessons and suggested stakeholder actions, which help better define arenas of MTP activity. The UCL OMEGA Team consider that these lessons and actions should be placed at the heart of future decision-making if projects are to meet the growing and changing aspirations for achieving future sustainable economic, social, environmental and institutional development.

A primary purpose of the OMEGA 2 Study is to foster institutional learning world-wide concerning decision-making in the planning, appraisal and delivery of MTPs. However, such is the volume of work produced by the research that it is impossible to do it full justice within the confines of this Executive Summary. Of necessity, this document consequently concentrates on those principle findings considered to be of greatest generic significance for future MTP developments rather than seeking to reflect in-depth findings for each case study.





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OMEGA research methodology and case studies

[section two]

OMEGA Research Methodology and case studies

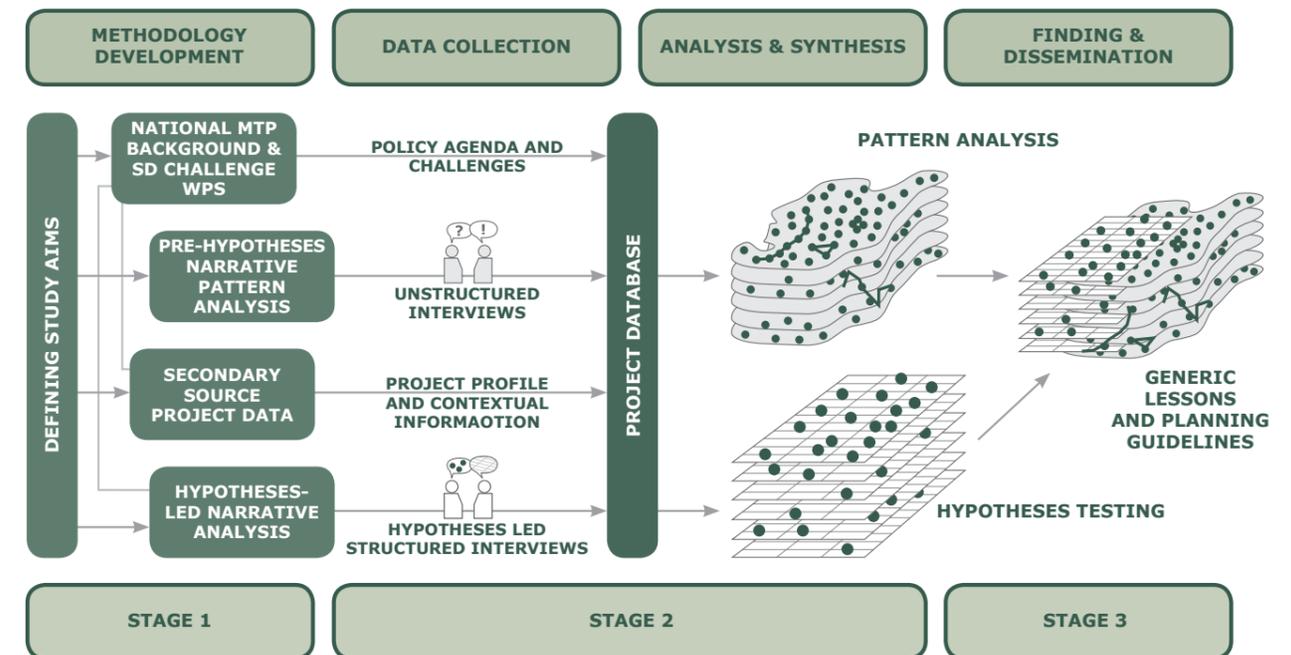
The research methodology employed for the OMEGA 2 Study was premised on an important underlying assumption, namely that knowledge about the planning, appraisal and delivery of MTPs resides not only in the academic and professional literature about accomplishments and practices in the field plus the government and consultancy reports produced for MTP developments, but also very much in the narratives (story-telling) of key stakeholders involved in such projects.⁶

With this in mind, the Study pursued a parallel approach of identifying findings derived from both the written word and stakeholder narratives to establish the extent to which one set of findings reinforced/contradicted the other – in order to identify new patterns of knowledge.

The Study was undertaken in three stages as illustrated in Figure 2 and elaborated in Annex 2:

- **Stage 1A & 1B:** The definition of study aims, methodology development, and preparation of key working papers
- **Stage 2:** Data collection and analysis entailing case study syntheses based on four key 'tests' of project achievements relative to: Project objectives; MTP sustainable development challenges; Treatment of risk, uncertainty, complexity and context in decision-making; and Synthesis of Tests 1-3 for each case study project.
- **Stage 3:** Formulation of OMEGA 2 Study findings as a Final Report.

Figure 2:
Study Methodology



Source: OMEGA Centre, 2011

The examination of the question of MTP 'successes' (or failures) investigated by the OMEGA 2 Study was largely confined to the experiences of projects in ten countries/territories in the developed world. From this the OMEGA Team sought to identify and share a new body of knowledge including the derivation of potential lessons aimed at informing better MTP development practices. This was done, as implied above, on the basis of the analysis and synthesis of findings derived from primary and secondary data sources including in-depth interviews of both a 'storytelling' (pre-hypothesis?) and hypothesis-led nature conducted with some 300 key decision-makers and other deeply involved stakeholders.

The 30 case studies were reviewed in conjunction with the OMEGA Team's Academic International Partners (see Annex 1). Under the overall supervision of the Director of the UCL OMEGA Centre, each Country Partner was headed by a Principal Investigator (PI) and supported by Research Assistants (RAs), including VREF-funded PhD candidates. Also included in this 'OMEGA Partner Network' was Cognitive Edge Pte Ltd. which provided guidance, training and advice on the application of Pre-hypothesis Analysis Techniques to research investigations.

⁶The decision to pursue this kind of investigation was based on persuasive arguments presented by David Snowden of Cognitive Edge Pte Ltd derived from his work (see Kurtz and Snowden, 2003) which, amongst other things, highlights the benefits of obtaining and analysing contextually rich experiences in the form of anecdotes or 'stories' provided by those actually involved in project planning, appraisal and delivery. For the OMEGA 2 Study, such experiences were obtained using what were referred to as 'naive' interview techniques so as not to expose interviewees to pre-conceived positions or hypotheses. Rather, the intention was that hypotheses would be formed only after the analysis of collected narrative and not up-front. Thus, this 'pre-hypothesis' approach enabled patterns of knowledge to emerge during the analysis of narrative data, often revealing hitherto unexpected findings.

⁷See footnote on page 4

Key lessons for MTP planning, appraisal and delivery

What follows is a selection of key lessons about the practice of international MTP planning, appraisal and delivery which form the backbone of the OMEGA 2 Study findings.

These are derived from the synthesis of the case study and country-based research outputs, as well as two other major inputs. These include the findings of the OMEGA 1 Study (see Annex 3), which critically examined the treatment of risk, uncertainty and complexity in decision making in the planning of major projects outside of the infrastructure field (OMEGA Centre, 2008), and a literature review of earlier key principal publications in the field (see References).

The lessons presented below are believed to be broadly 'generic' in nature, in that they resonated extensively across the countries and case study projects examined. These are offered, however, with an important 'health warning' as they were essentially derived from case studies in the so-called developed world. Their transferability to different contexts thus needs to have due regard to the many and varied political, cultural, temporal and other contextual circumstances that impact on MTP developments; an area of critical importance which is in need of much greater research.

The OMEGA 2 Study lessons offered below are therefore seen to reflect the principal areas where a real 'difference' can be made by MTP decision-makers and other key project stakeholders in the planning, appraisal and delivery of such projects. Most importantly, all of these lessons represent responses to the research questions posed and hypotheses mentioned above. In this regard, it should be noted that the lessons particularly suggest ways in which key risks, uncertainties and complexities that are associated with MTP developments can be identified and mitigated.

Here it is to be appreciated that such risks, uncertainties and complexities are seen to occur not only within projects, but also, and often more critically, in the external project environment.

The lessons are grouped under the following headings:

- MTPs as 'agents of change'
- MTPs as 'open systems'
- MTPs as 'organic' phenomena
- the need for proper framing of MTPs
- the power of context
- the role of sustainable development visions
- engaging with MTP stakeholders
- institutional, policy and legislative support
- the importance of lesson-learning and sharing.

In addition to the lessons offered, based on the research findings, recommendations of a generic nature are made relating to the need for MTP planning, appraisal and delivery agents to adopt different approaches and practices as responses to each of the following lessons. More specific proposals for action by individual stakeholder types in response to the whole suite of lessons provided throughout the Executive Summary are contained in the Conclusions section. For this latter purpose, MTP decision-makers and other key project stakeholders have been divided into four broad categories.

These comprise those actors perceived to be the most capable of effecting positive and beneficial change to current MTP planning approaches and practices, as follows:

- **politicians** operating at the local, regional, national or international level
- **public sector officials** involved in MTP planning, appraisal and delivery, together with those responsible for spatial/sectoral policies, plans and programmes that either accompany or are impacted by such projects
- **private sector personnel** operating at the local, regional, national or international level, comprising (but not limited to) project financiers/funding agents and advisors, developers, members of PPP/PFI consortia, consultants and contractors
- **other key MTP stakeholders** operating at the local, regional, national or international level, comprising (but not limited to) knowledge disseminators, the media, non-government organisation personnel, and members of lobby and community groups.

Apart from the 'health warning' already alluded to regarding the importance of context, it is necessary to highlight a number of additional very important caveats that must accompany the following lessons.

Firstly, the lessons are themselves not intended to represent an exhaustive list of all necessary actions to enhance MTP planning, appraisal and delivery. Rather, the intention has been to focus on those principal areas where different approaches can and should be adopted. Secondly, whilst it is clear that a number of the presented lessons are undoubtedly applicable to the retrofitting of existing MTPs, their intention is primarily to influence the planning, appraisal and delivery of future projects. This is so because the research undertaken has (most importantly) discovered that there is a real lack of clarity amongst MTP stakeholders as to how such projects can be retrofitted to enhance their future utility in light of the sustainability challenges ahead. It is therefore recommended that research into MTP retrofitting merits urgent discrete research.

