GENERIC LESSONS FOR IMPROVING THE TREATMENT OF RISK, UNCERTAINTY AND COMPLEXITY IN THE PLANNING OF MEGA URBAN TRANSPORT PROJECTS

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1. Introduction

This Working Paper, with the assistance of accompanying appendices, synthesises the concepts, ideas, issues and methods discussed in the preceding three Working Papers (see Appendix 1) prepared for the same project (VREF Smaller Project SP-2004-3). The commissioned papers contained in these three earlier documents offer a rich source of information from leading authorities within and outside the planning arena on the treatment of risk, uncertainty and complexity (RUC) in decision making for planning. The findings presented here, such as they are, are derived from a review of all the contributions to the three Working Papers and are examined in the latter part of this document in terms of their implications for decision-making in the planning, appraisal and evaluation of mega urban transport projects (MUTPs).

The structure of this Working Paper is in five parts. Following this introductory section, Section 2 summarises the key concepts, ideas, issues and methods in the field of RUC in the broad field of decision-making for planning broadly drawn from Working Paper #1. This is largely a theoretical examination. Section 3 outlines common characteristics of MUTPs, typical stages of their lifecycle, the critical significance of context on decision-making in the planning, appraisal and evaluation of such projects, and the need for strategic thinking throughout all stages of MUTP developments. Section 4 summarises both the findings of *each* of the commissioned papers as they potentially relate to the contemporary treatment of RUC in MUTP planning, and offers a comparative analysis of these findings. It also provides the basis for the overall conclusions which follow in Section 5. This final section brings together all the major findings of the study with a view to advancing future planning practices for MUTPs in general, and more specifically, informing the on-going research programme at the OMEGA Centre at UCL which examines the treatment of RUC in some 33 case studies in collaboration with Academic Partners in ten countries to clarify generically what constitutes a 'successful' MUTP in the 21st century.

2. Key concepts, ideas and methods

2.1 *Definitions of risk, uncertainty, complexity and context*

From the literature review undertaken for Working Paper #1 we have adopted the following definitions as a basis for the discussion(s) which ensues:

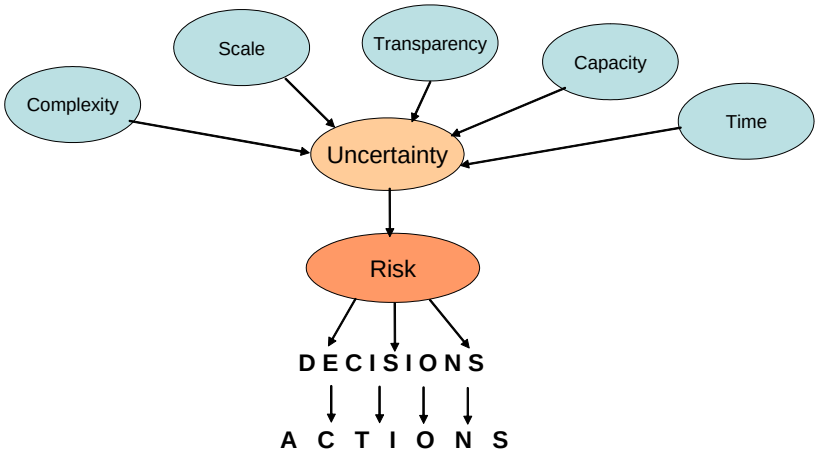
- ***Risk*** - this can be seen as an uncertain consequence of an event or activity with respect to something that we value.
- ***Uncertainty*** – this may be considered as an expression of confidence about the state of knowledge in/about a given situation, often relating to the future.

- ***Complexity*** – this arises in a system when a great many components interact simultaneously in a complicated form.
- ***Context*** – this is the multi-dimensional 'environment' within which a decision is made; it represents a unique set of conditions that exerts influence on the nature of the decision, and is often affected by the impact of subsequent actions.

2.2 *Relationships between risk, uncertainty, complexity and context, and representational paradigms*

How then do these terms related to each other? Figure 1 below seeks to illustrate the relationship between risk and uncertainty, and the complex factors that impact on decision-making and subsequent actions.

Figure 1: Relationship between risk, uncertainty and complexity in the context of decision-making in planning



Source: after Brown (2004)

No decision takes place within a vacuum; there is *always* a context. All contributions to the Working Papers stress the importance of context in the decision-making they reviewed - either explicitly or implicitly. All actions are undertaken within a context. Furthermore, these actions have a continuing impact on the very context in which the actions are taken. This implies that no decision-maker can have a perfect knowledge of a context, as he himself interacts with the context by making decisions – this then creates a divergence between what is actually happening, and what the actor thinks is happening, this divergence itself leads to uncertainties (Soros, 2008). These contexts have temporal, spatial, cultural and institutional contexts. They furthermore, as many of the contributions highlight, have contexts of systems whereby they may be sub-systems of other larger and more complex systems. These contexts are dynamic and subject to a multitude of forces – some known, some unknown and some unknowable.

The multi-dimensional characteristics of a context provide conditions that offer *both* opportunities and constraints, and are associated with values and goals that are brought to bear in the decision-making process. We concur with a number of our contributors that the sense-making of the context of a decision or decision-making process is a *pre-requisite* of effective decision-making, and that identifying the opportunities and constraints of a context is one of the first strategic steps of decision-

making. This makes the gathering of information and knowledge about the context of the decision *and* the object of decision-making a crucial step; the more complex the context the more difficult is this reconnaissance task. The dynamics of the context are also important since many of the known variables that mould it may have uncertainties, risks, threats and opportunities associated with them that need to be assessed. Over and above this it needs to be appreciated that the context often experiences on-going change, and however much knowledge we gather about a situation, our understanding of this is likely to lag behind reality.

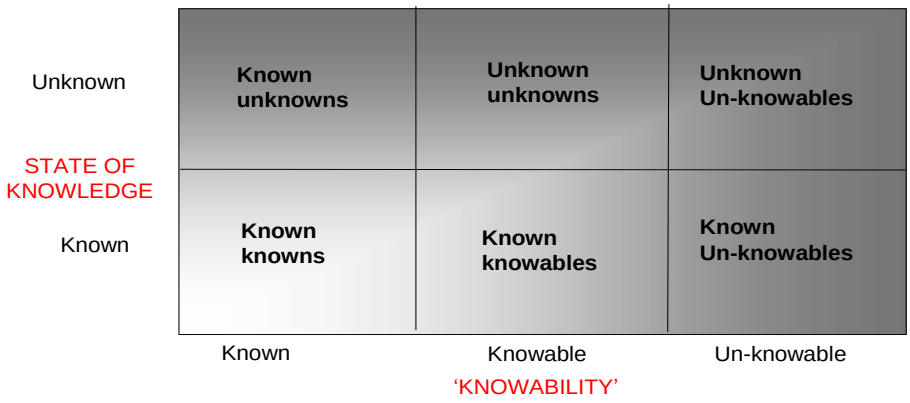
We can see from the various contributions in the different sectors, disciplines and professions reviewed in the Working Papers that uncertainty derives from a number of sources:

- it may be a matter of scale in which the decision factor is too large or indeed too small to observe;
- there may be insufficient transparency in that the decision factor may be obscured by for example secrecy, confidentiality, or inaccessibility to data;
- there may be constraints on the resources at their disposal of the decision-maker for gathering relevant information in which case the lack of capacity leaves gaps in knowledge; and
- Finally, the complexity of the context or indeed the decision-making process itself, with too many variables to comprehend and too many interactions between them, may defy conventional analysis and thereby generate uncertainty.

Context has, as already mentioned, a time dimension; uncertainties can exist about the present or the future. Predictive models, for the most part based upon the fundamental assumptions of equilibrium theory, seek to address the last of these; however, they do so with varying degrees of success. Lessons from history may be obscured by the passage of time and the inability to fully understand past events. Some uncertainties are resolved by the passage of time (where a 'wait and see' tactic might be appropriate), only to be replaced by other uncertainties about the future.

Risk – relates to the future, it is the interface between uncertainty about the future and decisions designed to generate actions that seek to move towards a new future, in a planning process, with predefined goals. The infamous quotation from Donald Rumsfeld, cited in Working Paper #1, is seemingly impenetrable as the spoken word. However, if we represent this graphically as a paradigm for decision makers (see Figure 2) it embodies some very useful insights.

