Incorporating Principles of Sustainable Development within the Design and Delivery of Major Projects: An international study with particular reference to Mega Urban Transport Projects
for
the Institution of Civil Engineers and the Actuarial Profession

Generic Lessons for Improving the Treatment of Risk, Uncertainty and Complexity in the Planning and Appraisal of Mega Urban Transport Projects

Omega centre
Centre for Mega Projects in Transport and Development

1.0   Purpose

This brief report is focussed on generic lessons for improving the treatment of risk, uncertainty and complexity within the project life cycle. The work draws from a core paper from an earlier study by the OMEGA Centre entitled and reflects the interest in a paper on Risk, Uncertainty and Complexity (RUC) as expressed by the RAMP Steering Group at its 29 May meeting.

The OMEGA Working Papers covered here are:
- OMEGA Project 1 Working Paper series #2 examined the treatment of RUC in decision-making from a wide variety of professions including medicine, defence, actuarial, finance, project management, earthquake engineering, insurance, agriculture and property development.
- OMEGA Project 1 Working Paper #3 which examine the treatment of RUC in decision-making for planning within the fields of infrastructure, and transportation policy, territorial and regional planning, urban development and project management/construction.
- OMEGA Project 1 Working Paper #4 "Generic Lessons For Improving The Treatment Of Risk, Uncertainty And Complexity in The Planning Of Mega Urban Transport Projects"

2.0   Comparative analysis of findings

This report highlights some of the key insights from a synthesis of Working papers #2 and #3 of the OMEGA Project 1 Study that can be drawn from the disciplines reviewed (both within and outside the Mega Urban Transport Project (MUTP) and/or related 'planning' fields) that have demonstrable relevance to MUTP lifecycles. It has to be acknowledged, however, that most of the insights provided by our contributors have broad relevance to multiple stages in the project lifecycle. Accordingly, the following concluding remarks identify those insights which occur *most* frequently in the contributed papers and that appear to have critical relevance to MUTP planning, delivery *and* operation under the actions of Risk, Uncertainty and Complexity.

It is hardly surprising, given the nature and scale of MUTPs, that many of the observations made in Working Paper #4 about Risk, Uncertainty and Complexity (RUC) resonate strongly with multiple phases in the lifecycle of such projects. Indeed, whether one looks at MUTPs from the point of view of being instruments of public sector policy-making or private sector investment, they are clearly characterised by significant elements of 'business' *and* 'government'. The processes/circumstances through which they are conceived, planned and delivered substantially resemble the practices, techniques and approach to decision-making found in fields such as banking, the military, public health, as well as in infrastructure planning.

There are a number of ways of defining the individual stages in a project lifecycle, depending upon which particular discipline/field is being considered. However, for the purposes of extracting useful lessons associated with the MUTP lifecycle, the following 'generic' definitions encompassing six key phases are adopted:

2

- **Phase 1: Project conception and definition**. This is the period/point when the apparent need or desire for the project is first considered by the sponsoring agent. This may be in response to a particular problem (e.g. traffic congestion) or where a MUTP is considered to be a potentially strategic instrument of public policy (e.g. as a catalyst for achieving spatial planning and development policy aims). At this stage the MUTP remains largely a 'concept' and lacks fine detail about the project's scope and operation, until the project is approved politically by Parliamentary or whatever other political procedures and is assigned a budget.

- **Phase 2: Project planning**. This is when action is taken to determine the scope, nature and cost of the project (including its key specifications, routing options, probable approach to funding and so on). The project planning period overlaps with the project conception phase as planning work is essential in order to both substantiate the viability of the project so that it can obtain political approval *and* to further develop/ amend the project after approval in light of new developments.

- **Phase 3: Project appraisal**. Here we refer to appraisal exercises that take place *prior* to project implementation (in Phases 1 and 2). We see project appraisal as part of project planning rather than separate from it. It addresses concerns regarding financial *and* economic viability (e.g. cost-benefit or value-for-money studies) as well as having been extended to include social, environmental and (even) institutional concerns regarding project feasibility, impacts and recommendations about how the MUTP is to be implemented. This phase may include various forms of public consultation and/or participation exercises.