MTPs as 'Agents of Change'

There is a need for a change of mind-set concerning the way in which MTPs are positioned, framed and planned.

This is so because MTPs frequently (either by design or by virtue of the nature and extent of their impacts) become critical 'agents of change' that have multiple spatial, economic, environmental and other implications. Indeed, we have observed from the case studies that the potential for such projects to change the context into which they are placed is often under-appreciated by decision-makers. This can result in unexpected/unintended consequences, both beneficial and/or problematic.

The research indicated that this finding reflects the rather narrow framing of many such MTPs solely as providers of transport infrastructure, as was the case (for example) for The Western Harbour Crossing in Hong Kong, HSL Zuid in the Netherlands, and the Athens Metro - which were all seemingly implemented without sufficient attention being paid to their potential capability to directly or indirectly stimulate urban regeneration and wider spatial and sectoral change. Conversely, projects such as the Hong Kong Airport Express, Tokyo's Metropolitan Expressway and the Oedo Line, the Sydney Cross City Tunnel and Channel Tunnel Rail Link (CTRL) in south-east England (Figure 3) were inherently positioned as components of broader agent of change strategies, albeit with varying degrees of success and over different periods of time.

It should be noted, however, that 'agent of change' objectives were not always a part of the initial *raison d'être* of such projects, as was the case of New York's Air Train. With these considerations in mind, MTPs therefore need to be seen as important potential 'agents of change' with such roles being taken into account during strategy formulation.

It is here that it becomes very apparent that many such projects are not mega projects but programmes of a combination of mega projects ('metaprojects') that evolve over time and in different contexts. Sometimes these metaprojects become part of an emerging strategy/plan as an 'agent of change'. On other occasions they develop on a more ad hoc basis, in response to changing forces. Here, we recommend that any new emergent 'vision' and related 'emergent objectives' associated with the transformational potential of a MTP/metaproject, needs to be stress-tested and future-proofed through the use of scenario-testing, involving key project stakeholders, so as to postulate potential changes (especially of contextual influences) over different time periods.

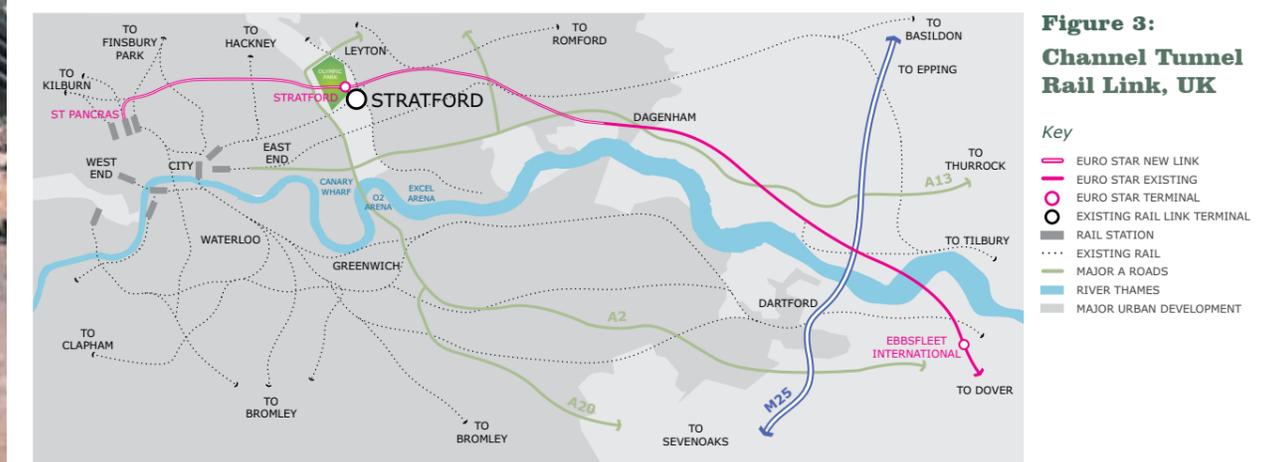


Channel Tunnel train

MTP CONSIDERATIONS

MTP planning, appraisal and delivery agents therefore need to be clear about:

- whether an MTP is expected to function as an 'agent of change', and if so, in what way
- what sort of territorial, sectoral or other type of change it is expected to achieve
- which forces of change the projects are trying to influence or harness
- the relationship between 'strategy' and forces of change affecting sustainable growth, especially economic growth ambitions
- the timeframe over which such change might be expected to take place given prevailing/forecast/scenario contextual conditions (see below)
- the type of resources (financial, institutional, personnel, legal, etc.) and policy frameworks that are likely to be needed (again see below) and over what period
- what the potential boundaries (physical and otherwise) are against which to judge the MTP's 'success'.



MTPs as 'Open Systems'

Planning, appraisal and delivery agents need to recognise that MTPs are phenomena that require 'open systems' treatment in light of their complex and fluid relationship with the areas/sectors/communities they serve, traverse and impact upon.

MTPs are seen as 'open systems' as a result of their continuous interaction and interdependency with the changing 'context(s)' they serve, traverse and impact upon – including environmental, social, economic, physical, institutional and political contexts. In seeking to adapt and respond to such changes, MTPs are themselves frequently changed. They in turn also alter the contexts into which they are placed. Such changes are continuous and evolving, thereby contributing to the development of a dynamic situation, which never reaches equilibrium.

Over half of the OMEGA case studies were found to be considered as 'closed systems' during both their planning and implementation stages. However, feedback from some case study interviewees suggests that when megaprojects are treated as 'closed systems' during the early stages of project development they cannot be adequately appraised as a constituent of the wider, and hence more complex, context into which they are placed. In so doing, legitimate stakeholder involvement in decision-making is frequently very limited or even omitted, with the result that such projects subsequently face the real possibility of having their potential impacts seriously underestimated. This, in turn, can lead to significant lost opportunities and downside risk of stakeholder opposition.

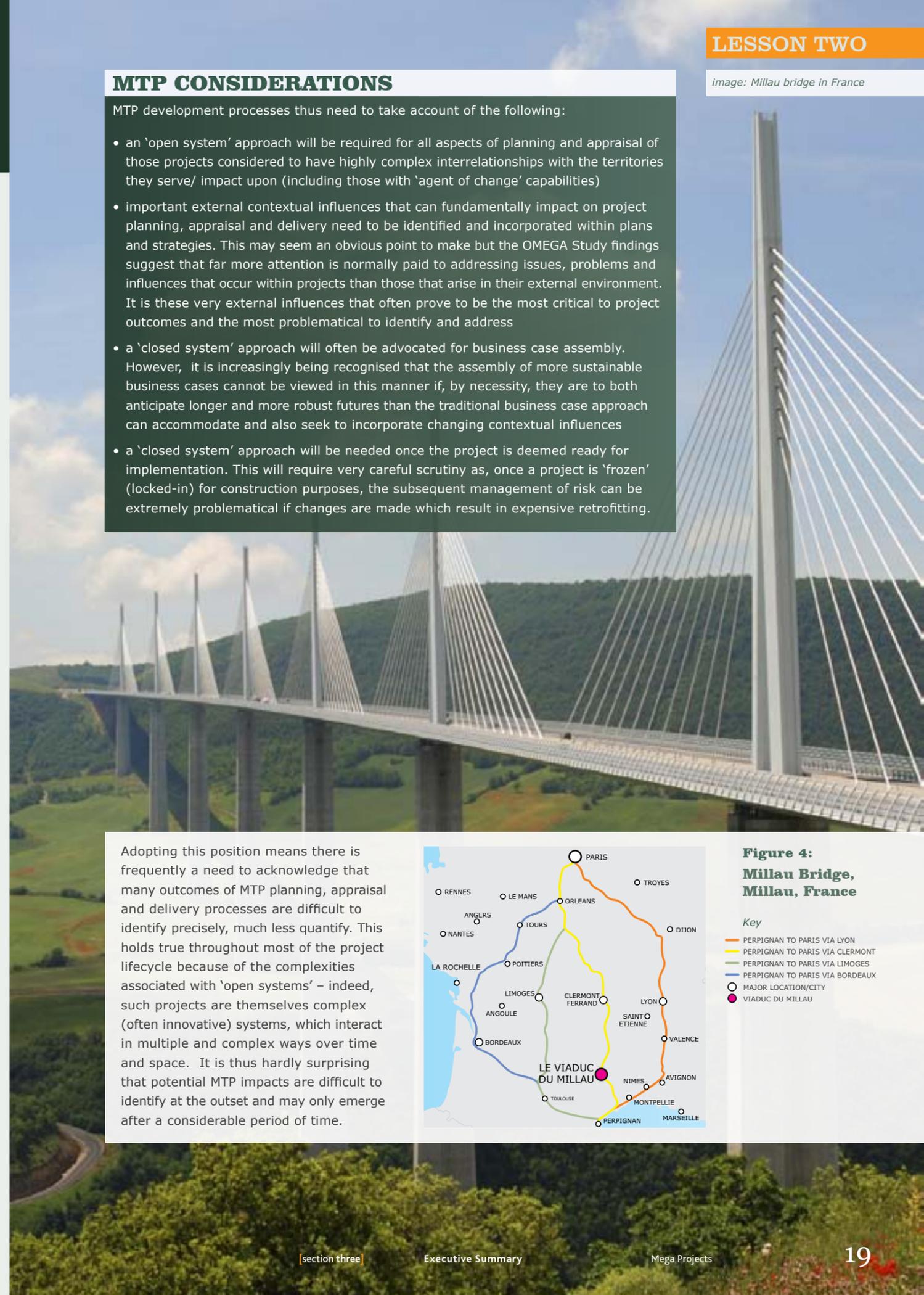
A number of OMEGA case studies were found to experience a transition from a closed to an open system approach. For example, the Metropolitan Expressway in Tokyo was initially treated as a closed system but was subsequently forced to be treated as more 'open' due to pressure from local residents demanding an environmentally sensitive design solution. Similarly, the Millau Bridge in France (Figure 4) came to be regarded in 'open system' terms as a result of the influence of two main developments: the increasing public sensitivity to sustainable development issues and the increasing forces of globalisation expressed through the implementation of EU regulations requiring the opening of MTPs to competition.