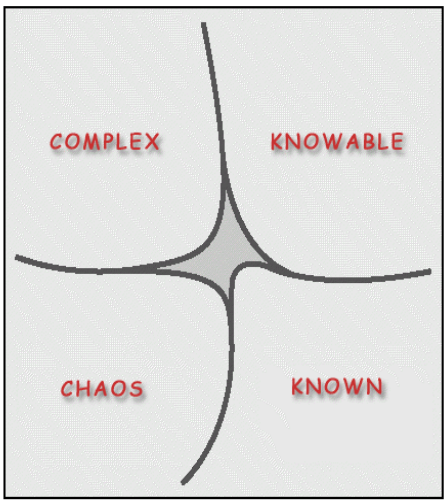
Figure 2: The Rumsfeld paradigm



As we have seen, in sense-making the context of a decision, the decision-maker needs to understand the nature of the context in which he is operating. Here he may wish to take into account a great many factors in that decision and assemble all relevant data to inform the decision. The Rumsfield paradigm depicts two dimensions, the current state of knowledge, and what we term 'knowability' (the extent to which a situation is, and can be, known through investigation and research). A decision-maker needs to understand *when* it is sensible to invest resources to clarify the decision and context, and *when* it is futile or not cost-effective in resolving uncertainty. This is much an art as a science, if not more so some would argue.

Working Paper #1 introduced ideas of Systems Theory and more particularly the *Cynefin* Framework cited also in Working Paper #2. Its relevance to decision-making in different decision environments was discussed. The framework (see Figure 3) is largely consistent in its division into four main quadrants with Rumsfield's paradigm, with each quadrant associated with a variety of attributes and implications. The division of domains into the known, knowable, complex and chaotic resonates with the Rumsfeld paradigm. These quadrants correspond to a Systems Theory perspective ranging from simple, through complicated to complex and chaotic systems. Directed order here applies to the 'known' and 'the knowable' of Rumsfield's framework, whilst complex and a chaotic systems are subject to notions of 'emergent order' and *cannot* be successfully and reliably directed or predicted, and are therefore *a priori* 'unknowable' (see Figure 4). The causes of an 'emergent order' are, nevertheless, discernable retrospectively. The phenomenon of emergent order may be interpreted as highly subversive in relation to master planning with aspirations toward social engineering. Indeed, it offers a high degree of explanation of why such expectations have been unfulfilled in the past.

Figure 3: The basic *Cynefin* framework



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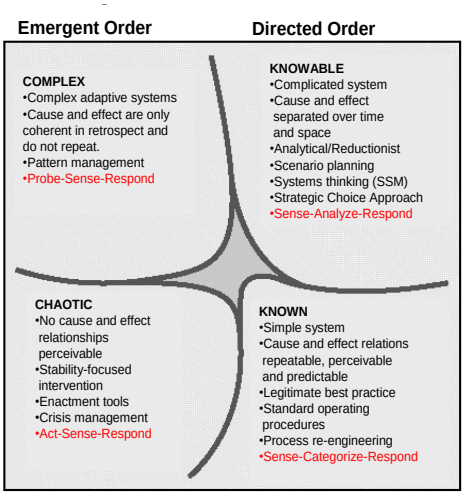
Source: Kurtz and Snowden, 2003

Figure 4: Characteristics and domains of the *Cynefin* framework



Source: Kurtz and Snowden, 2003

Kurtz and Snowdon (2003) tell us that the *Cynefin* model points to the decision-making style and roles appropriate to each of their main quadrants. Bureaucrats are appropriate for simple directed order systems, professional experts inhabit the knowable segment; the complex emergent order domain demands a quite different style of enabling change along desirable paths rather than directing it from above. Chaotic systems require innovative and radical intervention.

3. Advancing the future of MUTP planning practices

3.1 *Introduction*

This section begins to extract from Working Papers #2 and 3 some overarching lessons considered to be of generic value to the planning, appraisal and evaluation of MUTPs. Because the contributions of Working Paper #2 solely relate to disciplines, professions and sectors *outside* of the planning and urban development fields these lessons are by their very nature more theoretical and abstract than those derived from the contributions featured in Working #3 which are more applied and entirely associated with spatial, territorial, urban development and infrastructure planning. The discussion below commences with a description of the typical characteristics of MUTPs, followed by an overview of the MUTP lifecycle, an examination of the importance of the MUTP context for planning and an explanation of the need for a strategy. It is then complemented in Section 4 by the presentation of a summary of principal lessons from each contribution in Working Papers #2 and 3 of relevance to MUTPs, as a basis for arriving at the consolidated conclusions presented in Section 5.

3.2 *Typical characteristics of MUTPs*

If we are to summarise the implications of the theoretical discussion for MUTPs in the preceding section, as we propose, we can only do this justice by first reprising the typical characteristics of MUTPs. MUTPs are defined here as large-scale, complicated land-based transport infrastructure projects, such as: bridges, tunnels, highways, rail links and their related transport terminals (i.e., major airports, seaports

and railway termini/stations) plus combinations of such projects with construction costs *in excess* of US$ 0.5 billion (at 1999 prices) that are located in urban and metropolitan areas or regions[1]. They often link local networks with global networks, and are perceived as national icons of development, and critical to the delivery of national and regional development strategies.

While concerns have been expressed increasingly over the last three decades about the rising size and complexity of such projects and the fact that they require huge amounts of capital over long periods of time, these concerns do not appear to have hindered the propensity to embark on further projects of this kind. Indeed, new MUTPs are becoming bigger, more complicated and capable of greater environmental and development impacts, both locally and globally. There are several explanations for the growth of such projects. These include, according to SMEC (2001: 2), the prevalence of:

- **The 'big fix' mentality**, where development planners and political leaders alike are attracted to projects which offer the prospect of a single solution to massive problems.
- **The continued need for symbols of national development,** where mega projects are interpreted as tangible expressions of national aspirations for economic and social development.
- **Technological advancements** that have enabled the implementation of projects earlier technologies could not deliver.
- **An enhanced global institutional capacity** developed by global corporations affecting the attitudes of government decision-makers as to the size of projects, encouraging larger projects to be built.
- **An increased inter-dependency** of mega projects where they form part of an economic and technological system whose optimum efficiency is deemed achievable *only* if complimented by other mega project investment.
- **An enhanced global financial network** of banks and entrepreneurs, facilitated by global IT arrangements, capable of instantly moving funds from one part of the world to another, for the first time enabling world-wide sources of (private) capital to engage commercially in infrastructure projects.

While each of these factors is individually identifiable, they invariably do not operate in isolation, but in combination. They are especially influenced by forces of globalization which make it extremely important for policy makers, planners and community leaders of the territories acting as host to such projects to better understand how the drivers of globalization impact on such projects before the 'green light' is given for their construction (Dimitriou, 2005).

An analysis of MUTP experiences suggests that they are associated with a number of common features. Once again drawing from SMEC (2001:3), these include:

- **The irrevocable character of the 'green light' decision,** given that it is extremely difficult, politically, to cancel a large project once its construction has commenced. An incomplete project represents a huge waste of human and

[1] This definition has been adopted by the OMEGA Centre at UCL and is extracted from a paper entitled: *Globalization, Mega Transport Projects and the Making of Mega Places* presented at the Transportation Research Board Annual Meeting, Washington D.C. in January 2005

financial resources and political capital with the result that a 'green light' given by governments to go ahead typically represents 'a point of no return,' even in the context of escalating costs.

- **The rising demand for more comprehensive feasibility analysis,** by both project sponsors and governments, as a basis upon which to approve such projects. This contributes to project delivery delays, makes better known project risks and uncertainties, and accounts for an increasing unwelcome proportion of project costs.
- **The increase in public controversies** brought about as a result of the highly visible nature of MUTPs and the differential in benefits enjoyed by the project sponsors and by the communities they affect. There is a growing feeling among many such local communities that they are made to carry more than their fair share of the project's social, environmental and even economic costs.
- **The 'converging factor' phenomena,** where a MUTP may have been on the drawing board for years, even decades, until such time a favourable set of circumstances converge that make the project's implementation politically, economically, socially and environmentally acceptable and even an imperative.
- **The 'project champion' phenomena,** where the project is championed by a powerful politician or set of very influential parties over a sustained period. Support of this kind is rare, because such persons/parties need to possess a unique combination of vision and political 'know-how'. However, where and when the champion phenomena does materialise, it opens doors "as if by magic".

Additional characteristics associated with MUTPs include: their close association with a large-scale vision, their resource intensive character, their long term operation and payback periods, their *holonic* characteristics, association with many stakeholders (both from the public and private sector), their extensive (positive and negative) impacts on the areas they traverse and beyond, and increasingly their reliance on private sector finance.