- **Phase 4: Project implementation**. This period commences when the project deliverers (e.g. the project consortium/joint venture parties, public sector works organisations etc.) are appointed, contracts are awarded, financial packages are agreed, business plans are approved, any necessary land acquisition takes place, construction work is undertaken, mitigation measures are put in place and the operability of the MUTP is tested and commissioned.

- **Phase 5: Project operation**. This is when the project is brought into full use following the appointment of agencies responsible for its operation, management, maintenance and control and the provision of adequate funding.

- **Phase 6: Project evaluation and monitoring**. This is in effect a post - project implementation appraisal exercise when project assessments are made either as 'one-off' exercises and/or as part of on-going monitoring of performance against pre-set targets/measures/indicators designed to assess/monitor the performance of the project against pre-set objectives. This includes value-for-money assessments, audits, environmental impact studies, socio-economic impact studies and due diligence, on-going impact assessments, on-going monitoring of traffic flows etc.

Square pegs into round holes

It is important to note that the above definitions are neither exhaustive nor totally mutually exclusive – as phases do 'flow' into each other and there is a constant iteration of processes within and between these phases, made necessary as new

issues and problems come to light. In certain respects, this emphasises the cyclical character of the MUTP project lifecycle. In other respects it provides contradictions with the linear treatment of the sequential stages of the phases of MUTP developments that are often presented.

The following sections provide important insights into the nature of MUTPs and the RUC associated with decision-making in their planning and delivery gleaned from the analyses of Working Paper #4 and which may be summarised as follows:

- **MUTP lifecycles are typically fraught with concerns about risk, uncertainty and complexity** associated with (*inter alia*) their size, cost, long gestation and implementation periods, as well as controversy, extent of impacts, and uniqueness. To date they (and sometimes their contexts) have largely been treated as 'closed systems' for the purposes of managing their planning and delivery against the background of an essentially linear (sequential) framework and logic of the type where certain components of the MUTP are 'frozen' during different phases (to make implementation more comprehensible) often for longer periods than is desirable irrespective of the downstream ability to respond to changing contexts.

- **MUTPs are frequently considered as 'closed systems'.** This is the case where outcomes are expected to be both controllable and in accordance with pre-determined plans, schedules and programmes. Reality suggests that MUTP planning (especially) and delivery are subject to manifold contextual influences that make detailed control on *all* fronts difficult if not impossible to achieve. We argue, therefore, that MUTP planning and delivery exercises should be treated as 'open systems' which see the project and its interaction with 'context' (in its broadest sense) as exploratory and almost organic and where unexpected outcomes become recognised and accepted as part of an 'emergent order'. As a corollary, we see evidence of past MUTP planning and delivery having frequently failed to deal adequately with the complex and adaptive social, economic, environmental and urban and regional systems into which they are placed. Here, we see the domains associated with the *Cynefin* framework as offering a pragmatic way of considering both the nature of these systems and the RUC associated with MUTP decision-making at different phases in the project lifecycle making the task to fit these observations into the project's lifecycle akin to knocking square pegs into round holes.

- **Regular and sustained monitoring throughout the project lifecycle of all contextual influences is clearly of utmost importance**. This is especially so if MUTP planning and delivery is to be effective in responding to changing circumstances. Particular importance needs to be paid to contextual change resulting from a sense-making of the interplay of ideas, beliefs and values associated with different stakeholder groups and individuals. We acknowledge that this is often a most difficult exercise to undertake and discern since fully comprehending the complexities of context owes much to personal, group and institutional perceptions and experiences where (for example) values change, new agendas form, new allegiances and networks wax and wane, and new imperatives come and go.

- **The changing demands placed on MUTPs can make it excruciatingly difficult to judge project successes and failures**. Changing demands placed on MUTPs (often *during* the project lifecycle) as commodities, services and instruments of public policy make it exceedingly difficult to establish what should be the actual criteria for judging whether projects are 'successful' or not at any point in time. This calls into question: who should set the criteria for success?; what weight should be given to different stakeholder perceptions of 'success'?; what information should be used to measure success against such criteria? and for how long do these judgements remain valid?