'Open systems' treatment needs to be reflected in the types of approaches and processes that are established for the purposes of (particularly) MTP planning and appraisal. This enables their potential interaction with the context into which they are to be placed to be seen as more exploratory than traditional infrastructure planning permits – thereby allowing for unanticipated outcomes to be better discerned and accepted as part of an 'emergent order'. This conclusion reinforces earlier observations made in the seminal work of Friend and Jessop (1968) and Hall (1980) and more recently by Snowden (Kurtz and Snowden, 2003) and Frontier Economics (2012).

MTP CONSIDERATIONS

MTP development processes thus need to take account of the following:

- an 'open system' approach will be required for all aspects of planning and appraisal of those projects considered to have highly complex interrelationships with the territories they serve/ impact upon (including those with 'agent of change' capabilities)
- important external contextual influences that can fundamentally impact on project planning, appraisal and delivery need to be identified and incorporated within plans and strategies. This may seem an obvious point to make but the OMEGA Study findings suggest that far more attention is normally paid to addressing issues, problems and influences that occur within projects than those that arise in their external environment. It is these very external influences that often prove to be the most critical to project outcomes and the most problematical to identify and address
- a 'closed system' approach will often be advocated for business case assembly. However, it is increasingly being recognised that the assembly of more sustainable business cases cannot be viewed in this manner if, by necessity, they are to both anticipate longer and more robust futures than the traditional business case approach can accommodate and also seek to incorporate changing contextual influences
- a 'closed system' approach will be needed once the project is deemed ready for implementation. This will require very careful scrutiny as, once a project is 'frozen' (locked-in) for construction purposes, the subsequent management of risk can be extremely problematical if changes are made which result in expensive retrofitting.



Adopting this position means there is frequently a need to acknowledge that many outcomes of MTP planning, appraisal and delivery processes are difficult to identify precisely, much less quantify. This holds true throughout most of the project lifecycle because of the complexities associated with 'open systems' – indeed, such projects are themselves complex (often innovative) systems, which interact in multiple and complex ways over time and space. It is thus hardly surprising that potential MTP impacts are difficult to identify at the outset and may only emerge after a considerable period of time.



Figure 4:
Millau Bridge,
Millau, France

Key

- PERPIGNAN TO PARIS VIA LYON
- PERPIGNAN TO PARIS VIA CLERMONT
- PERPIGNAN TO PARIS VIA LIMOGES
- PERPIGNAN TO PARIS VIA BORDEAUX
- MAJOR LOCATION/CITY
- LE VIADUC DU MILLAU

Image: Big Dig in Boston

MTPs as 'Organic' Phenomena

MTPs are 'organic' phenomena (rather than static engineering artefacts) that often need 'time to breathe'. This time for reflection can present special opportunities that should be seized and exploited by key decision-makers.

Against the background of the OMEGA case study projects, it is clear that most MTPs are subject to an 'organic', evolutionary process that often produces fundamental change in the *raison d'être* or scope/scale of the project and/or the thinking behind plans for the areas they impact upon. This organic process (alluded to in Lessons 1 and 2 above) is frequently necessary to enable MTPs to respond to changing contexts, ideas, political agendas and visions of future possibilities.

Given the organic characteristics of MTP developments, whereby such projects cease to be seen as essentially static engineering artefacts, and given the period of reflection ('time to breathe') they often require in decision-making (particularly for larger and more complex projects), the long gestation period that is commonly experienced need not necessarily be considered ineffective.



Big Dig Tunnel

Aspects of this lesson about the organic nature of infrastructure networks are reflected in the writing of Mitchell and Rapkin (1954), Meier (1962), Graham and Marvin (2001), Alexander (2001) and Batty (2005). In certain cases, fast tracking of projects can indeed prove lethal if insufficient time has been allowed to absorb/deal with the numerous issues they need to address.

Contrasting examples of the use of a time to breathe period can be illustrated by three of the OMEGA case studies, as follows: An illustration of the good use of the time to breathe was the Tokyo Metropolitan Expressway which, during a period of national economic difficulties during the 1990s that resulted in a more protracted implementation programme, saw the introduction of more efficient and highly successful technical innovations that effectively reduced costs, and opposition (on environmental grounds) by local communities. Conversely, examples of when a period such as this was not well managed are highlighted by both: the Big Dig in Boston (Figure 5) where, after four years of disagreement over the design for the crossing of the Charles River, the Transportation Secretary had to intervene, and; the JLE, where the project was put on hold for 18 months following the collapse of private sector funding while the government sought a contribution to the overall (project) costs from the private sector.

MTP CONSIDERATIONS

MTP planning, appraisal and delivery agents need to acknowledge the evolutionary nature of many/most such projects (especially those with clear 'agent of change' roles), and in so doing:

- recognise that many MTPs and the plans, programmes and projects they spawn will often need to evolve in response to changing contextual influences that exert themselves over the (often lengthy) project lifecycle
- this requires frequent, and very deliberate opportunities to re-assess and debate the very *raison d'être* of the project and its attendant plans and programmes in conjunction with all key stakeholders. Such re-assessments should encompass a re-examination (and monitoring) of all key project objectives and introduce the ability to more readily incorporate newly 'emerging objectives' hitherto unanticipated but which become the new yardsticks for assessing 'success'
- more carefully manage the 'time to breathe' periods (where they exist) to avoid the misuse of resources and to identify the potentially precious opportunities for beneficial change
- acknowledge that such opportunities may present themselves when contextual influences are 'right' (i.e., when the 'planets are aligned') to take decisive action, thereby making constant context scanning of paramount importance (see also Lesson 5)
- similarly, acknowledge that the ability to control every aspect of project planning and delivery is often fundamentally undermined by 'happenstance' (i.e. unforeseen circumstance) and that 'crisis management' in response to such circumstances is not only an understandable response it is also often (although not always) implemented in a laudable manner that demonstrates an expertise and capability that warrants much greater appreciation/respect (especially by politicians and the media)
- prepare flexible, robust and adaptable strategies for MTP developments that are able to address and respond to the complexities they pose, especially in relation to their interaction with the areas and sectors they impact upon. Such strategies need to particularly acknowledge the seeming 'inevitability' of unexpected occurrences/decisions/outcomes arising from both within and outside the project; and
- abandon the notion that the fundamental *raison d'être* of MTPs and their attendant agent of change objectives must necessarily be firmly fixed at the outset (and must remain so over time).

Consequently, notwithstanding the significance of this lesson, it is important to note that this time for reflection should be well managed so as to ensure a genuine re-examination of past decisions and future direction involving key MTP stakeholders.

As a corollary, we suggest that there is a need for those involved in MTP developments to positively embrace the possibilities/opportunities associated with evolutionary (emergent) change(s), rather than insisting that original project visions, concepts and objectives must necessarily remain firmly fixed in all cases. This calls for action from key actors, as shown above.



The Framing of MTPs

The changing demands placed on MTPs can make it excruciatingly difficult to judge their successes and failures. This makes it imperative to ensure proper project framing so as to enable their appraisal to be based upon a fair and transparent foundation.

At present, the most common criteria employed for judging MTP 'success' are those associated with completing projects on time, on budget, and as per specifications (Morris and Hough, 1987; Mellow, 1988 and 2011; SMEC, 2001; Flyvbjerg et al, 2003; Priemus et al, 2008). However, findings from the OMEGA 2 Study suggest that the criteria covered by this focus are capable of only providing a partial (albeit important) basis for such judgements.

In this connection it is perhaps worth noting that of the 30 OMEGA case study projects (see http://www.omegacentre.bartlett.ucl.ac.uk/studies/by_place_2.php):

- the average cost-overflow was found to be 22%
- only one project (the Boston Central Artery Tunnel, or 'Big Dig') was found to have exceeded its original budget⁸ by more than 100%, whilst three were found to have been between 50% and 100% over budget. Half of the case study projects were successfully delivered at less than 10% over budget
- half were found to have been delivered either on time or less than one year behind the original schedule
- only one-third achieved more than 75% of their initial objectives. However, for those 13 case studies where 'emergent objectives' were identified, the success rate was much higher, with more than three-quarters achieving 100% of their 'emergent objectives'.

It should also be noted here that the OMEGA 2 Study found that most stakeholders recognised the dangers of relying solely on 'Iron Triangle' considerations as a means to ultimately judge the 'success' of MTPs. Indeed, reflecting both earlier and later observations (Hall, 1980; Altshuler and Luberoff, 2003a; Gualini, 2007; Allport, 2011), research suggests that to make a sound judgement about a project's 'success' or 'failure' it is critically important to also understand contextual influences that prevailed at the time the project was conceived, planned, appraised and implemented. This position is reinforced by earlier OMEGA Study findings (OMEGA Centre, 2008) which highlighted the fact that because many/most mega projects evolve considerably over time, they need to be understood as dynamic phenomena, to the extent that yesterday's 'failures' can in some instances become tomorrow's 'successes' (and vice versa).

Proper project framing also requires careful thought regarding the nature and clarity of MTP visions, goals and objectives – whether these relate to the project itself, associated spatial and sectoral transformational initiatives or a combination of the two. The OMEGA 2 Study findings suggest that (inter alia) there should be a clear early statement of project roles, goals and objectives, together with key assumptions, appraisal criteria and anticipated impacts which need to be disseminated to (and thoroughly discussed with) impacted key stakeholders. However, paradoxically, it should also be acknowledged that having such clarity might be harmful if a resistance to change accompanies this in the face of fluid contextual influences and the consequent need to accommodate emergent objectives (as noted in Lessons 1-3 above). Moreover, MTP objectives relating especially to the degree of spatial/sectoral impact that they may have are often insufficiently developed at the outset.