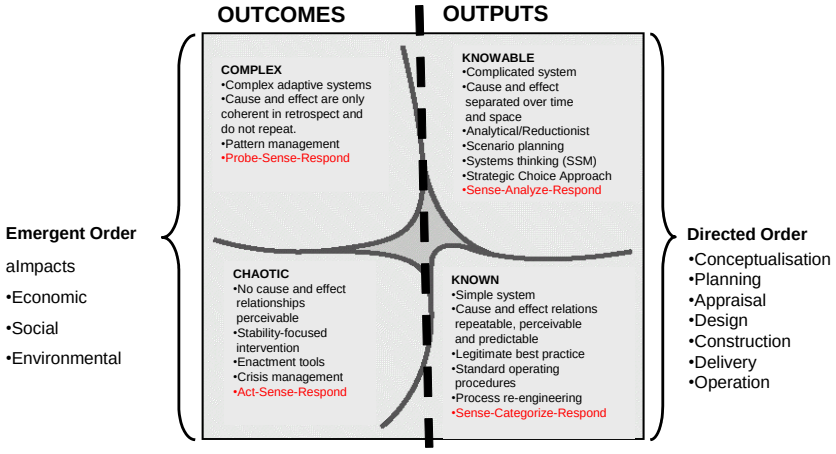
3.3 *The MUTP life cycle*

The project cycle of an MUTP - from conception, planning, appraisal through to execution, operation, evaluation and monitoring - is typically very long; in many cases more than 30 years. In the UK and elsewhere, such projects can be subjected to lengthy public inquiries lasting themselves years in some cases.

We look here at the implications of the experiences of decision-making and planning in a variety of disciplines, professions and sectors where RUC has long-time been at the centre of their planning exercises. We do this on the premise that much, if not most MUTP planning, would benefit from this insight given the highly complex nature of such projects and the uncertain impacts and outcomes so many of them have. We also see the closed-systems thinking typically applied to the planning of these highly complex and costly projects have led to a poor treatment of RUC. This, we contend, has led to much disappointment, confusion, even resentment as regards what such projects finally offer when completed and matched against their ultimate cost. On occasions, these outcomes have led to unfair judgements about their success, as the expectations and rhetoric that preceded them distorted what could be reasonably expected of such projects given the highly dynamic and uncertain environments in which they were conceived, planned and built.

The observations and lessons we have drawn from the various contributions to our Working Papers have in our view relevance to each of the principal project life cycle stages of MUTPs, including: project conception, planning, appraisal (meaning pre-project appraisal), design, construction, operation, evaluation (meaning post-project appraisal) and monitoring. RUC influences each and every one of these stages in MUTP planning. To explain this we refer to Figure 6 below. Here the domain of the 'known' and the 'knowable and directed order' (on the right hand side of the figure) is the area associated with the design and delivery of the MUTP and its operation (the project outputs). The left hand side of the same diagram refers to 'the complex' and 'the chaotic' which is about 'emergent order' i.e. unexpected outcomes in the form of economic, social and environmental impacts of MUTPs which reflect both the adjustment of the new project to its context, and the context to the project.

Figure 6: The *Cynefin* framework and its relevance to MUTP planning



Source: Kurtz and Snowden, 2003

It is apparent from several of our commissioned contributors that while urban and regional systems as a whole are 'complex and adaptive', not all aspects of decision–making and planning of MUTPs are dealing with 'complexity'. It is in other words important for MUTP planners and promoters to understand which decisions fall within which decision domain and whether the decision domain is simple, complicated, complex, or chaotic.

Typically, closed-systems planning expect outputs to be largely in line with scheduled, planned and event driven programmes. Open-systems planning, on the other hand, looks at the project and its interaction with its context as part of a complex (organic-like) adaptive system, with unexpected outcomes as a recognised part of the 'new emerging order' which needs to be understood. Our commissioned contributions also tell us that outcomes (both expected and unexpected) are not instantaneous, they are furthermore process-driven over time, but there is *no* guiding hand or authority that can predetermine detailed outcomes. These changes are continuous and continuing as the MUTP interacts as a *holon* within a *holarchy* of project elements and contexts.

3.4 *The importance of the MUTP context*

Several of the contributors to our Working Papers have made reference to 'agents of change' and their impact on the contexts of, and drive for, MUTPs. Globalisation and the vision of hyper-mobility are but two of such forces cited. These can alter over time (sometimes dramatically), leading to changed expectations of MUTPs. Frequently government agendas also change and spawn more expectations; sometimes these are hitched to the MUTP to heighten its attractiveness. This we can observe in the case of the Channel Tunnel Rail Link (CTRL) which is now seen both as an agent for urban regeneration *and* sustainable development, even though these aims were not initially part of the project. The success of MUTPs is also greatly determined by the effectiveness and political clout of the institutional framework in which the planning, construction and operation of the project takes place. A fragmented institutional framework is detrimental, whereas a political champion is highly advantageous. In both instances, risks and uncertainties are directly affected by these circumstances.

Furthermore, the organisational capacity in the planning, construction and operation of the project must be taken into account. These are all very different and distinct capacities. Failure to provide in any one capacity can jeopardise the entire project (and its reputation). Political culture also exerts its influence. The governmental and regulatory 'styles' that define particular institutions are also important in determining the treatment of risk. Risk-averse cultures embedded with government departments such as the Treasury in the UK provides a very different backcloth to the treatment of RUC than does, say, a more vision-led culture such as that usually associated with the French government's 'grand project' visions.

The regulatory system can also be highly influential. An adversarial contract system as exists in the UK can frustrate collaboration through consortia. There is much debate as to whether a risk culture is national or not – are the French, German and Japanese less risk-averse than the British? It would seem so; but why? Either way, RUC is treated differently because the context is more accommodating in one context and less so in another. Then there is then the issue of trust**.** The more complex the project the more risks it poses, and the more risks posed demands more trust – both among consortia members and between the consortia and government. Trust in turn, is affected by past track records of parties keeping to agreements. In more volatile conditions (as we are in at present), keeping to agreements and deadlines becomes more difficult. This calls for the raising of the trust thresholds and the need for government to act as last resort project guarantors.

3.5 *The need for a strategy*

It is clear that any explicit treatment of RUC requires a strategy, and in times of flux, this strategy needs to be robust. In other words, it needs to be sustainable throughout both the long and short-term, with mid-term strategies providing crucial bridges between time horizons. Since MUTPs have long project cycles their patrons and managers need to assume changing contexts to be the norm, possibly with several crises en route. There therefore needs to be more attention given to making the MUTP planning process more robust rather than treating the project as a process for producing a technological and commercially predetermined product. This requires greater realism in expectations and outcomes in the face of uncertainty (to avoid optimism bias) but clear payoffs for stakeholders, both intermediate and long term.

Short term payoffs (at the cost of medium and long term benefits) should *not* be on anyone's agenda.

There is no doubt that MUTP planning benefits from clear and sustained objectives and an overarching purpose that has broad ownership. The absence of these will fail to attract a champion, undermine the morale of the technical staff involved and fail to attract adequate committed stakeholders. Having said this, it is also apparent from other decision-making and planning exercises where RUC concerns are important, that ambiguities exist and need to be identified and addressed in as realistic a manner as possible. In so doing, transparency of process is becoming important both as a result of the increasing tendency for governments becoming the banker of last resort in financially uncertain times *and* because of the environmental impacts that many such projects impose. Here the need to view such projects from the bottom-up as well as from the top down becomes crucial, particularly if we wish to have local communities to buy into the vision of the project. This requirement for inclusivity is becoming increasingly important as too many MUTPs do little to address the social exclusion problems of the areas they are located in and traverse, and because planning appeal procedures can cause considerable delay. The Swedish Government has long-sought to engage the public in major projects at the very earliest of the planning stages. In this way, overall the project planning and delivery time is much shortened in comparison with past practices of inviting participation once the proposals have been firmed-up.

Setting realistic targets and timescales is *critical* in any planning process, especially for MUTPs. Such targets can only be deemed 'realistic', however, following a competent reconnaissance of the contextual forces affecting the project and its outcome, bearing in mind the proviso that these contextual forces are constantly changing, and are a product of both externalities and decisions made by the observer. Optimism should be avoided at all costs, it is bound to ultimately create disappointment and undermine the reputation of the target-setters as well as the project as a whole. Having said this, project promoters and decision-makers require a healthy attitude toward the need to adapt (targets) to suite new emerging circumstances and allow contingencies for both unknowns and unknowables.

4. Transferable lessons for MUTPs

4.1 *Introduction*

We here offer a detailed account of statements made by all the contributors to Working Papers #2 and 3 regarding the treatment of RUC in decision-making in their own fields, with comments by us on their potential relevance to MUTP planning, appraisal and evaluation. These statements are clustered and analysed under sub-themes and examined in terms of key relationships identified among the various key concepts, ideas and issues identified. A compare and contrast analysis of the findings of the various contributors is then made with the assistance of conclusion drawn from a visualisation pattern analysis of topics explained in Appendix 2.

4.2 *Working Paper #2*

The summary/ discussion below of potentially transferable lessons in the treatment of RUC for planning MUTPs is derived from nine commissioned contributions contained in Working Paper #2 which examine the treatment of RUC in decision-

making for planning *outside* the fields of infrastructure, territorial and transportation planning and urban/regional planning. It is important to stress here (and for Section 4.3) that although clustered under sub-themes of relevance to MUTPs, the quotations/statements and comments offered are not presented with any pre-diagnosed structure in mind but instead represents an *ad hoc* collection of observations provided in an attempt to seek out/ identify any emerging patterns where they exist.