- **A pre-requisite for successfully dealing with RUC in decision-making in MUTP planning and delivery is the possession of a well thought-out strategy**. Possessing a strategy of this kind that reflects the priorities of the tasks at hand and the resources available, in line with the opportunities and constraints presented by the context in which the strategy is to be implemented, represents the most effective means of dealing with RUC in decision-making throughout a MUTP's lifecycle. Given the constant interaction with context by an MUTP throughout its lifecycle, strategies need to be clearly articulated, realistic, shared with all stakeholders, and sufficiently robust/flexible to cope with changing circumstances (including changing contexts). Since MUTP lifecycles are typically perceived as lengthy (paradoxically) linear processes, subject to changes in context and consequently changes in demands, all strategies employed require regular iteration and adjustment (sometimes wholesale change). This we argue should be seen to be the norm rather than the exception. Strategies therefore need to be sustainable in the short, medium and long-term and capable of operating across the three horizons, with appropriate bridging mechanisms between these different time horizons. Strategies are also important because clear and widely agreed objectives for MUTPs at the outset represent a key means of attracting project champions and galvanising stakeholder buy-in and appropriate responsive action.

Importance of context to project lifecycles

The awareness of 'context' as the key factor in successful decision-making that addresses RUC is clearly recognised (either explicitly or implicitly) by all contributors within and outside the MUTP/planning field. This is to be expected since all decisions are made based on an individual's or group's perceptions of context and the levels of RUC prevailing (or anticipated) in that context at the time of making such decisions. It should be appreciated that we may not consciously account for all of the individual contextual matters being considered at these decision-making points, we are nevertheless (perhaps subconsciously) very 'context aware'. Arguably, context awareness is a characteristic possessed by the most effective politicians, entrepreneurs and managers; such awareness can be intuitive rather than systematic - this however makes it no less powerful as an agent of change.

If we accept that context awareness is a vital pre-requisite for effective decision-making then it is clearly critical for *all* phases in the project lifecycle. As noted above, 'context' encompasses a very large variety of dimensions for decision-making - including culture and societal beliefs/ values, time and space, economic circumstances, institutional frameworks and networks and, not least because of its impact on MUTP decision-making, political influence. All these aspects reflect

5

different sources and degrees of RUC, and conspire to mould the way in which MUTPs are initially planned, implemented and ultimately brought into use. Clearly also, context both changes over time and may be seen from different perspectives by the multitude of stakeholders involved in or impacted by the project. Thus, MUTP planning and delivery has to cope with a very broad spectrum of contextual elements which will inevitably change during the various stages in the project lifecycle. It is therefore unsurprising that treating MUTPs as a closed, linear system where outcomes are thought to be thoroughly predictable throughout the project lifecycle is, at best, wildly optimistic.

This is as because as Batty (2008) points out:

- **City and regional systems into which MUTPs are placed are extremely complex** and evolve over time as order emerges from agents responding to context and each other - sometimes change is abrupt, sometimes it is subtle and takes place over a long period, making it doubly difficult to discern the magnitude and extent of such evolution. These then are clearly open systems where impacts and outcomes are frequently unpredictable.
- **MUTPs as complex systems can never be precisely defined, or perhaps even comprehended**. If one considers MUTPs as influential components of city/ regional systems, then closed system thinking cannot adequately address their fluidity and evolutionary nature. Indeed, it is arguable that such complex systems can never be precisely defined or perhaps even comprehended.
- **The absence in reality of an 'equilibrium' in city/ regional systems as the context(s) of MUTPs** – makes the adoption of any premise about optimality more a feature of modelling convenience than anything else.