MTP CONSIDERATIONS

MTP development processes thus need to take account of the need to acknowledge that sound judgement about the 'success' (or failure) of MTPs is more likely to be achieved when projects are presented to key decision-makers in a manner that lays out key financial and non-financial costs and benefits in a transparent way against different time-lines and within a policy-led multi-criteria analytical framework to assess progress. This assists the setting of priorities and helps make trade-offs among different project objectives and stakeholder interests much clearer. A framework of this kind (discussed further below) should simultaneously highlight those aspects of the project that are:

- subject to considerable uncertainty (both currently and in the future) due to changing contextual influences
- dependent upon the parallel implementation of attendant initiatives
- likely to require short-term decisions so as to 'fix' particularly fundamental project components
- identify those project elements that may be allowed to evolve over time in response to particular stakeholder visions and/or (accepted) lobbying.

Perhaps, unsurprisingly, OMEGA 2 Study findings indicate that stakeholders and stakeholder groups not only often have fundamentally different expectations of the roles and impacts of MTPs (despite the publication of agreed official project objectives) but also that their perceptions of 'success' or 'failure' are frequently highly individual, based on a particular aspect/component of a project or even an emotional response to it, and may change appreciably over time.

Despite the above, most stakeholders acknowledge that MTP objectives (both original and emergent) should help provide a sound basis on which to appraise the performance and achievements of such projects in a holistic and transparent manner.

MTPs such as the CTRL, JLE and the Big Dig demonstrate that, post-completion, the perception/criteria of 'success' often changes – sometimes dramatically. In all three cases, the problematic circumstances surrounding the funding and delivery of these projects attracted considerable controversy. This was especially true in the case of the Big Dig, in light of the immense cost of the project to the State of Massachusetts and the US public purse in general. It has been featured as the most costly urban road project in the history of US public works. However, subsequent benefits that have accrued to the project diluted this criticism somewhat, especially in those quarters which acknowledge the positive impacts of agglomeration impacts, including those knowledgeable of related property/land value uplifts and environmental improvements.

As part of this process, it should be acknowledged (once again) that the achievement of project completion on time, to cost and to specification, though very important, does not necessarily represent the *raison d'être* for undertaking MTPs. This conclusion was reflected in a number of OMEGA case studies, including the JLE.

The above call for a broader framework for judging the success or failures of MTPs is supported by the findings of work (OMEGA 3 Study) undertaken by the Centre for the Actuarial Profession (AP) and Institution of Civil Engineers (ICE) for its joint RAMP Working Party (OMEGA Centre, 2010). Amongst other things, this concluded that there are major advantages in adopting a 'policy-led' Multi Criteria Analysis (MCA) of major infrastructure projects throughout all stages of a project's lifecycle. This is advocated because MCA can do much to:

- highlight stakeholder's common and divergent interests
- integrate the use of different appraisal tools
- identify which interests/criteria are important/appropriate by stakeholder category (detailing why, where and when)
- identify which criteria should receive priority in accordance with policy and resource scenarios
- indicate how trade-offs between tangible and intangible criteria of different stakeholders are best made, and in a transparent manner.

⁸Taken at project ratification/political approval.

The Power of Context

Context awareness and sensitivity to context on the part of project decision-makers is vital for both the successful planning, appraisal and delivery of MTPs and suitable treatment of contextual risks, uncertainties and complexities.

The findings of the OMEGA 2 Study reveal that while the context of individual decisions and events impacting on MTP planning appraisal and delivery is essentially unique for each project, time-line analysis of key decisions associated with the case studies (see Figure 1) suggests certain basic influential patterns regarding the 'power of context' on project outcomes. Clearly, the term 'context' here embodies many and varied dimensions for decision-making including: culture and societal beliefs/values, time and space concerns, economic circumstances, institutional and planning frameworks and, not least because of its impact on MTP decision-making, political contexts. Literature that reveals the influence of context on decision-making in general (Gladwell, 2000; Surowiecki, 2004) and in project planning in particular (see for example, Friend and Jessop, 1969; Hall, 1980; Altshuler and Luberoff, 2003; Engwall, 2003; Cicmil et al, 2006; Allport, 2011) is extensive and varied.

It is also clear that contexts are today being changed seemingly at an ever increasing pace due, among other things, to rapid technological improvements, global financial and environmental instabilities and forces of globalisation. This resonates especially strongly with those MTPs that have a transnational function such as the Øresund Link (Figure 6). This project sought to link the economies of Sweden and Denmark with that of Germany and other EU countries (and beyond) by facilitating the enhanced movement of passenger and especially freight, making the cities of Copenhagen and Malmö more competitive in face of fast gathering globalisation forces. The CTRL and JLE were each in their own way also seen as projects influenced by issues of globalisation - with the former providing direct access to the European rail network and the latter being

seen to enhance the role of Canary Wharf and London as a global financial centre. Perhaps the epitome of MTPs that are influenced by forces of globalisation are the megaprojects reviewed in Hong Kong where their implementation was seen to be part of an overall strategy for the Territory to remain as a major international financial and transportation hub of Asia post-1997 in the face of competition from other global centres such as Shanghai and Singapore.

The OMEGA case studies also highlight the need to pay careful attention to the governmental (and spatial/territorial planning) policy contexts into which MTPs are to be inserted as, again, mis-matches in expectations and outcomes are frequently experienced. For example, country contexts that are characterised by 'strong' or visionary governmental and planning traditions more able to exert control over project impacts (identified in the Hong Kong, Japanese and French case studies) need to be treated very differently from those where the ability to control unintended outcomes is, at best, patchy (as was found in all three Greek case studies and the Sydney Cross City Tunnel).

The OMEGA case studies also highlight the need to pay careful attention to the governmental (and spatial/territorial planning) contexts into which MTPs are to be inserted as, again, mis-matches in expectations and outcomes are frequently experienced. For example, country contexts that are characterised by 'strong' or visionary governmental and planning traditions more able to exert control over project impacts (identified in the Hong Kong, Japanese and French case studies) need to be treated very differently from those where the ability to control unintended outcomes is, at best, patchy as was found in all three Greek case studies, including Attiki Odos and the Sydney Cross City Tunnel in Australia.

MTP CONSIDERATIONS

MTP planning, appraisal and delivery agents faced with this reality consequently need to acknowledge the importance of:

- undertaking periodic sensitivity analyses of the context(s) of such projects over the entire project lifecycle since contextual changes will invariably drive pivotal decisions that affect outcomes
- context awareness as a key factor in successful decision-making to address the risks, uncertainties and complexities that characterise MTPs. In particular, key project stakeholders need to identify and analyse the critical contexts (and interdependencies) that surround pivotal project decision making
- recognising the likelihood (perhaps inevitability) that the constant ebb and flow of context will almost certainly result in the need to adjust project objectives, appraisal methods/approaches and delivery plans and programmes
- acknowledging that there are occasions of serendipity ('happenstance') in MTP decision-making when unique opportunities present themselves that need to be seized by key stakeholders who are keen to influence project outcomes. Notwithstanding this, planning, appraisal and delivery agents need to be aware that taking precipitous advantage of such opportunities may well limit/preclude the possibility to allow projects to evolve (Lesson 3 above) in response to changing contextual influences by having a 'time to breathe', and that this may introduce additional risks
- awareness that 'change' is gathering increasing pace and posing rising uncertainty and risks in 21st Century due, among other things, to rapid technological improvements and the forces of globalisation
- acknowledging that 'mega events' (such as major political change, World Cup Finals and Olympic Games) may have both positive and negative impacts on the contextual risk, uncertainty and complexity of MTPs
- recognising that the scale, cost and often controversial nature of MTPs means that political influence/support will remain a critical contextual factor over the entire project lifecycle.

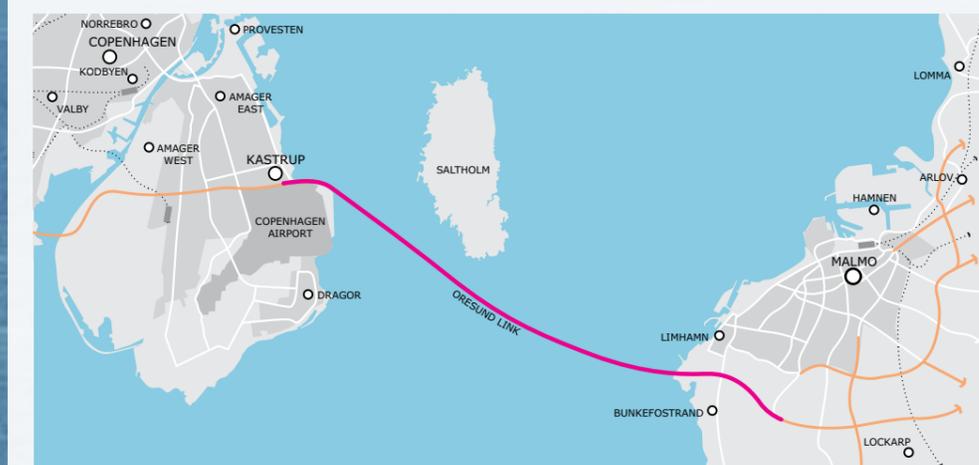


Figure 6:
**Øresund Link,
Kastrup to
Malmö, Sweden**

Role of Sustainable Development Visions

The lack of a clear and shared vision of the meaning of 'sustainable development' threatens to seriously undermine the potential for, and use of, MTPs to make a positive contribution to its achievement.