4.2.1 *Military Planning (J.Stone, 2008)*

Theoretical lessons

- There is a long history of evidence-based military planning theory from which a body of "good practice" has emerged. Unfortunately, MUTP planning cannot at present draw on an equivalent systematically reviewed resource, despite the existence of mega projects throughout history from ancient Greece, Rome, Egypt, and China, and through the Victorian era to the present day.

- Clausewitz's definition that an "effective strategy is one that generates desirable political effects *without* incurring disproportionate costs" is a transferable and usable maxim in MUTP planning practice. The matter, however, of who defines 'disproportionate' costs is nevertheless a key question.

- The realisation has come late to many quarters of urban and transport planning (and MUTP planning) that the "blueprint" approach to planning as social engineering, designed to yield "the optimum solutions" and free of uncertainty is just not realistic. This is despite the fact that planning academics have, since the 1960s, cautioned against this degree of determinism.

Importance of adversarial contexts

- The existence of an "adversary" in military planning is not a perception that prevails in MUTP planning. Having said this, lawyers dealing with MUTP planning appeals in the UK are obliged to adopt an adversarial approach when planning decisions are challenged by other stakeholders. Early stages of MUTP planning require consensus building within and between stakeholders who may at the outset be potential allies or adversaries. The aim should be to avoid adversarial situations if at all possible, but they are bound to occur as win-win outcomes are not always possible.

- It is acknowledged by the military that "war is risky, not least because its conduct is beset by the influence of uncertainty as to the enemy intentions, and the influence of complexity which renders operations vulnerable to the retarding effects of friction." By and large, MUTP planners do *not* have the powers successfully to play the adversarial game especially in the current context of public private partnership. A high degree of overall consensus is a prerequisite of, but no guarantee of, success. Planners, politicians, businessmen and others are also acutely aware of the adversaries *within* their own organisations.

Uncertainty and risk

- The notion that "strategy should be understood as an activity that is attended by risks that *must* be balanced against each other" has an inherent universal logic. There is, however, a contrast between the institutions in which it takes place: in the military it involves hierarchical decisions and *non-democratic* organisations whereas in MUTP, planning decisions are more likely to reside within a transparent political process, although with increased private sector involvement this transparency is beginning to be eroded.

- Uncertainty relating to the *context* of planned (military) operations or to unexpected failures of the *means* of planning and supporting resources, finds parallels in the process of strategic thinking in MUTP planning. Constant monitoring of context (in its widest sense) is critically important before and after decisions have been taken. There is little point, however, in monitoring context if you do not have the means to respond to identifiable changes and/or are not prepared to alter strategy and operations.

Management and control

- The accepted premise that some planned operations "can *never* be perfectly controlled because many of the decisions made are frequently based on partial information or are made under such stressful circumstances that they can impair clear decision-making and conspire to reduce the efficiency of the armed forces by continuously bringing them into contact with the influence of chance" is directly relevant to MUTP planning.

- The lesson from the military that resources needed to redress past set-backs can be disproportionately high, thereby making it doubly important that project risks be *consistently* kept down to a minimum is highly relevant to MUTP planning. It should be noted that we more often learn from failure than success, especially if there is a willingness to examine uncomfortable truths.

- The assertion by the military that the more complicated plans require a higher degree of effective and efficient co-ordination and complex systems of co-ordination are often very fragile is an observation that holds equally true for MUTP planning practice. The more specificity a plan contains the greater the chance that deviations will take place. By virtue of the interrelationships between components they are also more difficult to adapt and are thus inherently less flexible.

- The theatre of war is one of complexity in which outcomes are unpredictable and 'wicked problems' are manifest. In their efforts to manage risk, the US in the second Iraqi war "succeeded only in shifting that risk into different areas of concern." Translating this into the fields of MUTP planning one may conclude that uncertainty and complexity *can* lead to decisions being made that shift identified risks into new and different areas of concern to those in which they were originally located.

- The notion that so long as overall objectives are met, the charting of an "acceptable path between the risks associated with refusing to intervene in crisis situations, and the equally unacceptable risks of getting drawn into new … quagmires" … has to be an acceptable strategy that is preferable to crisis management. Crisis management is where some or many overall objectives are *sacrificed* in order to avoid a full-blown crisis erupting, leaving "winning" as undefined. This emphasis of the value of strategic thinking offers a useful reminder to MUTP planners to keep sight of the ultimate objectives and purpose of their planning exercise, even when tempted by short term expediency.

Political intervention

- Both military planning and MUTP planning are subject to intervention by politicians who may have a very different perspective to that of specialist advisors to government. Such intervention can moderate or *even* totally re-position the specialist's advice. It is "sometimes undertaken with an uncertain mix of ideological fervour and unashamed pragmatism, executed in a manner that *can* totally alter or dilute the potency of the original technical solution". While this can transform planning exercises to ones that end up servicing political ends rather than addressing the problems they were originally designed to address, it can have a very healthy impact where MUTP specialists and sponsors lose sight of societal and other responsibilities.

Commentary on lessons: their identified relationships of relevance to MUTP planning

Complimenting the above, the text below summarises *some* of the relationships/ links among the principal lessons extracted from Stone's contribution that appear relevant to MUTP planning. These relationships are visualised in Figure 7.

Link 1: Political Goals – Vision - Strategy: The relationship between Political Goals – Vision - Strategy is critically important for MUTPs, where strategy is the instrumental link that operationalise political goals and the MUTP 'machine' that can realise those goals. It is usual for vision to precede strategy either implicitly or explicitly. In the context of MUTPs, there is evidence to suggest that 'visions' can be somewhat of an anathema to many politicians as they typically require a relatively long-term buy-in and may not give the room for manoeuvre that politicians desire. There is also evidence to suggest that (some) MUTPs do *not* get built in response to a coherent pre-determined 'strategy' per se but instead respond in a rather ad hoc manner to different contextual forces emerging over time.

Link 2: Interdependence of Choice – Strategy and MUTPs. The military strategist must make plans with an adversary in mind. A typical adversary for a MUTP could be global competitors such as another airport, changes in government, project-creep, or environmental activists. A politician who is supporting rail as a primary transport mode of preference over other modes will need to build adversarial responses to the road/air lobby. Such strategies have to be very flexible/adaptable as adversary positions change/flow very quickly in the political arena of MUTP planning.

Link 3: Interdependence of Choice – Complexity and Uncertainty. Whilst allowing for an adversary with interdependent thoughts, and choice leads to

uncertainty and complexity in military planning, the nature of planning (in its widest sense) is to identify and analyse a potential range of outcomes and prepare responses thereto. In MUTP planning, the selection of individual responses is assisted, but not driven, by techno-rationalist models/techniques – real selection is instead so often driven by politics (local, regional, national and international). Politics could, therefore, be considered a major driver of uncertainty in MUTP planning alongside the use of techno-rationalist models.

Link 4: Strategy – Political Goals. Although strategy is an instrumental link in the context of both military and MUTP planning, political goals can often interfere with formed strategies. In the case of MUTP studies, the full capabilities of the project may as a result not be used, or in the worst case, the project can fail even though the project contains all the required capability/ capacity for success.

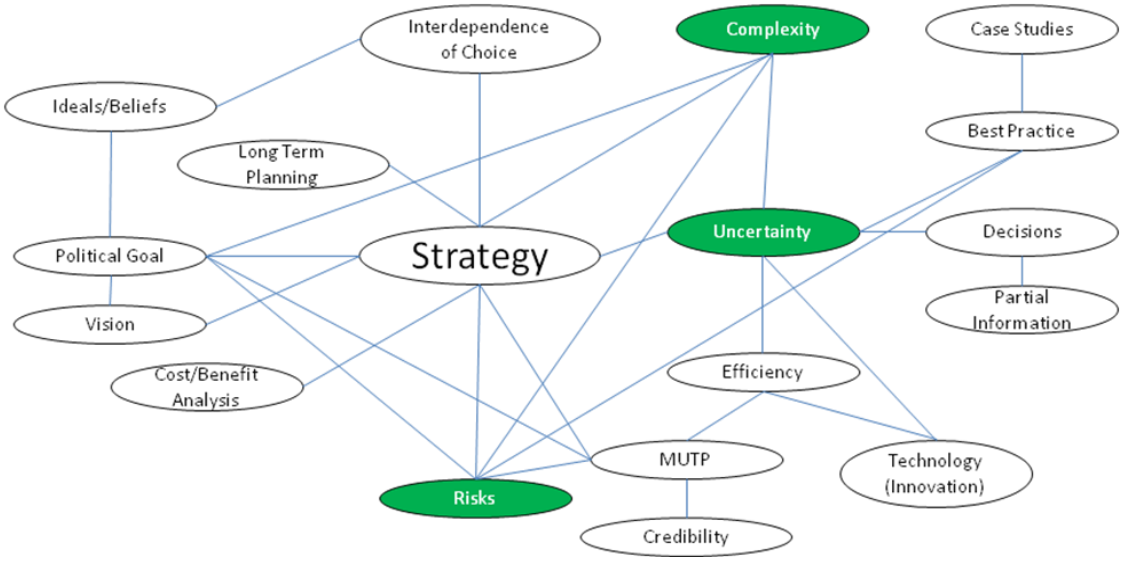
Link 5: Case Studies – Best Practice – Uncertainty and Risk. Military historians favour the opinion that it is possible to form universal rules on strategic thinking and planning on the basis of evidence based on past practice, which hold the essence of success, and can be applied to *any* situation, thus reducing the uncertainty and risk. This belief also rests amongst many MUTP specialists. The rules are formed here by looking back at history and searching for regularities. It can, however, be argued that these regularities are mere surface manifestations of more fundamental forces and as a result it is risky to follow such 'best' practice/ path dependent ways.