Changes in context make it especially difficult to use (effectively) prescriptive tools, models and techniques that are based on the notion of a 'closed system' equilibrium as they are, by nature, largely insensitive to such change. They instead essentially present a snapshot or range of snapshots of outcomes based on the perceived value of identified variables that reflect current and future contexts. Scenario planning has been earlier offered as a partial answer to this, especially in the context of strategy formulation (see below), while the *Cynefin* framework also offers a useful perspective in sense-making possible approaches to decision-making in different domains associated with RUC.

In light of the above, it is critically important for MUTP planners and delivery agents to *constantly* scan the many different elements of context throughout the project lifecycle - both before and after key decisions are taken. The gathering and analysis of such contextual data (both top-down and bottom-up, involving manifold stakeholders) is a first, very necessary step in strategy formulation, and outputs from these broadly based scans need to be widely disseminated to stakeholders so as to receive input on their validity and to discern the often subtly different 'weight' that groups, individuals and institutions attribute to individual aspects of context. This process may also enable MUTP planners and delivery agents to discern elements of RUC and impacts that might previously have been seen as 'unknown' or 'unknowable'.

Other key selected findings drawn from the review of contributions are seen to comprise:

- **Understanding the reasons why MUTPs evolve as they do**. This can offer vital clues to MUTP planners and delivery agents (and operators) how to plan/deliver future projects, notwithstanding lessons from past history having validity *only* when context is taken fully into account – since history does not fully repeat itself.

- **Stakeholder contexts can be especially fluid and are therefore a major source of RUC**. Stakeholders and stakeholder groups/networks change in response to different perceptions about the nature, scale and impacts associated with MUTPs over the course of the project lifecycle. New foci and agendas also emerge over time resulting in the need for the project to evolve.

- **Defining 'winners and losers' and the attendant different perceptions of MUTP 'success or failure'**. This is a very significant task in understanding context. Today's winners may be tomorrow's losers and today's successes may become tomorrow's disasters (and *vice versa*).

- **MUTP planners and delivery agents need to be fully aware that 'change' is gathering increasing pace due to technological improvements and globalisation.** These are highly important contextual factors. MUTPs themselves may also positively contribute to the pace of change. This is particularly important given the likelihood that inadequate sense-making of context leads to dysfunctions later - both in relation to later phases of the project lifecycle and in respect of changes that occur in city and regional systems after MUTP implementation.

- **Interconnectedness between different elements of context leads to RUC that are particularly difficult to identify or analyse successfully**. There is arguably, no amount of detailed context scanning that can successfully identify and analyse RUCs that arise in this way. The lesson here perhaps, using Peter Hall's words, is to "make haste slowly" (Hall 2008) by allowing MUTPs to evolve gradually in response to changing contextual forces and be given 'the time and space to breath'.

- **Complex adaptive systems do *not* return to a state of equilibrium after being disturbed**. This has, for example for plans for the implementation of MUTPs and any attendant city/region restructuring initiatives, particular implications for decision making in regard to the choice of a distinct moment in time when to 'freeze' a MUTP since, from that point, it becomes resistant to change.

Importance and nature of 'Strategy' in the project lifecycle

As noted above, planners, delivery agents and operators need to consider MUTPs as strategies which have different needs, outputs and impacts at different stages in the project lifecycle (and also post-implementation). They are consequently not 'projects' *per se* since their spatial, social, economic, environmental and other impacts are generally very far reaching indeed. As a minimum, MUTPs represent a bundle of projects and accompanying plans/programmes which clearly require strategic thought at the outset and on an on-going basis. MUTPs are demonstrably

7

not 'closed systems' or commodities (though they may encompass elements of commodity provision). Rather, they are 'open systems' treated on specific occasions (for practical purposes alone) as 'closed systems' that themselves change contexts and are themselves changed *by* context. They often have public service objectives and are employed (implicitly or explicitly) as a means to effect strategic change in city and regional systems (through for example, regeneration and economic restructuring efforts) even though they may utilise aspects of the market in the financing and funding of these public services.