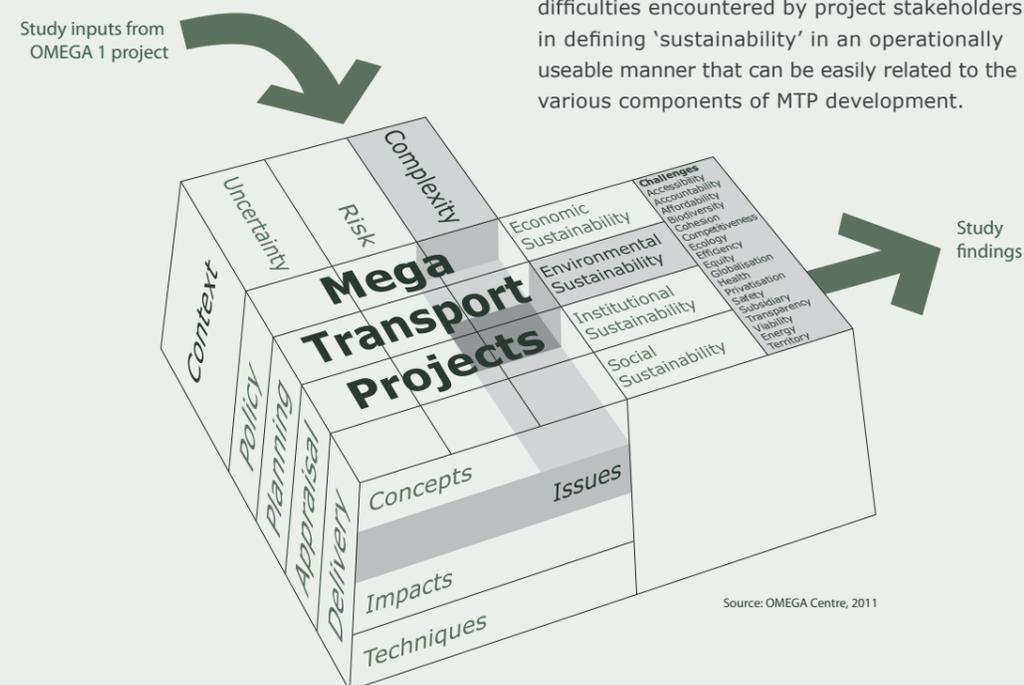
It is readily apparent that there is a widespread lack of clarity about the capability of such projects to support sustainable development visions (despite the rhetoric that exists in this respect).

The lack of clarity and consensus regarding the operationalisation of sustainable development visions as they concern MTP planning, appraisal and delivery identified by the OMEGA 2 Study poses a number of critical challenges. These include questions about whether such projects can effectively meet the needs of intra and inter-generational equity of sustainable social, economic and environmental development – including global concerns about energy consumption, carbon footprints, climate change, greenhouse gases and Co2 emissions.

Additionally, there are manifold concerns about the ability of MTPs to deliver beneficial impacts at the local level in terms of such matters as sustainable patterns of development, successful integration with existing/future transport systems and land uses, air quality and noise – all of which are key measure of project 'success'.

Notwithstanding these concerns, what is readily apparent from the OMEGA 2 Study findings is that sustainable development visions are not currently seen as providing adequate frameworks for either setting MTP goals and objectives or judging their subsequent success or failure. While this can in part be attributed to the fact that the case studies examined were mostly conceived and planned in an era (1970s to early 1990s) when the vision of sustainability as applied to such projects was still in its relative infancy, it can also be explained by the perceived difficulties encountered by project stakeholders in defining 'sustainability' in an operationally useable manner that can be easily related to the various components of MTP development.

Figure 7:
Study Relationship of Key Themes



Source: OMEGA Centre, 2011

MTP CONSIDERATIONS

MTP development processes therefore need to address sustainability concerns in these broader terms. However, this poses further challenges on account of the existence of significant institutional/organisational and professional barriers and silos that often inhibit the application of 'holistic' visions to MTP developments. Moreover, certain MTPs (especially large-scale projects with important highway components such as the Øresund Link and Hong Kong's Western Harbour Tunnel) are characterised by an inbuilt conflict between concerns for environmental sustainability and the manner in which they are designed and funded – ie. their continued financial sustainability is frequently dependent on revenues that require ever increasing patronage/rising traffic levels which, in turn, provide government with sources of revenue (directly by means of tolls or indirectly through fuel tax). On the other hand, in the case of mega public transport projects, especially those which may be considered components of transit-orientated developments (ToDs), potentially have far-reaching positive sustainability benefits that go well beyond their immediate line-haul operations by virtue of the positive urban agglomerations they can attract and the reduced private motorcar dependency they can encourage. The OMEGA 2 case studies which fall within this category include: CTRL in UK, the Hong Kong Airport Express Railway (Figure 8) and Perth-Mandurah Railway.

Additionally, in France and Japan (for example), OMEGA case study interviewees expressed the view that sustainable development visions require long-term appraisal and evaluation cycles which in turn need to be supported by sustained political support and institutional frameworks which share the same vision. It is questionable, it is contended, whether such visions can expect to be delivered in the absence of institutions with these characteristics.

Particularly problematic are the inherent dilemmas encountered in reconciling aspirations associated with the different dimensions of sustainability (Adams, 2008; Low, 2007; Hillman, 2008; Zegras, 2011; Zeybek and Kaynak, 2008), including sustainable funding (Pretorius, 2008; Dimitriou, 2009). For the purposes of the OMEGA 2 Study, sustainable development was deemed to encompass environmental, economic, social and institutional concerns – i.e., the concept was seen to be founded on four rather than the three pillars of economic, environmental and social development (Figure 7).

image: Hong Kong Station, Hong Kong Island



Figure 8:
Airport Rail Link, Hong-kong

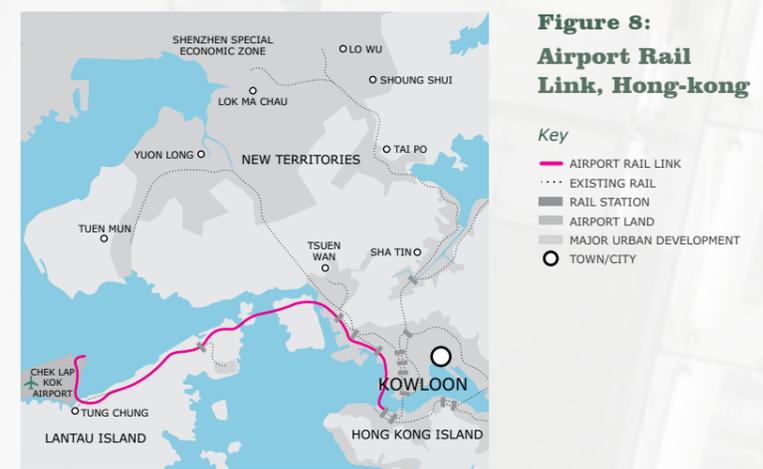


image: Sydney Cross City Tunnel

Engaging with MTP Stakeholders

Effective and early engagement with key stakeholders is seen as critical in MTP planning, appraisal and delivery.

This presents important opportunities to manage/mitigate risk, uncertainty and complexity in project developments and more specifically to assist in the adjustment of project objectives to address manifold contextual influences (and changes thereto), manage expectations and help progress the project delivery process.

It is very clear from the findings of the OMEGA 2 Study that discerning and analysing key stakeholder motives/agendas and levels of influence on MTP developments is never easy – not least, because they are subject to change over time. This is compounded by the likelihood that relationships amongst and between major stakeholders will similarly alter during the MTP lifecycle.

As already implied, building effective relations with key project stakeholders is dependent upon the establishment of trust, credibility and transparency – (Cowe, 2002; Flyvbjerg et al, 2003; Hardin, 2006; Currall and Inkpen, 2008) – which, in turn, represent important factors in creating consensus in decision-making, especially necessary in turbulent and uncertain times. OMEGA 2 Study findings suggest that consensus building at the preliminary stages of the planning and appraisal of MTPs is essential since this can often contribute to significant cost savings through the reduction of delays caused by public opposition and challenges that could otherwise occur in the post-planning stages.

This conclusion was arrived at in the case of the west coast rail project in Sweden in the mid-1990s (Päiviö and Wallentinus, 2001) and subsequently communicated in numerous interviewee responses to several OMEGA case studies – as in the case of Sydney Cross City Tunnel (Figure 9), Hong Kong Airport Railway and JLE and also confirmed by lessons derived from the Øresund Link (Dahlsten, 2010). With this in mind, MTP planning and delivery agents are well advised to especially identify those pivotal decisions, which require a high level of trust to be established.

What is also readily apparent from the OMEGA 2 Study findings is that those 'would be' key stakeholders (such as local community groups) who have a critical interest in project outcomes and who are not directly involved in the core of MTP decision-making processes rarely trust their outcomes on account of the frequently perceived opaqueness of such processes. Thus, access by key stakeholders to all relevant, high quality, information is seen as critically important. It is acknowledged here, however, despite increasing demands for access to such information, that there are usually limits to full disclosure as a result of legitimate commercial sensitivities. This requires MTP planning and delivery agents to take a very carefully considered view as to how much 'sensitive' information can/should be released (and to whom, and when).

The Study findings also indicate that stakeholder engagement was found to be much less effective if undertaken after project objectives had been firmed-up by project promoters.

MTP CONSIDERATIONS

MTP planning and delivery agents, in light of the above, therefore need to undertake frequent scans of the stakeholder environment of their projects in order to assess the willingness, ability and capacity of different stakeholder groups and networks involved in the project to exert critical influence on pivotal decisions. The possession of such information places these agents in a significantly better position to both anticipate the need to amend project strategies, plans and programmes and to respond quickly to stakeholder influence on pivotal decision-making.

In fact, it was suggested that such belated consultation can actually increase confrontation in certain instances. Stakeholders thus need to work closely with each other and keep each other fully informed throughout the project in order to retain and build on trust (Currall and Inkpen, 2010). The presence of trust allows the identification of potential issues going forward that could otherwise jeopardize project planning and delivery processes. In the context of pre-project execution, stakeholder engagement presents opportunities to:

- identify those concerns that, if properly addressed, can actually lead to improvements in project concept and design
- reduce conflict, which may otherwise jeopardize legitimate project plans and programmes
- produce decisions that are fast, transparent, inclusive, robust and defensible and of a high quality.