Link 6: Ideals Beliefs – Strategy – Uncertainty. The military premise that knowledge of an adversary: their ideas and beliefs, is an important part of strategy and can help reduce uncertainties is becoming increasingly relevant to MUTP planning. This is so both as a result of the increased reliance upon competitive private sector involvement in MUTPs and where opponents to a project go to extreme lengths to achieve their aims of stopping a project. Such 'strong believers' are not always easy to identify, hence the need (in MUTP planning) to scan the full spectrum of possible stakeholders to try and detect signals indicating who is occupying an adversarial or supporting position. Clearly such scans need to be monitored over time as stakeholder positions and agendas change.

Link 7: Complexity and Uncertainty – Technology (Innovation). The military experience suggests that where there is an inter-play of complexity and uncertainty this can lead to unexpected delays, reducing the efficiency of a project. One way to improve efficiency in a military project is often to invest in new technology, although the effects are not always decisive as sometimes their impacts/ effects can be detrimental to the project. In the case of MUTP planning, and in military planning, where there is a tight project sponsors may see the introduction of new technology as too high risk - preferring instead to stick to the tried and tested.

Link 8: Credibility – Stakeholders - Strategy. The military and corporate worlds, in particular, suggest credibility of those promoting a strategy is all important. Some strategies will *not* work unless the project team are seen to be credible and there is a need for strategies to be 'acceptable' to key stakeholders. Much work is spent, therefore, by 'strategy formulators' in 'selling' their strategies to politicians, business sector, financiers etc. This is increasingly the case with those involved in proposing MUTPs as part of a wider transport and spatial development strategy.

Figure 7: Treatment of RUC in the military: lessons for MUTPs



4.2.2 *Earthquake engineering (T. Rossetto, 2008)*

Disaster risk assessments and context

- "Earthquakes in some parts of the world are one of the most dangerous and destructive natural hazards and thus pose a major threat to MUTPs in such areas requiring seismic precautions to be incorporated within the design and construction processes of the infrastructure facility." This raises the issue as to whether MUTPs are as a matter of course subjected to overall risk assessments for natural disasters such as: earthquakes, flooding and other major disasters – over and above the structural risk assessment – and man-made disasters, such as terrorism?

- "The objective of earthquake engineering is to provide an adequate level of seismic resistance in engineering works, through the *reduction* of vulnerability, at an acceptable cost". The 'acceptable level' of risk is determined by a balance between the cost of providing earthquake resistance and the losses (in both human and monetary terms) that this investment will prevent. It is important to note here that the context will determine the extent to which vulnerability is a factor in the risk assessment of any particular MUTP.

- A scanning of context may reveal the need to undertake risk assessments for natural disasters and man-made disasters. The former can be conducted on the basis of sound scientific evidence, in the latter the threat may be difficult to quantify but in both vulnerability can be reduced by design and construction through scenario planning. This kind of planning and testing for MUTPs is one way of assessing the implications of the risk.

Grouping uncertainties

- The uncertainties incorporated in hazard assessment can be grouped into: inherent variability (aleatoric uncertainty); limited knowledge (epistemic uncertainty);

inability to accurately represent/model (what we know), and differences between assumed and actual values (parametric uncertainty). These are very useful distinctions when analysing uncertainties surrounding a MUTP. A breakdown of this kind will indicate where it may be appropriate to invest resources to reduce particular uncertainties.

Management of risk

- Seismic capacity design concepts are not 'fail-safe' but can be termed 'safe–to-fail'. This acceptability of a certain level of damage occurring depends on the importance and use of the structure and context. The fundamental issue here is to "seek to balance the cost of coping satisfactorily (to an acceptable risk level) with the risk with the losses that this investment will prevent." This principle can be applied to most levels of conscious risk-taking in MUTP planning and appraisal once the risks are identified. Identifying risks, however, is invariably the difficult issue. The levels and types of 'risk' associated with a seismic event are rather easier to determine, being a force of nature, than those surrounding MUTP planning and delivery in general.

- "Socially acceptable risk is the probability of failure (damage) of infrastructure that is acceptable to governments and the general population in view of the frequency and size of natural hazards, and the infrastructure use, importance and potential consequences of its damage. A *limited risk* is thus always accepted rather than taking a comprehensive risk-averse position. To an extent this concept is already inbuilt into MUTP planning - albeit implicitly. All key players in the MUTP planning process are aware of risk at some level - the point is they may not be able to quantify it or are only partially aware of its potential impacts. The key points here is how do we identify the risk, how big a risk is it, at what level is it acceptable, and whose risk is it anyway? Each stakeholder has his/her own view of this.

- In the world of earthquake engineering, "Determining what constitutes an 'acceptable risk' involves the use of an acceptable decision process based on Paté-Cornell (2002). This lists the elements of an acceptable decision process, which includes: a sound legal basis with clear understanding of individual and societal risks and treatment of economic effects, a communication system, a public review process, a conflict resolution, monitoring and feedback system." While an equivalent list for MUTP planning raises the importance of transparency and regulatory frameworks at the institutional level, particularly for international use, it fails to incorporate an individual's assessment of risk or his/her appreciation of the context for that risk.

Implementation

- "The correct application of the seismic codes requires skilled engineers, architects and builders, and effective enforcement and inspection procedures." While good seismic codes of practice exist in some places, their non-enforcement, combined with poor inspection procedures is, in reality, lethal. The implementation of seismic codes in a framework of quality control and enforcement is thus crucial. The use of instruments of governance to mitigate the scale and the vulnerability to

risks may be undermined by weak enforcement. The critical importance of skilled expertise, effective enforcement and inspection procedures also apply to MUTP planning and execution. This drives home the point that strategies and policies alone without effective regulation and enforcement at the delivery level can cause the project to go awry especially if there is a flawed reward structure in place that for example penalises delay at the expense of quality.

- The claim that "New paradigms that will help move the power of the decision of 'acceptable risk' from code-makers to building owners are being developed in earthquake engineering is important. However, despite the improvements this is expected to generate, earthquake resilience will *only* be achieved if the importance of code enforcement, quality control and maintenance are appreciated by governments and the private sector alike worldwide". In the context of MUTP planning and implementation, this raises the question of whether there is a need for the special development of international context-sensitive regulatory frameworks for MUTP engineering and financing practices, especially since they increasingly rely on global players

Commentary on lessons: their identified relationships of relevance to MUTP planning

Complimenting the above, the text below summarises *some* of the relationships/links among the principal lessons extracted from Rossetto's contribution that appear relevant to MUTP planning. These relationships are visualised in Figure 8.

Link 1: Risk – Cost Benefit – Stakeholders. The acceptability of damage to or failure of a project in earthquake engineering depends on the imporance of the project and its context. As in the case of MUTP planning, the search for a balance between limiting damage and costs involved in making interventions entails agreeing on acceptable levels of damage by *all* stakeholders involved in the project. These should consider social, environmental *and* economic factors.

Link 2: Risk – Exposure and Hazard and Vulnerability – Path Dependency. Risks in earthquake engineering can be expressed as a factor of the likely magnitude of hazard, the vulnerability of the project to the hazard, and the exposure such as human, equipment or project losses which could occur due to the hazard. The definition of these three factors, as argued above, have potential applicability to MUTP planning and require mathematical models based on historical data (which may reflect a path dependency), the quantification of uncertainty, and estimations based on expert opinion.