Taking into consideration the various contributions to the three Working Papers, the following observations may be made about the broad characteristics of an effective MUTP strategy which need to be considered throughout the project lifecycle:

- **An effective strategy is one that achieves desirable (political) effects *without* incurring disproportionate costs.** It must also produce an acceptable cost solution in the face of perceived RUC. MUTP strategies, therefore, need to balance the requirements for implementing a vision for the project and its accompanying spatial and temporal contexts with the practical requirements associated with the efficiency of services offered, cost ceilings etc. and of course the resources (including institutional and regulatory support) available to deliver the project. In this regard, it is important to acknowledge that for PPP/PFI projects, private sector goals and objectives (generally short-term and accompanied by the need for 'certainty' on the part of public sector delivery) may well *not* align precisely with those of public sector sponsors whose expectations are often more longer term in respect of desired outcomes. Achieving consensus in this context is difficult but invaluable.

- **MUTP planning and delivery strategies need to identify which forces of change they are trying to influence or harness**. They need to be clear and consistent about such matters as project definition and how this interacts with wider agendas such as those surrounding 'sustainability' and 'regeneration' (terms which are subject to widely differing interpretations). Without such clarity, projects are vulnerable to the use/misuse of rhetoric. It must also be borne in mind that project definition represents a major cost, mainly due to the long gestation period for MUTPs.

- **Consensus-building at the preliminary strategy formulation stages is likely to be essential.** Here the ability to scan and understand stakeholder frameworks and the positions adopted by stakeholders over time is imperative. The concept of adversaries and allies is also highly relevant. So too is the ability to build trust through transparency across and between organisations and individuals, so as to achieve a solid foundation of support.

- **Strategies typically need to be flexible/adjustable and robust, paying due attention to short, medium and long term consequences simultaneously.** Changes in context brought about by such influences as changing stakeholder positions are also important. As noted above, highly prescribed 'blueprint' approaches are inflexible, contextually insensitive and rarely remain appropriate over the project lifecycle. The more specific or precise strategies are, furthermore, the more they are vulnerable to RUC. In certain circumstances it

may even be appropriate to adopt strategies that adopt a 'safe-to-fail' approach or a 'probe-sense-respond' type of approach in the case of a complex domain and 'act-sense-respond' approach in a chaotic domain.

- **In the early planning stages, there should be a clear statement of MUTP goals and objectives, roles and functions, evaluative criteria, key input assumptions *and* potential impacts.** These need to be properly disseminated and thoroughly discussed with all impacted stakeholders identified in an open and transparent manner. Such dissemination needs to be characterised by effective community engagement with inclusivity and an understanding that there will be many differing views about how to make best use of the project as an agent of change. In light of this, there may well be a need for several iterations of such matters as project objectives, scale and scope.

- **All strategy components (including those listed above) need to be constantly monitored and analysed during the different phases of the project lifecycle.** This is to be done in order to assess their continuing validity (i.e. to examine whether the strategy as a whole remains effective, appropriate and deliverable) in the face of changing contextual elements. However, faced with the emergent order that accompanies open systems, strategy formulation for MUTPs needs to consider the nature of the responses it proposes. It is acknowledged here that, in many instances, particularly when faced with genuine (or perceived) and imminent issues and problems, it is simply untenable to avoid taking action, especially when faced with political imperatives.

- **Any strategy needs to take a practical and realistic view of when the MUTP design work is to be 'frozen'.** At some point 'certainty' about the size, scale and nature of the project is clearly required if costs/revenues and impacts are to be identified and programmes proposed to enable the appointment of a constructor/ funder. Such decisions, however, need to be preceded by a *full* analysis of when is the 'right' time to freeze the project. Once frozen, MUTPs become distinctly contextually insensitive and errors made through premature freezing are likely to be costly to rectify (through retrofit action, for example) and distinctly sub-optimal if this concept applies.