Examples of effective consultation among the OMEGA 2 Project case studies include the Perth-Mandurah Railway in Australia, where consultation was introduced at the outset of the project. Two projects for which effective consultation processes were established in response to initial public opposition include the TGV Med fast train project in France and the Big Dig in Boston. In regard to the Øresund Link, it is suggested that the fear of stakeholder resistance contributed to a more thorough environmental assessment and stringent environmental requirements for the project.

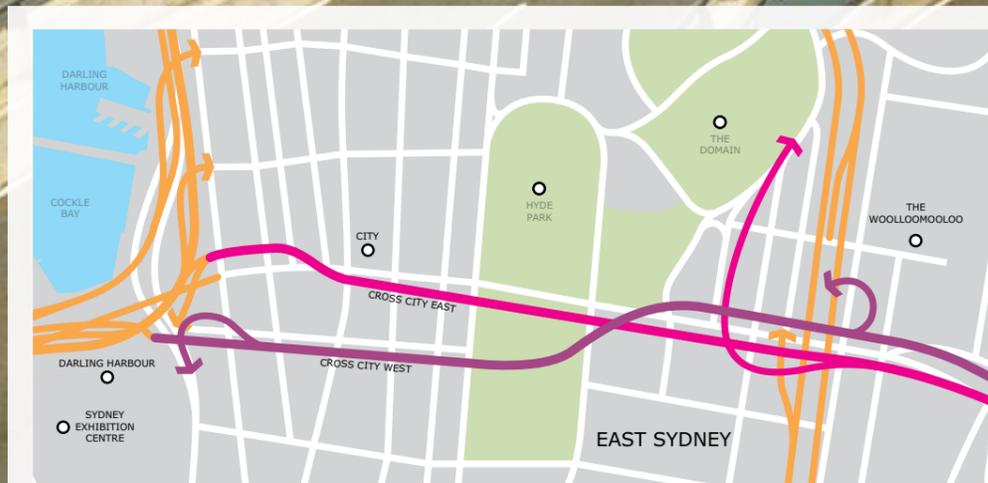


Figure 9:
Sydney Cross City Tunnel, Australia

Key

- WESTERN CITY LINK TUNNEL
- EASTERN CITY LINK TUNNEL
- LINK CONNECTIONS
- MAJOR ROAD NETWORK
- SITE OF INTEREST
- PARK LAND

image: St-Lazare Station, Paris

Institutional, Policy and Legislative Support

MTPs are unlikely to be able to deliver the full range of agent of change benefits unless accompanied by a suitable institutional, policy and legislative framework that remains in place throughout the project lifecycle.

Insights offered by the OMEGA 2 Study suggest that whether or not such MTP institutional frameworks are bespoke or take the form of an adaptation/extension of currently available institutional, policy or legislative arrangements, it is (as earlier explained) critically important that they are transparent, accountable and sustainable over the long-term – including during the project operations phase.

Such frameworks also need to address the wide-ranging variety of stakeholder expectations and aspirations that MTPs inevitably engender; and the multiple territorial, sectoral and stakeholder interfaces with which project planning, appraisal and delivery processes have to deal. It is, furthermore, the case that such projects benefit greatly from sustained political support and leadership, particularly to the point of their political approval and commencement of construction.



Meteor in Paris

This has been highlighted by a number of writers and analysts in the field, including Altshuler and Luberoff (2003b), Capka (2004), Prieto (2008) and Pool and Samuel (2011).

Of the OMEGA case studies examined, the advantages of a MTP enjoying sustained political support and the patronage of a political champion was apparent in the case of Attiki Odos in Athens, Meteor project in Paris (Figure 10), Oedo Line in Tokyo, CTRL in UK, Big Dig project in Boston, Øresund Link in Sweden/Denmark and the Perth–Mandurah Railway. Such support helps to maintain both consensus and momentum. Failure in any of the above respects is likely to lead to an inability to deliver on objectives that express 'agent of change' aspirations/expectations.

Interestingly, all the Japanese OMEGA 2 Project case studies, including the Kyushu Shinkansen (Figure 11), appear to have enjoyed an integrated long-term institutional framework based on a rail-oriented urban development strategy employed throughout the country. It should be explained that rail companies in Japan are part of large national commercial and industrial consortia that also have real estate and retailing interests, as well as construction and banking interests, which look to take advantage of land developments around stations so as to ensure maximum use of their rail networks (Dimitriou, 2012).

MTP CONSIDERATIONS

MTP development processes therefore need to:

- ensure the availability of suitable institutional, policy and legislative frameworks in both the short and long-term so as to ensure that MTPs retain the capability to deliver the fullest possible range of transformational benefits
- acknowledge that institutional, policy and legislative frameworks that remain appropriate over time will also make it much easier for MTPs to respond to contextual change
- acknowledge the very critical roles that can be played by political champions in building consensus and driving projects forward.

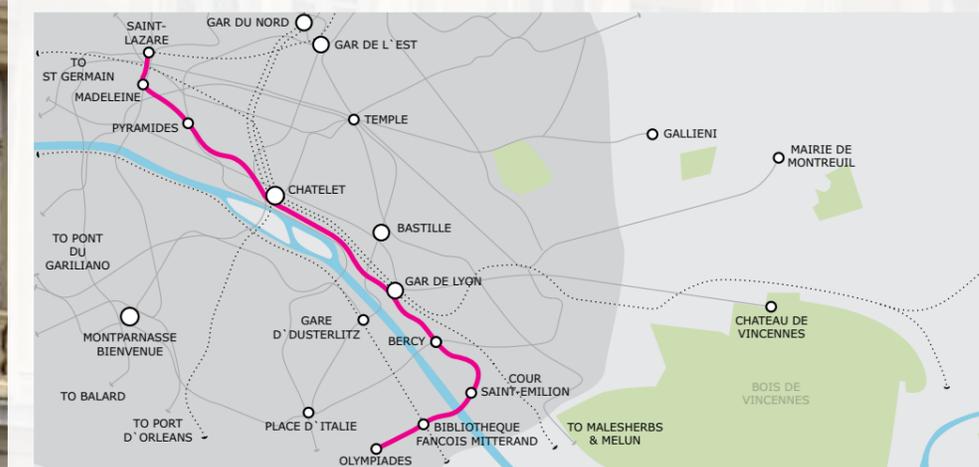


image: Shinkansen bullet train at station

Lesson Learning and Sharing

It is apparent that systematic, widespread lesson-learning and sharing is not currently a significant feature of MTP planning, appraisal and delivery, and that there are few examples in the public domain of post-project evaluation that go beyond time/cost/specification assessments of project performance.

Furthermore, there is evidence to suggest that knowledge acquired by the private sector in the field of MTP developments is frequently jealously guarded for commercially competitive gain, often ultimately at the expense of the public purse.

OMEGA 2 Study evidence suggests lesson-learning and sharing from past MTP international practice beyond academia is often treated more seriously by the private sector than the public sector – in that key project experiences are often exchanged within these organisations (especially those that have global practices), with lessons learned often being treated as a saleable commodity and thus not widely shared.



Kagoshima central station

In the public sector, OMEGA research revealed that there are too few formal mechanisms in place to enable systematic lesson-learning and sharing in the public domain beyond the exchange of anecdotal evidence by involved personnel and academic commentaries.

What is important to recognise here, however, is that this limited systematic sharing of experiences within and between public sector agencies has much to do with silo thinking among different organisations, departments and professions. This both decreases the potential for the application of innovation and deprives different sectors and interested parties of the ability to capitalise on each other's past experiences. These developments have attracted comment by a number of analysts and critics in the field, including: Allen and Barnes (2004), Hauswirth et al (2004), Project Smart Co. (2011), and Greiman, (2010).

MTP CONSIDERATIONS

MTP planning, appraisal and delivery agents should therefore seek to:

- ensure that the findings of more extensive and systematic lesson-learning and sharing of the kind featured here are integrated into project decision-making practice world-wide. This should be achieved through the introduction of global information and learning systems that are capable of capturing and disseminating these lessons (whether positive or negative) from a full spectrum of stakeholders throughout the project lifecycle
- acknowledge that the aim here is to build-up an international, publicly available, knowledge platform based on case histories that especially reflect 'good practice' in relation to contextual circumstances. These should impart important lessons learned that go beyond academic critiques to enable MTP decision-makers to better address risk, uncertainty and complexity, and the influence of context in project planning, appraisal and delivery. The costs of setting up and maintaining such systems are likely to be very small indeed, especially in comparison to the huge construction costs of any individual MTP investment.



Figure 11:
Kyushu Shinkansen, Hakata to Kagoshima-Chuo, Japan

Key
 — KYUSHU SHINKANSEN, HAKATA TO KAGOSHIMA-CHUO
 ○ CITY/TOWN
 ... EXISTING RAIL
 ■ MAJOR URBAN DEVELOPMENT



conclusions

What constitutes a
successful MTP?

[section four]

Conclusions

What constitutes a successful MTP?

As is apparent from the preceding lessons, this simple question demands many varied and interrelated responses. In the context of MTP planning, appraisal and delivery, these include taking a view on: understanding how well risk, uncertainty and complexity has been treated; and, acknowledging the importance of context in decision-making and, most importantly, in making judgements about 'success'.

The OMEGA 2 Study findings reveal a great deal about the power of context and how this colours judgements about 'success.' This not only highlights the fact that the contexts of MTP developments are fluid, but that in order to mitigate against the risks and uncertainties these changes produce, the project itself often needs to undergo adaptation. On this basis, the OMEGA research also reveals that governments, investors, academics and civil society alike can no longer afford to confine the formal planning and appraisal procedures of MTPs to 'closed system' decision-making given the 'open systems' realities and uncertainties associated with such projects.

Indeed, the UCL OMEGA Team conclude that decision-making for MTPs should transparently include a much wider set of complex considerations than those traditionally acknowledged by formal procedures that are 'Iron Triangle- led'. This is so since many 'so called' MTPs are not projects at all but programmes of projects (sometimes programmes of mega projects - metaprojects) that become very significant 'agents of change.' This is especially pertinent for very complex projects that are intended to have strategic development functions.