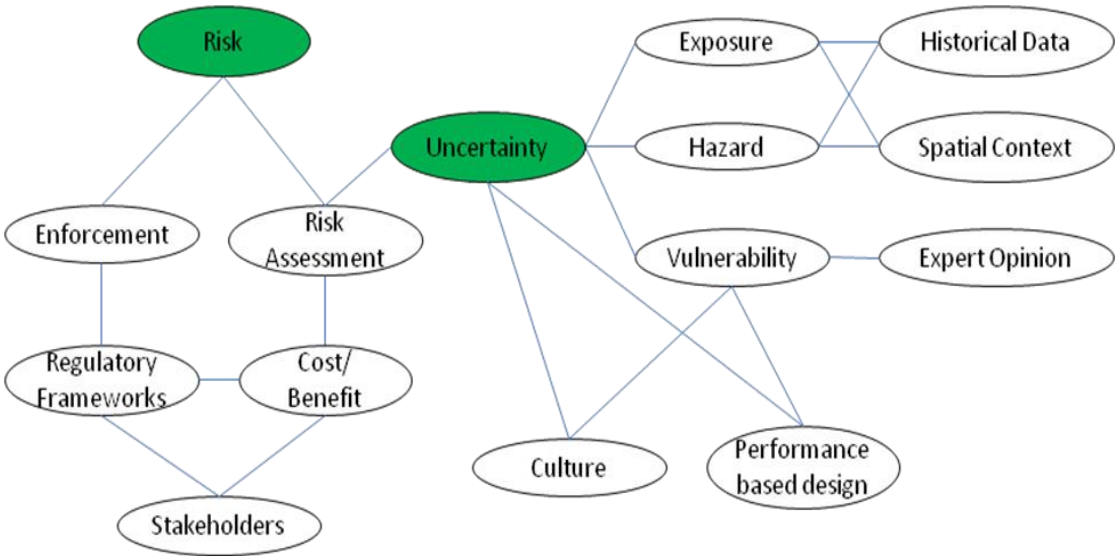
Link 3: Risk – Enforcement – Regulatory Frameworks. When good international codes and guidelines (regulatory frameworks) are available to reduce the likelihood of certain project risks, such as earthquake risks, there is still the risk of non- adherence to such codes. The reluctance to adhere to these codes is often due to the extra costs associated with this requirement, which when combined with poor/inadequate inspection procedures by government, can create result in lethal consequences. The implications of these concerns resonate with MUTP planning and the importance of supporting enforcement procedures.

Link 4: Data - Vulnerability – Experts. Expert opinion is often incorporated into assessments of structural vulnerability alongside formal mathematical models in earthquake engineering. Where there is a lack of historic quantitative data, expert opinion is used to define likely project responses to different levels and types of risk. This can yield better results than mathematical model running on sparse data. The use of such expert options must, however, be transparent and qualified in any risk assessments. This resonates with MUTP planning and modelling practices where forecasting and other modelling exercises are often founded on sparse data and subsequently call on informed expert inputs to advance decision-making.

Link 5: Uncertainty – Culture –Vulnerability. Rossetto's account of the treatment of RUC in earthquake engineering indicates that the culture(s) of an organisation (and country) can have serious implications for the vulnerability of a project that affects uncertainty. Cultures confident in 'tried and tested' tools and techniques can paradoxically create projects which are more vulnerable to uncertainty. This conclusion potentially poses important questions for MUTP planning on situations where parties are well versed in tried and tested approaches taken from previous experiences.

Link 6: Uncertainty – Performance Based Design –Vulnerability. The experience of earthquake engineering teaches us that the recognition of uncertainty can be built into techniques for reducing project vulnerability. The recognition that unforeseen events may occur which may cause the project to fail, allow the project to be designed to accommodate 'safe failures'. This in turn can limit stakeholders' exposure to the risks of failure. In some industries this technique is called performance based design. Research into the application of such techniques into MUTP decision making and planning would seem appropriate.

Figure 8: Treatment of RUC in the earthquake engineering: lessons for MUTPs



4.2.3 *Bank project finance (M. Lemmon, 2008)*

Reputation and trust

- While large international banks exist to make profits for their shareholders and optimise returns on the amount of capital they deploy given the level of risk at the time, they also need "to nurture a *reputation* for conducting business to the highest possible standards of honesty and integrity, and with due care for the environmental and social impact of its own direct operations and the impact of the operations of the clients which it supports." These sentiments may be relatively easy to uphold when times are good, but are put to the test in more stringent financial climates where it may be tempting to sacrifice these principles, although paradoxically in a shrinking market it may be these very components that help maximise share of a dwindling market. The same sense of developing trust is highly relevant to all types of organisations and institutions involved in the planning, delivery and management of MUTPs.

Risk hierarchy

- The portfolio of risks which a project finance banking business takes on is typically a subset of larger group of risks within a much wider portfolio of the whole banking group. "The mindset and tools with which a bank measures (these) risks and uncertainties have elements which are specific to the products it provides and the business it undertakes." This mirrors the concept of hierarchies of systems and different levels of contextual risks discussed in earlier sections of this report and which can be closely identified with the risk components of a MUTP.

Context

- "It should be noted that project and infrastructure finance transactions tend to be highly bespoke. No transaction is the same as another and the risk solution applicable in one instance will *not* necessarily be appropriate for the next, even if the assets appear superficially similar". Acknowledging obvious differences exist in terms of location and transaction counterparties, and pointing out that there is no standard risk analysis framework that applies from bank to bank, institution to institution is most significant for MUTPs. This differs from the more templated approach that often seems to accompany major civil engineering projects. This contrast would seem to suggests that the banking sector is much less path dependant and more 'context aware' than civil/transportation engineers.

Management of Risk

- "Levels of senior debt can range from approximately 70% of the total funding requirement for a project exposed to a relatively high level of business/ market risk to more than 90% for PPP style infrastructure projects with low levels of business risk (primarily because of Government guarantees/ assurances). This compares to 0% to 40% for corporate investments, and 40% to 60% for typical 'leveraged' corporate financing". These figures are highly relevant to MUTPs where PPP is increasingly used as a delivery vehicle for such projects. The cited figures beckon the question as to what is the key difference that makes the former

context less risky? The also suggests that the public sector pays a high price for PPP if the finance sector associates them with "low levels of business risk", that are well below those on the market in general.

- The concept of 'net' risk position in banking entails *risk assessment*s that review a range of likely outcomes (i.e., scenarios) expressed as financial projections which "show the financial consequences of a particular risk emerging over the life of the debt service or asset – perhaps up to 35 or 40 years for the longest term transactions" - adding to this contingency assessments. These stated practices highlight the importance of scenario thinking which is most relevant to MUTP planning in order to formulate robust flexible plans that have the capability to deliver on agreed goals and targets even when contexts change.

- "Contractual risk allocation can be very finely tuned through complex contractual provisions within the concession agreement and subcontracts entered into by limited recourse borrowers to allow risks to be shared and capped between different parties within the project arrangements." In the context of MUTPs this sharing of risk (through consortia, joint ventures and subcontracting) are all mechanisms not only to deal with capacity issues needed to handle the large scale of such projects, but also to share the risk and dilute it for any individual party. Politically, the more buy-in (consensus) one can achieve, the more risk is shared and the consequences of failure become less drastic for individuals.

- Bankers have concerns that relate to an infrastructure asset failing to be brought in to service at the right cost, time, and level of quality or performance. Construction risks of this kind vary according to the complexity and scale of the construction requirement, and the experience and capability of the contractors delivering such requirements. "Liabilities under the construction contract are typically capped at levels equal to the likely worst case outcome in terms of cost overrun and/or delay." Invariably, however, it is the public purse that covers the risk *beyond* these capped limits. These risks are high in the planning periods for MUTPs. They are often the most uncertain, and fall outside the definition of 'construction risk'

- Elements of revenue risk can be contractually allocated through 'off-take' contracts and tolling agreements, which guarantee both to supply raw materials and to off-take final products, traffic guarantees or operating contracts which pass through revenue deductions to an operator. These all constitute risk-transfer and risk-sharing measures. In the case of MUTPs, the increasing involvement of infrastructure investors in real estate ventures associated with MUTPs is a way of offsetting risk through diversification.

- Risk and uncertainty is largely treated by the banking sector as the same thing. While academically there is a distinction (see earlier discussion and Working Paper #1), for the banker this may be largely immaterial as all private sector concerns - from developers to financiers - place great store in having 'certainty' about the context for, and components of, financial undertakings. Banking (up until recently, at least) is/has been unique in possessing great faith in its ability to generate favourable outcomes, despite being buffeted by change. One needs to consider the significance and implications of this for MUTPs given the fact that risk and uncertainty are *not* the same.

- Contractual arrangements demanding practical interfaces between multiple parties themselves add a layer of complexity to MUTP planning. This complexity "creates significant risks to be analysed, understood and appropriately controlled, especially when a major investment is to be financed on a limited recourse basis at a high level of gearing." In a broader financial context the 'credit crunch' that began in 2007 was magnified in severity by a complex web of diversification transactions between financial institutions that no single party fully understood. Ironically, individual decisions to diversify risk built a fragile structure such that a failure at one point rapidly escalated to reach a tipping point to descend to wholesale financial calamity.