- **Although perhaps unpalatable, it is important to concede that many components of the MUTP planning and delivery strategy (and of the project itself) are very difficult to identify or quantify.** This is true both at the outset and throughout the project lifecycle as a result of the complexities associated with open and complex systems. Impacts, in particular, may only emerge over time and are frequently difficult to discern, as are tipping points when new ideas and methods for project planning and delivery emerge. This is particularly true when changing contexts result in unforeseen impacts (what seems like a 'safe' decision/ choice now may ultimately be costly later). MUTP planners will be well aware that conceding the unknown/unknowable is somewhat anathema to many project sponsors and traditional closed system thinkers who pay scant regard to the existence of the type of 'wicked problems' that are routinely associated with the nature and fluidity of 'context'.

- **Systems need to be in place to enable thorough post-project institutional learning.** This is not currently undertaken in the UK for MUTPs in any systematic manner to enable outcomes and the associated occurrence of RUC factors to be evaluated. It would prove particularly valuable in efforts required to identify impacts that were not discernable previously.

Tools, techniques and methods

While models and other analytical tools (including 'case histories') that are firmly based on 'closed system' thinking do pose major limitations, as already explained, in reality they do have a role to play in attempting to sense-make a MUTP during different lifecycle phases on the *proviso* that detailed attention is paid to their impact on context, and the way in which context impacts on the project. Such tools though are generally fundamentally flawed by virtue of their inability to cope with the complexity associated with *all* aspects of context, including the nature of open systems and the evolutionary fluidity that accompanies them. Many project sponsors (including politicians and business leaders) are acutely aware of this and model outputs (for example) are used or discarded depending upon whether they support or negate previously held views and 'gut feelings' - which frequently places the techno-rationalist professionals at odds with those pursuing other (political and business) agendas.

Many of the commissioned contributors to the Working Papers emphasise the importance of case history and the existence of a body of 'good (not 'best') practice' as essential to the identification and handling of RUC in business and other fields. This may especially be noted among the military, in earthquake engineering, in civil engineering as well as insurance and banking). A similar body of systematic data does not appear to exist for MUTPs, however, which would seem to suggest that there is little evidence of systematic institutional learning and knowledge-learning from past projects that go beyond personal exchanges of experiences and employment of common international handbooks and standards that can have the effect of standardising MUTP solutions.

Evidence-based learning alone is, however, *inadequate* if past contexts are not fully identified and understood since it may sustain, even reinforce, path-dependent practices and the 'templating' of solutions based on previous experiences which are perceived as successful from a singular point of view and in one point of time/place. Indeed, many note that hindsight and best practice is only appropriate in the context of ordered, stable systems (perhaps most applicable during the project construction).

Individual observations from the Working Paper contributions reviewed that appear to have particular relevance to the use of tools, techniques and models in association with the MUTP lifecycle are as follows:

- **Risk assessment is habitually carried out by many sectors and is seen as a mature methodology.** Although this is especially so in the insurance and banking sectors, we conclude that such assessments and their subsequent use in MUTP planning and delivery needs to be:
    - o as all embracing and contextually sensitive as possible, able to anticipate contextual change wherever possible;
    - o based on the concept of risk hierarchies;
    - o accompanied by constant monitoring and iteration; and

- o undertaken collectively so as to expose all stakeholders to the inputs and assumptions used.

- **Subjective assessment based on experience and common sense is acknowledged as an appropriate and effective response to RUC in decision-making.** This is especially significant for sectors that acknowledge the complexities associated with 'open systems' and the consequent existence of 'unknowns' and the 'unknowable' – such as MUTP planning and delivery.

Stakeholders

As already acknowledged the ability to identify and understand the motives, beliefs and values of the wide range of stakeholders involved in or impacted by MUTPs is extremely difficult, but vitally important. Arguably, stakeholder perceptions about 'the project' and any accompanying development including restructuring and regeneration initiatives, represent the most powerful contextual force for MUTPs and will undoubtedly impact over the whole project lifecycle (albeit to differing degrees). For this reason, the constant scanning of stakeholder groups, organisations and networks over time, in order to determine their willingness, ability and capacity to exert effective influence, will remain critical before and after key decisions are made.