It is further contended that to perpetuate the practice of planning, appraisal and delivery of MTPs principally around traditional project management concerns as a basis for judging 'success' is not only highly misleading but also promotes additional major risks and uncertainties to the sustainability of such investments. The perpetuation of restrictive 'business case' judgements that essentially de-emphasise 'non-business' case considerations and achievements furthermore devalues the contributions of planners, project managers and engineers who seek to take a more holistic and long term approach. This in turn deprives civil society of opportunities to use such projects to transform the economies, territories and cities they serve in line with more sustainable outcomes. Conversely, such practices can also hide the broader and long-term damage created by MTPs by excluding parameters not considered within the scope of 'Iron Triangle' concerns.

OMEGA 2 Study findings indicate that the acceptance of MTPs as 'open systems' with powerful 'agent of change' functions necessitates the need for them to be seen as 'organic' phenomena requiring time and space to evolve and adapt in response to changing contextual influences that exert themselves over the (often lengthy) project lifecycle.



The Big Dig in Boston

This finding – especially for very complex projects – challenges the notion that the planning and appraisal of MTPs should be tightly controlled from the outset and achieved with the greatest possible speed. Rather, it points to the requirement for project decision-makers to adopt more holistic, flexible, robust and long term strategies and procedures that incorporate periods of engagement with a wide range of project stakeholders from the earliest opportunity.

The treatment of MTPs as 'adaptive systems', combined with the changing demands placed on such projects, creates considerable difficulties for their subsequent evaluation. The OMEGA Team therefore conclude that it is imperative to ensure proper project framing that enables appraisals to be based on a more broad, fair, transparent and sustainable foundation. Such project framing requires careful thought to be given to the nature and clarity of the role of MTPs, and the visions, goals and objectives of such projects from multiple stakeholder perspectives over different time periods and scenarios. To help capture these dimensions and encourage more holistic thinking, the OMEGA 2 Study recommends the adoption of policy-led MCA frameworks as the basis for decision-making throughout all stages of a project's lifecycle. Frameworks of this kind have the potential to provide broader and more transparent opportunities for making (and tracing) decisions about stakeholder trade-offs and risks in different scenarios and changing policy contexts.

Additionally, to instil a greater level of resilience and robustness in MTP decision-making, such projects require significant support through the establishment of suitable institutional, policy and legislative frameworks that are sustained throughout the project lifecycle (including the operations phase). Such frameworks need to encompass more than simply ensuring operational efficiency, viability and affordability if MTPs are to fulfil broader transformational roles. Where such projects are financed on the basis of public private partnerships (PPPs) and public finance initiatives (PFIs) (see Van Mawijk et al, 2008 for a review of PPP/PFI projects), what is critical for all concerned is that public sector expectations of the transfer of financial risks to the private sector are both realistic and sustainable, and not masked by government guarantees of financial salvage in the last resort. For this to work, the OMEGA research findings suggest there is also a need for a mutual appreciation among key project stakeholders as to who is best placed to accept particular risks (and when). The case studies suggest that it is the public sector which is better able to take-on long-term risks and the private sector, short-term risks.

The role of sustainable development visions in MTPs was found to be problematic, as a lack of a clear and shared vision of the operational meaning of 'sustainable development' could seriously undermine a MTP's potential to contribute towards sustainability. In order to make gains towards the resolution of this issue, the OMEGA 2 Study findings suggest, as a first step, that key MTP actors should advance clearer and more shared visions of their meaning of 'sustainable development' in an operationally useable manner.

Who should do what differently?

The lessons offered above suggest the need for concerted action by all key stakeholders, and, in particular, a number of important changes in ways of thinking about MTPs and their development processes. For the purposes of this Executive Summary the focus here is on describing critical responses to the lessons by four main groups of stakeholder: politicians; public sector officials; private sector personnel, and; other key MTP stakeholders. It should be noted, however, that the following discussion represents merely a selection of suggestions as to 'who should do what differently' and that a much fuller account is provided in the OMEGA 2 Study Final Report (OMEGA, 2011).

Politicians clearly have a most significant role to play in decision-making for MTP planning, appraisal and delivery. We suggest that there are three key areas where they can make an enhanced contribution:

- by adopting a more open view about the capabilities and impacts of such projects
- by providing strong and sustained leadership in regard to such capabilities
- by increased participation in information gathering, scrutiny and sharing concerning MTP developments.

Regarding the first area, there is a strong need for politicians to become more open to the idea that MTPs are not simply engineering artefacts but are, in their own right, complex systems that can have significant transformational influences (as 'agents of change') on the areas they traverse/impact upon. This not only calls for their whole *raison d'être* to be carefully considered at the outset but on an on-going basis, in light of the likelihood (perhaps inevitability) that MTP plans and programmes will need to change in response to contextual fluidity. In turn, as already implied, this means treating such projects as 'open' evolutionary/organic systems that are subject to risks and uncertainties (often for lengthy periods) that frequently make them 'big gambles'.

The implication of the above may be somewhat uncomfortable for politicians in that they will need to often forego short-term political self-interest and 'quick wins' in decision-making in favour of the more strategic long-term benefits that MTPs and their attendant visions can produce.

Concerning the second area, any change in mind-set of the type mentioned above has to be accompanied by strong and sustained leadership in promoting visions (including those associated with sustainable development) that MTPs in general, and individual MTPs in particular, should seek to fulfil. With this in mind, among the whole raft of areas where such leadership is required, the following are seen to be particularly important:

- facilitating debate about the potential multiplicity of roles that MTPs can fulfil in helping to deliver spatial and sectoral restructuring strategies, and; demanding the removal of organisational and professional silos that frustrate holistic approaches to the development processes of such projects
- scrutinising individual MTPs to determine their sustainability credentials; ensuring that appropriate and sustainable institutional, legislative, policy and financial resources are in place to enable the full realisation of transformational and other benefits of any such projects under consideration
- emphasising the importance of maintaining effective stakeholder engagement programmes throughout the MTP lifecycle so as to encourage genuine debate and a transparent exchange of information.

Politicians also clearly have a major leadership role in steering MTPs through the planning, appraisal and delivery process. Here, project champions will undoubtedly continue to play a key role in reconciling the need to maintain an 'open systems' approach during the planning and appraisal periods, whilst simultaneously sustaining the momentum of the project's development. All of these actions will require politicians to act decisively in response to moments in time when contextual conditions are ripe for 'seizing the day'.



Millau bridge in France

Finally, regarding the third area, we suggest that politicians need to focus more attention on information gathering, scrutiny and sharing. This demands action on a number of fronts:

- demanding from government and/or project sponsors periodic reports on the achievement of MTP visions, goals and objectives, which can be used over time as a basis for corrective action where necessary
- identifying potential 'winners and losers' associated with MTPs (especially those with 'agent of change' roles), and potentially powerful contextual influences that are likely to critically impact on MTP development processes
- scrutinising available planning and appraisal information to determine whether it represents a full account of likely short, medium and long-term costs and benefits (financial and non-financial) and whether project plans are capable of fulfilling project aspirations having regard to key stakeholder inputs
- ensuring that 'open' and 'closed system' information has been appropriately placed in the public domain so as to better inform transparent decision-making and facilitate future lesson-learning and sharing.

Public sector stakeholders/officials can provide significant support by ensuring that a full and transparent account of key factors that may potentially contribute to project 'success' and 'failure' is provided to key MTP decision-makers. Officials also need to be more proactive in the support/guidance they offer by presenting (to key decision-makers) MTPs as having potentially wide-ranging and uncertain impacts over lengthy time periods, which sometimes make them even 'bigger gambles' than originally perceived. They should prepare spatial, sectoral and other plans and programmes (as part of an overall strategy) to demonstrate how such projects might effect beneficial change over time. Too often, MTPs lead plans rather than being embedded in a broader strategy or strategic plan. In parallel, officials should acknowledge the likelihood that many 'open system' projects will need to evolve in response to changing contextual influences, rather than insisting on a narrow set of fixed appraisal criteria. Officials, in turn, will need to anticipate and make provision, in robust strategies, plans and programmes, for corrective action made necessary by contextual change(s).

Other areas where public sector officials can play a key role in alerting decision-makers to the need for corrective action include:

- the identification of any institutional, legislative or policy changes and overall resource requirements that might be required to maximise beneficial change
- placing broad financial and non-financial costs and benefits associated with MTPs and attendant scenarios/future proofing proposals within a MCA framework;
- identifying potential 'winners' and 'losers' associated with MTP transformational roles under different scenarios
- suggesting to key MTP decision-makers those parts of the project lifecycle that they consider can/should be treated in an 'open and/or closed system' manner – and when circumstances permit/imperatives require projects to be 'frozen'
- ensuring full and effective stakeholder engagement at the outset and throughout the project lifecycle.

We also suggest that public sector officials pay more attention to preparing systems and processes that enable full disclosure of all project experiences and lessons based thereon (whether negative or positive) to be placed in the public realm.

Finally, it is strongly considered that officials need to implement organisational change within the public sector so as to enhance its capability to adopt a truly holistic approach to MTP developments based upon the four key dimensions of sustainability. In parallel, they should promote serious debate about the role of MTPs in relation to sustainable development visions. In particular, they should pay attention to how such projects can harness agent of change capabilities for territorial and sectorial restructuring in accordance with agreed sustainability visions, and how these might be more clearly operationalised.

Private sector stakeholders/personnel

can become even more significant forces for change by adopting a proactive and open attitude towards sharing the extensive knowledge they have gained in planning, appraising and delivering MTPs in different contexts worldwide. Sometimes this information is jealously guarded for commercial advantage whereas it should be shared with MTP decision-makers and other stakeholders, particularly if the project is funded in any significant proportion by the public purse. Knowledge of this nature concerns such matters as:

- 'agent of change' experiences drawn from other contexts
- the likelihood and nature of contextual change
- the ability to identify potential project 'winners and losers'
- enhancing the robustness and adaptability of MTPs and their attendant plans and programmes
- identifying ways in which to operationalize MTP objectives/deliverables in a way that reflects the broader visions of sustainable development
- advising on the capability of proposed institutional, policy, financial and legislative frameworks to deliver on MTP objectives (including, or perhaps especially, those associated with agent of change functions) over the short, medium and long-term.