- Detailed *due diligence* performed on categories of risk for each project transaction can provide a clear understanding of the quality of all key aspects of project finance "with some reliance on the judgement and instincts of experienced project finance credit experts performing objective reviews on the cases proposed by others". This enables banks "to gauge *probabilities* for each key risk aspect of a transaction within bands of quality which are fairly narrowly set." The importance of expert 'due diligence', 'judgements' and 'instincts' in the treatment of risks in complex decision-making environments is highly relevant MUTP planning as its risks are typically high and complexities are great. In the UK, at least, there is little evidence of post-project due diligence in MUTPs in terms of analysing what went right and what went wrong in the planning and delivery process - except for the work of the National Audit Office (NAO), which is essentially limited by a narrow financial remit.

New players

- "The big players in global project finance lending are a smallish group of leading international banks. Typically, one or a small number of banks from this group will take the lead on a deal …. The lead bank will often build the financial model which all lenders use to analyse potential case scenarios under varying economic conditions and practical pressures. Such lead banks will frequently commit to underwrite the total amount of the loan proposed, with a view to subsequently *selling down* significant proportions or all of its underwriting to other banks which have some appetite and experience of project finance lending but less resource to devote to originating such a transaction and commit to underwrite 100% of the required lending." By these means the big players share and off-load risk, at the same time liberating funds to allow them to diversify their own investments. Over recent years we have seen significant changes in the structure of the sector. We now see a great many equity and sovereign funds entering the fray. They do not adhere to the same rulebook as traditional banks. Equity funds look for a quick return while Sovereign Funds frequently act as agents of foreign governments seeking to extend their international influence. These new players are of growing significance to MUTP developments world-wide, but the true scale of their involvement is currently unknown.

Monitoring of risks

- Banks re-appraise the risks of project finance transactions on a regular basis throughout the life of the loan. "Typically, once completion has occurred, a project finance case will then be reviewed and the risks it faces will be reassessed at least once annually thereafter." In contrast, the impacts of MUTPs are *not* systematically monitored and adverse affects acted upon. One can readily appreciate the incentive for a bank that lives by a single meta-indicator, and has discretion on actions to safeguard or withdraw from investments. Why not extend these monitoring principles to assets/parties impacted by MUTPs? Monitoring can make sense for two reasons: to learn about the consequences of actions in order to apply lessons in the future; and to gauge the need for action in relation to the project under examination.

Track record

- The project finance industry we have in today's global markets is a little more than 20 years old and whilst subject periodically to temporary ups and downs, "it has grown gradually to its present annual total of US$273 billion for deals closed in 2007 from very much smaller volumes 20 years ago." The significance of this for MUTPs is that the relevant data we have on international financing in MUTPs is somewhat limited. For MUTPs this means that the empiricist basis for tackling risk spans a relatively short period and only few geographical contexts.

- Data collected on the performance of project finance lending, which covers more than 80% of all project finance deals closed over the last 15 years across the global market place, shows "the probability that a case in an overall portfolio would default in any year was on average less than 2% and the average loss occurred in that same period if a loan defaulted was less than 25%." These numbers produce a lower average annual cost of loss for project finance deals than for loans to equivalently rated corporate borrowers over the same period. This suggests that "project finance lending by banks over the recent past has been well structured with risks relatively well controlled". We believe that MUTPs form part of that overall cohort of projects that has performed so well for the youthful project finance sector. This evidence seems to explode the myth that MUTPs are somehow inordinately burdened by risk and uncertainty. One may question whether this trend will continue in the face of tighter financial markets and less favourable market conditions than those prevailing since the mid 1990's.

Commentary on lessons: their identified relationships of relevance to MUTP planning

Complimenting the above, the text below summarises *some* of the relationships/links among the principal lessons extracted from Lemon's contribution that appear relevant to MUTP planning. These relationships are visualised in Figure 9.

Link 1: Risk – Assessment - Confidence and Path Dependency. During long periods of success, a high degree of confidence can develop in an industry's capabilities to assess project risk (due diligence), using tools which are generic across the industry. It would appear prudent for those involved in MUTP developments to, firstly, employ such tools on the understanding that they are specific to the type of

projects characterised as MUTPs and the business they undertake, and secondly, to monitor the performance of these tools at regular intervals.

Link 2: Risk – Profit – Trust - Rhetoric – Reputation. The basic aim of a commercial organisation is to make a profit for its shareholders. It is, though, also critical for the organisation to maintain a good reputation through trust. Trust is directly related to risk, while the track record of how an organisation has dealt with risk establishes its reputation. Rhetoric (and excessive marketing) can erode reputation and trust, and thereby itself create risks and vulnerability for organisations. All these considerations are most relevant to MUTP planners, investors and operators.

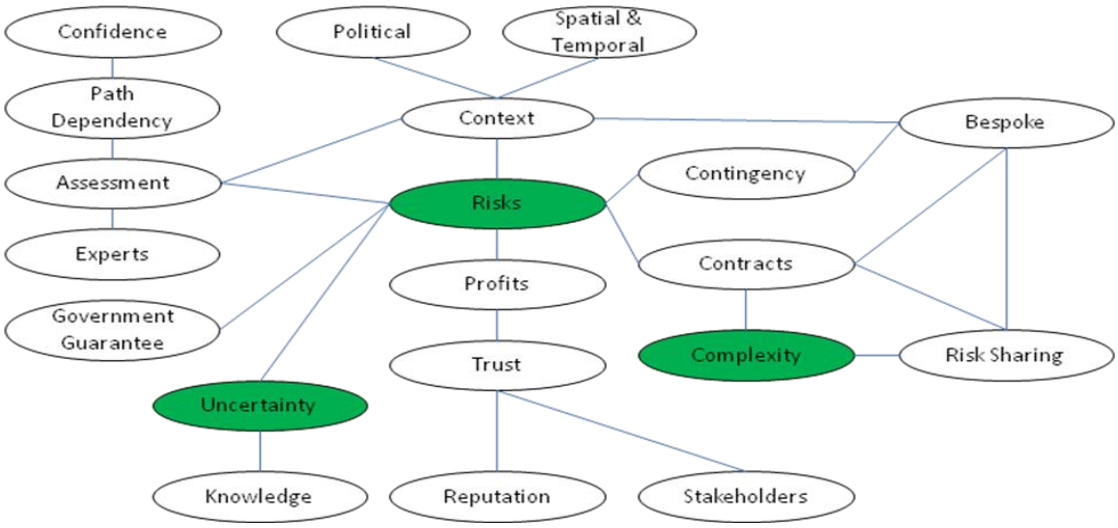
Link 3: Risk – Uncertainty – Knowledge. There are generic areas of risk in MUTP finance which are well known. These are all linked to uncertainties and the collection and comprehension of new information (and the knowledge derived from it) that has the ability on many occasions to reduce uncertainty. There are, however, also 'unknown unknowns' with the result that there are few cases where we could say with precise percentage probability what is the most likely outcome.

Link 4: Risk – Contracts – Risk Sharing – Complexity. It is essential for MUTPs, given their complexity and size, that risks are shared. The sheer scale of such projects and subsequent risk-sharing contracts can however create a whole new level of complexity and resultant risks that need to be better understood. With this in mind it is important to appreciate that MUTP contracts are significant sources of complexity in themselves and can spawn new known and unknown risks which thus need to be identified, better understood and wherever possible better managed/ controlled

Link 5: Risk – Contracts – Bespoke – Context. Infrastructure finance transactions (and therefore contracts) tend to be highly bespoke in banking. They are in other words highly context-specific. This is presumed to also be the case for MUTPs – these being a particular kind of infrastructure project. No bank project transaction it is argued is the same. The risk solution applicable in one instance is not necessarily appropriate for the next – with the result that there is a claimed high degree of awareness of context in the forming of contracts by banks, even though much templating of projects takes place within the civil engineering and transportation fields of expertise.

Link 6: Context (Spatial and Temporal) – Experts – Path Dependency. Among other characteristics, context has spatial and temporal characteristics which differentiate one context from another. Bank project finance risks and their relationship to changing contexts are monitored at regular intervals throughout the project by the use of expert opinion and experience. This is highly important for the risk monitoring process where modelling exercises fail and where special expertise regarding particular spatial and temporal features of the project's context is considered significant. In contrast to these practices it would appear that MUTP planning practices rely on less context-sensitive planning and appraisal processes, while the tradition of post project completion monitoring is very limited.