Against this background, reflecting many contributions from different fields in the preceding Working Papers we also see following insights as highly important in the context of the MUTP lifecycle:

- **Stakeholders often perceive RUC in a highly individual way.** Such perceptions may change over time, as a MUTP passes from one lifecycle phase to another, or as policy and political agendas change. This calls for the constant updating and recalibrating of judgements of the related parties.

- **The building (and sustaining) of reputation and trust is vital in all aspects of stakeholder relations.** Early and sustained flow of information from MUTP planners and deliverers will enhance trust, reputations and support – vital to the viability of projects where joint ventures are critical to the success of the project.

- **Risk may be shared through consensus building between stakeholders.** It is important to appreciate here that imposed risks are seen as less tolerable than voluntary ones in consensus building and known risks preferable to unknown risks.

- **Certain stakeholders have extensive faith in the ability to manage risk**. - While this is the case, notably in the insurance and banking fields, others (for example planners) are less trusting of market forces and their ability to manage the risks such markets pose. The reputation of bankers and insurers has incidentally taken a major knock in recent months as a result of developments arising from the current Credit Crunch which has exposed a collapse of trust among certain banks and some reputations.

- **There are limits to adopting a comprehensive approach.** The desire emanating from comprehensive analyses to identify *all* potential stakeholders that might impact on, or be impacted by, MUTPs must clearly be tempered by an

appreciation of the practicalities involved, especially given that many potential impacts of such projects are likely to remain unknown or unknowable for some time after their completion.

- **Transparency and information-sharing within and between stakeholder groups can become problematical when issues of 'commercial sensitivity' are involved**. In MUTP planning and delivery this is frequently an issue since such projects are pursued as PPP/ PFI initiatives become more common.

- **It is important to examine inter-personal, group and organisational trust not as a snapshot but in a way that demonstrates how it has evolved**. In the context of MUTP planning and delivery this will enable a 'trust record' to be built-up and maintained among the various project stakeholders.

- **MUTP planners and deliverers need to identify which key decisions require a high level of trust to be implemented successfully**. This calls for the identification of trustees and trustors – i.e., clarification *of* whom to trust and *by* whom. In this context, it is interesting to note the contention that success reinforces trust (and *vice versa*) and that the higher the RUC associated with a particular action or decision, the higher will be the need for trust.

- **The identification of potential MUTP 'winners and losers' and how these change over time is critical.** This is especially important for efforts in making judgements about the success of such projects**.** It also represents a key basis for relations with stakeholders for MUTP 'winners' are often seen as those that are clustered around important project nodes (i.e. line-haul termini, access points etc.) and thus benefit from enhanced services, property price uplift and environmental upgrading.

12

3.0 Summary & Relationship to Stratrisk

The above report highlights some of the key lessons from a synthesis of a previous OMEGA project on the treatment of Risk, Uncertainty and Complexity and their relationship to the phases of the Mega Urban Transport Project lifecycle. Whilst the research presented here focuses on RUC and its action upon the Mega Project there is much read across between this work and the conceptual results of the Stratrisk project on Strategic Risk Management within the context of the enterprise. Both projects highlight the importance of (using Stratrisks vocabulary) performance, people, process, patterns and perceptions in the management of risks.

Whilst it is acknowledged, that most of the insights provided by our contributors have broad relevance to multiple stages in the MUTP project lifecycle, it is important to also consider the boundaries of an MUTP are often blurred and porous allowing risks to cross freely. In terms of risk, boards and senior directors of stakeholder enterprises are not isolated from an MUTP but can be considered part of the MUTP system, along with politicians, local residents e.t.c. As such all parties are exposed to risks created within any part of the system – a critical reality for project risk analysis.

4.0 References

Batty, M. (2008) Complexity and Emergence in City Systems: Implications For Urban Planning, Section 3.2 in Working Paper 3, *Review of past & contemporary treatment of complexity, uncertainty and risk in city and regional planning, transport, and project development*, OMEGA Centre, University College London, pp. 3-15.