Train leaving Kagoshima Central Station

It is also suggested that private sector parties involved in MTP developments need to give more thought to acknowledging the frailties associated with solely/primarily adopting a 'closed system' approach to project planning and appraisal. In parallel, such parties would do well to acknowledge the advantages of an 'open system' approach as a means to identify (and place 'value' on) the wider potential benefits (and dis-benefits) of such projects and their attendant spatial/sectoral plans to investors and other stakeholders. With this in mind, we see the private sector being well-placed to assess whether available planning and appraisal information provides a full account of likely short, medium and long-term costs and benefits (both of a financial and non-financial kind). Such assessments can draw upon past project-based experiences in other domestic and international contexts to help identify 'new' criteria for judging 'success' not previously considered. These assessments can use aspects gleaned from other projects globally, as well as advising on contextual influences that might otherwise have been overlooked.

Finally, we suggest that private sector stakeholders should more closely and extensively assist in the preparation and testing of future contextual scenarios so as to facilitate the preparation of more robust and adaptable MTP plans and programmes. In so doing, this would usefully inform and advise the public sector and politicians of contextual influences (and changes thereto) of which the latter may be unaware but which are likely to have a critical impact on decision-making.

Other key MTP stakeholders can and should play a particularly crucial role in relation to MTP development processes by: providing a critical 'oversight' function; sharing and disseminating knowledge, and; promoting debate about MTPs' transformational roles and functions and contribution to sustainable development.

The 'oversight' role of this group of stakeholders encompasses many aspects of project planning, appraisal and delivery but is primarily focused on scrutinising the relative transparency and efficacy of project plans and programmes. This will include scrutinising the degree of transparency with which debates about the *raison d'être* of MTPs (including their transformational potential) are carried out.

The above also includes the scrutinising of accounts/criteria presented to decision-makers concerning project planning and appraisal, stakeholder engagement programmes and the capability of proposed institutional, policy and legislative frameworks to adequately and sustainably support MTPs over the medium and long-term. These stakeholders should be called upon to assist in the identification of the extent to which 'real' progress is being made by the public and private sectors in relation to the quality of MTP planning procedures, appraisal methodologies and delivery systems, as a result of lesson-learning and sharing. This will necessarily involve a thorough examination of all major project outcomes and the identification of lessons that can be drawn from these so that they can be included in the lesson-learning and sharing process to help adjust and resource MTP training and education programmes accordingly. This type of activity is worryingly lacking at the present time.

In relation to knowledge sharing/ dissemination (including providing advice), we suggest that this group can make an invaluable contribution to enhancing MTP development processes by identifying:

- potential project 'winners' and 'losers' over time, geographically, socially and economically
- emergent MTP roles and the potential impacts of these (including during any 'time to breathe' periods)
- project planning and appraisal concerns where unforeseen contextual influences might apply
- the need for enhanced robustness and adaptability (in the face of possible contextual change) in MTP plans and programmes.



Sydney Cross City Tunnel

Lastly but not least, we suggest that these stakeholders can play a vital role in improving MTP development approaches and practices by stimulating debate in the field and generally acting as an important pressure group to spur-on MTP planning and delivery agents to 'do better'. With this in mind, it is considered that groups of this kind should:

- strengthen efforts to facilitate debate about: what actually constitutes project 'success'; what the 'agent of change' roles should be; what are the features of an 'open system'; how should planning and delivery agents and other stakeholders react to the 'evolving/ organic' nature of MTPs; and, what are the roles of MTPs relative to sustainable development visions
- call for the adjustment and appropriate resourcing of education and training programmes so as to stress the importance of MTPs as having the sorts of multiple functions and impacts identified in the above-mentioned debates, simultaneously allocating resources for research and development to better develop capacities to respond to this new understanding
- promoting the need for a broader appraisal framework than traditional time, cost and specification criteria
- lobbying for the removal of organisational, sectorial and professional silos that preclude holistic approaches to MTP development processes.

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USA	The Big Dig, Source: Massachusetts Department of Transportation (2012)

Annex 1:

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Annex 2:

OMEGA 2 Study Methodology

In order to obtain responses to the overall OMEGA research questions and hypotheses, the research programme study methodology comprised three principal stages, as follows:

Stage 1A & 1B: The definition of study aims, methodology development, and preparation of key Working Papers.

Working Papers were prepared on two themes: National MTP Backgrounds and Sustainable Development Challenges. This stage also entailed the collection of secondary source data on case study projects resulting in the preparation of detailed project profiles for each of the 30 case study projects (see Figure 1). A very significant component of this stage was the formulation and agreement by the OMEGA International Academic Partners of approaches to the collection of interview data using innovative pre-hypothesis ‘storytelling’ methods and more traditional hypothesis-led investigations. This enabled the consistent application of data collection and analysis methods across the Network for all case studies. Another major set of inputs in Stage 1 were key findings from the OMEGA 1 Project (the VREF ‘Smaller Project’ on the Treatment of Risk, Uncertainty, Complexity and Context among professions outside of the infrastructure and territorial planning professions). This informed both the formulation of normative criteria for assessing project achievements and the content of hypothesis-led investigations, particularly as they related to the treatment of risk, uncertainty, complexity and the importance of context.

Stage 2: Data collection and analysis.

Pre-hypothesis (storytelling) investigations entailed 'naïve' face-to-face interviews with a diverse range of key stakeholders involved in or impacted by the case study projects where the emphasis was on the sharing of project-related experiences. These experiences were analysed using a combination of 'sense-making' software developed by Cognitive Edge Pte Ltd, aided by a more traditional examination of responses to determine key patterns of knowledge. Hypothesis-led investigations comprised structured interviews with a similarly diverse range of key stakeholders who were requested to respond directly to the OMEGA overall research questions and hypotheses, as well as a range of other project-related hypotheses. Narrative data was again analysed here to determine patterns of responses to the OMEGA research questions and hypotheses, plus other important insights.

Case study syntheses were conducted using four key 'tests' of project achievements, summarised as follows:

- **Test 1: Project objectives** – project 'achievements' were analysed relative to: original project objectives set when the project commenced; and new project objectives that 'emerged' during the course of planning and implementation (thereafter referred to as 'emergent objectives'). Preliminary 'lessons' were identified regarding how project performance could be further enhanced through objective setting.
- **Test 2: MTP sustainable development challenges** – project 'achievements' were analysed relative to identified visions, challenges and issues of sustainable development as represented by prevailing policy and normative values/criteria for 21st Century MTPs, established by reference to the OMEGA Working Paper Series 2 and other cited literature, including the UN Millennium Development Goals. Preliminary 'lessons' were identified regarding how project performance could be further enhanced in relation to the normative values for 21st Century MTPs.
- **Test 3: Treatment of risk, uncertainty, complexity and context in MTP decision-making** – this involved the analysis of project 'achievements' relative to the treatment of risk, uncertainty and complexity in MTP decision-making by reference to key normative values drawn from the earlier VREF 'Smaller Project' (OMEGA 1). Particular attention was paid to the context(s) of pivotal decisions in the project's history. Again, preliminary 'lessons' were identified.

- **Test 4: Synthesis of tests 1-3 for each case study** – this involved the identification of:
 - o the chief 'context-specific' influences on project achievements
 - o the chief 'generic' influences on project achievements
 - o principal stakeholder 'winners and losers' associated with project performance levels
 - o responses to the key research questions and hypotheses in the form of 'provisional' lessons considered to be of: 'context-specific' relevance that could enhance case study project planning and delivery of other MTPs in similar contexts; and 'provisional' lessons considered to be of generic relevance that could enhance case study project planning and delivery of other MTPs universally.

The final component of this stage comprised the preparation of 'Country Synthesis Reports' for each of the countries involved. These reports represented a synthesis of all case study findings in the form of:

- context-specific and possible generic responses to the research questions and hypotheses
- lessons of a context-specific and potentially generic nature likely to inform the enhancement of the performance of existing and new projects relative to MTP sustainable development challenges and visions and the treatment of risk, uncertainty, complexity and context in decision-making.

Stage 3: Formulation of the OMEGA research programme findings as a Final Report

The Final Report provided an account of what are considered to be the key lessons resulting from the research programme, drawing initially from evidence-based findings derived from the three UK case studies and then cross-checking these with the analysis and synthesis of the international case study findings. In subsequent steps, the sequence of comparative analysis was reversed, whereby the findings of the international case studies are examined in terms of how they resonate (or otherwise) with the UK case study findings. It is important here to note that in both cases these findings drew heavily from the Case Study and Country Synthesis Reports prepared by the OMEGA Academic Partners.

Annex 3:

Related Research

A number of OMEGA Centre working papers and complementary studies were undertaken in conjunction with the centre's international research programme on MTPs. These were carried out by the centre and its Academic Partners in the nine countries of study, and also by associated academics and practitioners undertaking specially commissioned studies.

These various studies (contained in Volume 2 of the Final Report) were as follows:

- **The OMEGA 1 Project:** carried out by the OMEGA Centre on the treatment of risk, uncertainty and complexity by different disciplines and professions producing 15 working papers
- **The OMEGA 2, Working Paper 1 Series:** a synthesis of ten working papers prepared by the Academic Partners on 'National Planning, Appraisal and Funding Frameworks for Mega-Projects'
- **The OMEGA 2, Working Paper 2 Series:** a synthesis of ten working papers prepared by the Academic Partners on different aspects of 'Sustainable Development Challenges of MTPs'
- **The OMEGA 3 Project:** alternatively referred to as the RAMP (Risk Analysis and Management for Projects) Study, carried out by the OMEGA Centre for the UK Institution of Civil Engineers (ICE) and the UK Actuarial Profession on 'how better to incorporate social and environmental dimensions of sustainability into the appraisal of major infrastructure projects'.

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