Currall, S. C. and Inkpen, A. C. (2008) On the Complexity of Organizational Trust: A multi-level co-evolutionary perspective and guidelines for future research, Section 2.8 in Working Paper 2, *The Contemporary Treatment of Risk, Uncertainty and Complexity in Decision-making in Selected Disciplines*, pp. 119-151.

Dimitriou and Thompson (2008) Strategic Thought and Regional Planning: The importance of context, Section 3.3 in Working Paper 3, *Review of past & contemporary treatment of complexity, uncertainty and risk in city and regional planning, transport, and project development*, OMEGA Centre, University College London, pp. 17-39.

Dora, C., Vickers, C. & Walker, K. (2008) Scientific Uncertainty and Complexity in Public Health, Section 2.7 in Working Paper 2, *The Contemporary Treatment of Risk, Uncertainty and Complexity in Decision-making in Selected Disciplines*, pp. 89-117.

Gibson, L. (2008) Complexity, Uncertainty and Risk-Taking in General Insurance and the Role of the Actuary, Section 2.5 in Working Paper 2, *The Contemporary Treatment of Risk, Uncertainty and Complexity in Decision-making in Selected Disciplines*, OMEGA Centre, University College London, pp. 53-71.

Hall, P. (2008) Great Planning Disasters: What lessons do they hold, Section 3.5 in Working Paper 3, *Review of past & contemporary treatment of complexity, uncertainty and risk in city and regional planning, transport, and project development*, OMEGA Centre, University College London, pp. 55-82.

Kelsey, J.M. (2008) Risk, Uncertainty and Complexity in Construction and Civil Engineering Projects, Section 3.7 in Working Paper 3, *Review of past & contemporary treatment of complexity, uncertainty and risk in city and regional planning, transport, and project development*, OMEGA Centre, University College London, pp. 101-129.

Kurtz C.F. and Snowden, D, J. (2003) "The new dynamics of strategy: Sense-making in a complex and complicated world"*. IBM Systems Journal*, Vol. 42, No. 3, pp. 462-483.

Lemmon, M. (2008) The Treatment of Risk, Uncertainty and Complexity in Project Finance: A banker's perspective, Section 2.4 in Working Paper 2, *The Contemporary Treatment of Risk, Uncertainty and Complexity in Decision-making in Selected Disciplines*, OMEGA Centre, University College London, pp. 41-51.

Mumford, J. (2008) Agricultural Pests and Diseases: Complexity, uncertainty and risk, Section 2.6 in Working Paper 2, *The Contemporary Treatment of Risk, Uncertainty and Complexity in Decision-making in Selected Disciplines*, OMEGA Centre, University College London, pp. 73-88.

Perry, K. (2008) Property Sector Approach to Major Projects: Risk, uncertainty and complexity, Section 3.6, in Working Paper 3, *Review of past & contemporary treatment of complexity, uncertainty and risk in city and regional planning, transport, and project development*, OMEGA Centre, University College London, pp. 83-100.

Rossetto, T. (2008) Earthquake Engineering and Seismic risk, Section 2.3 in Working Paper 2, *The Contemporary Treatment of Risk, Uncertainty and Complexity in Decision-making in Selected Disciplines*, OMEGA Centre, University College London, pp. 21-39.

Snowden, D (2008) Naturalising Knowledge Management, Section 2.10 in Working Paper 2, *The Contemporary Treatment of Risk, Uncertainty and Complexity in Decision-making in Selected Disciplines*, OMEGA Centre, University College London, pp. 181-209.

Sparrow, O. (2008) A New Kind of Competence: On avoiding mistakes in large organisations, Section 2.9 in Working Paper 2, *The Contemporary Treatment of Risk, Uncertainty and Complexity in Decision-making in Selected Disciplines*, OMEGA Centre, University College London, pp. 153-179.

Stone, J. (2008) Strategy: Military Planning Under Conditions of Uncertainty, Complexity and Risk, Section 2.2 in Working Paper 2, *The Contemporary Treatment of Risk, Uncertainty and Complexity in Decision-making in Selected Disciplines*, OMEGA Centre, University College London, pp. 3-20.