Figure 9: Treatment of RUC in bank project finance: lessons for MUTPs



4.2.4 *General insurance (L. Gibson, 2008)*

Price of uncertainty

- "General insurance is a means by which the buyer, or the insured, can pay money to buy out their risk. They reduce their remaining uncertainty at a price. The price, or premium, is determined by the insurer by considering the risk spread across a wider group of the insured, their own resources and risk appetite, and with regard to the unique characteristics of the individual". An appreciation by MUTP sponsors of the degree of interdependence this insurance strategy entails is important. Recognition that this strategy to date has been both robust and context-sensitive is important. However, the new emerging 21st century risks of climate change, flooding, energy shortages; terrorism etc. threatens to make a previous robust strategy far more fragile.

- "By paying a premium the insured transfers his risk, or some defined part of it, to the insurer. The insurer needs to hold enough capital to ensure it can pay claims if and when they occur. The more business a company writes the more it can spread risk and so make more efficient use of capital." The issue of premiums to offset risk becomes particularly important for MUTPs where government is keen to transfer the risk from the public to the private sector. This comes at a price, however. Commentators have argued that in the case of many PPP/PFIs, the premium to offset this risk has been far too high and does not represent value for money for the public purse. This is an observation also noted in the previous analysis of Lemmon's work.

- "Underwriters and actuaries seek to determine an appropriate price for each insurance contract by considering, amongst other things, the expected cost of future claims". Many potential rating factors are used here, so one must carry out a range of analyses. These rating factors, however, are not always independent of each other with the result that "there can be correlations and interactions which also need to be allowed for." Translating this to MUTPs, a straightforward

example of interactions can occur as a result of operational line-haul deficiencies leading to real estate revenue shortfalls or government policy on energy pricing altering the cost of line-haul services provision which in turn leads to fare hikes of public transport service and dips in patronage. There is, in other words, an 'open system of risks' in operation that by virtue of interconnectedness impact one upon another not always in a predictable manner.

- "Pricing for risk is partly an art and partly a science. Some risks do not belong to groups of large policies but must be priced on an individual basis. Underwriters will use their experience and judgment, which in some ways is like an implicit statistical analysis of the sum total of their experience of risks." For MUTPs, the impact of the totality of risks does not equate to the sum of the individual risks. This is so because the chemistry of risk interactions can add, subtract or even compound risks, depending upon their relationships. But again, the 'art' lies in determining the risks associated with existing and future contexts. Here, the judgment of a 'wise head' may be far more important than a technocrat's attempts at quantification.

Drivers of uncertainty

- "An important part of the role of the actuary in reserving is to understand the *drivers of the uncertainty* and to communicate them and their effects to the users of their work in as clear and helpful a manner as possible". In the context of MUTPs, the first requirement to comprehend here is that 'uncertainty' exists, and to communicate that to the stakeholders. To a technocrat owning up to uncertainty can sometimes be seen as tantamount to an admission of failure. 'Certainty' has its place in a closed deterministic system, *but* it is wholly inappropriate in anticipating outcomes in an open behavioural system. Nevertheless, to understand *and* to communicate the drivers of uncertainty and their effects is most important for MUTPs in devising strategies that are both robust and resilient in identifiable dimensions.

History and dynamics of context

- "Insurance policies are *not* independent of each other and so sometimes can all go wrong together." Because claims frequencies and severities are not known, past data is employed to analyse these. However, "the older data is less relevant because things keep changing. The more recent data is (also) unreliable because the claims have not all been settled" and so case reserves are used which could "turn out to be too high or too low." In the context of MUTPs, this tells us that history is *not* necessarily an appropriate guide, indeed it may be positively misleading "as contexts continuously change and outcomes of decisions emerge over time and cannot be unambiguously determined".

Contingency and reserving risk

- "Arguably the most important risk faced by an insurance company is reserving risk. An under-reserved company can stay under-reserved for several years before claims payments push through and make the situation visible. In that time the company will have been deluded into thinking it was operating more profitably

than it really was, and so it may well have been under-pricing each successive year of business." A privatised MUTP too can be an under-reserved company which accumulates risks over time of which it is unaware, only to be finally confronted by them through litigation (e.g. health or environmental) that may ultimately lead to the privatised MUTP insolvency. The difficulty with these instances is that many begin as 'unknown unknowns' eventually to be transformed by an accumulation of evidence.

Risk management

- The understanding, tracking, measuring and mitigating of all insurance company risk is *Enterprise Risk Management*. "This generally involves risk registers, control processes, and complex stochastic simulation modelling of large numbers of potential sets of circumstances. Such modelling allows management to test the robustness of their capital and reinsurance arrangements and to demonstrate their solvency to rating Agencies and Regulators." There are parallels in the planning and delivery of MUTPs with risk registers, control processes, and simulation modelling of potential sets of circumstances. Where this may currently fall short is that this is not done in a collective way so as to determine and manage risks which may be caused by or impact on more than one agent.

- "In order to plan for a general insurance company, in the face of uncertainty and complexity, the analysis supporting the plan will often break down expected claims into three categories: catastrophe claims, large losses and attritional claims. In this way the company is able to sub-divide the uncertainties by cause, which allows for clearer and more explicit assumptions in planning." In the context of MUTPs it may be appropriate to similarly subdivide the uncertainties associated with the project by cause in line with the categorisation outlined elsewhere (e.g. epistemic, aleatory). As a mechanism to help allocate planning resources this categorisation may have its place to deal with the knowns, some unknowns, but not for the unknowable.

- "An actuary's 'best estimate' of an outcome of ultimate losses is 'her/his subjective derivation of the mean of all possible outcomes, taking into account all available information about the business being analysed". This allows for the subjective interpretation by the actuary of available data and the choice of models and methods used. The acknowledgement of the role of subjectivity is important here because it emphasises that even with a standard insurance definition of 'best estimate' "one would still expect different parties to produce different estimates." Acknowledgement of the role of subjective judgement is similarly also vital for MUTP planning where technocratic forecasts may have excessively bounded utility in a complex and changing context.

- "There may be circumstances where the actuary wants to communicate *only* the severity component of uncertainty. This would typically be because the actuary was unable *or* unwilling to take a view on the likelihood component." It should be noted that if a scenario approach is used in the quantification of overall uncertainty "then the actuary should consider carefully how the scenario has been incorporated in the 'best estimate… The actuary may also wish to have regard to the wordings suggested for communicating the impact of large losses." Here the

question of transparency, integrity and openness arises. The actuarial profession is meticulous about probabilities and the caveats that surround them. In this they may have much to teach consultant MUTP engineers and planners. This strength of the actuary profession may not be that surprising, because anticipating the probability and magnitude of insurable events are at the centre of its core competencies, and because the very existence of the business of which it is part depends on sound performance in that area.

Model use and limitations

- "No matter how sophisticated the model or the tool, how multi-faceted the underlying analysis to support the parameterisation, how many years of complete and robust data have been considered and how experienced the modeller, all models are *only* models. There will *always* be some contingency not allowed for by the model, or some nuance of interaction not fully understood. It is easy to become seduced by a model, and to believe everything it tells you. This over-confidence may lead to poor decisions. *No* model is perfect – it will need to be rebuilt again soon when it next fails! Models need to be considered alongside other important inputs, such as experience and common sense. These two subjective resources can be thought of as more fluid models, constructed in the abstract and parameterised by the experience and capacity of the individual. These can be a lot more developed and sophisticated than their computer counterparts." These are powerful and generic lessons wholly applicable to MUTPs. A model can be seized upon by decision-makers hungry for certainty, but there are inherent dangers for those who do not appreciate their limitations. They are always a gross simplification of a complex reality. It places the excessive confidence often put in modelling in a much more realistic perspective rather than casts doubt on the integrity of the modellers. For MUTPs, it also begs the question of how much reliance decision-makers actually put on modelling as opposed to broad-based judgement in consideration of impacts and outcomes.

Commentary on lessons: their identified relationships of relevance to MUTP planning

Complimenting the above, the text below summarises *some* of the relationships/links among the principal lessons extracted from Gibson's contribution that appear relevant to MUTP planning. These relationships are visualised in Figure 10.

Link 1: Risk – Insurance – Stakeholders – Cost. Insurance allows a buyer to transfer their risk to the insurer, who then spreads the risk across a wider group of insurers (stakeholders) at a cost. The price of this risk transfer is determined by the resources and risk appetite of the insurer and the characteristics of the individual. It is important for MUTP planners to be cognisant of the above and to factor in characteristics of individual as well as major stakeholders when assessing MUTP risks and related costs.

Link 2: Cost – History – Path Dependency – Complexity. Calculating risks takes into consideration frequency and severity of historical events affecting risks and claims. Risks are therefore calculated using path dependent techniques. Over and above the risks that have a history there are also a number of important risk factors which are interdependent of these which add to the complexity of risk-taking. These

can be referred to as 'open system risks' which can impact on each other in unpredictable ways. All these considerations are highly relevant to MUTPs and the appraisal of their risks.

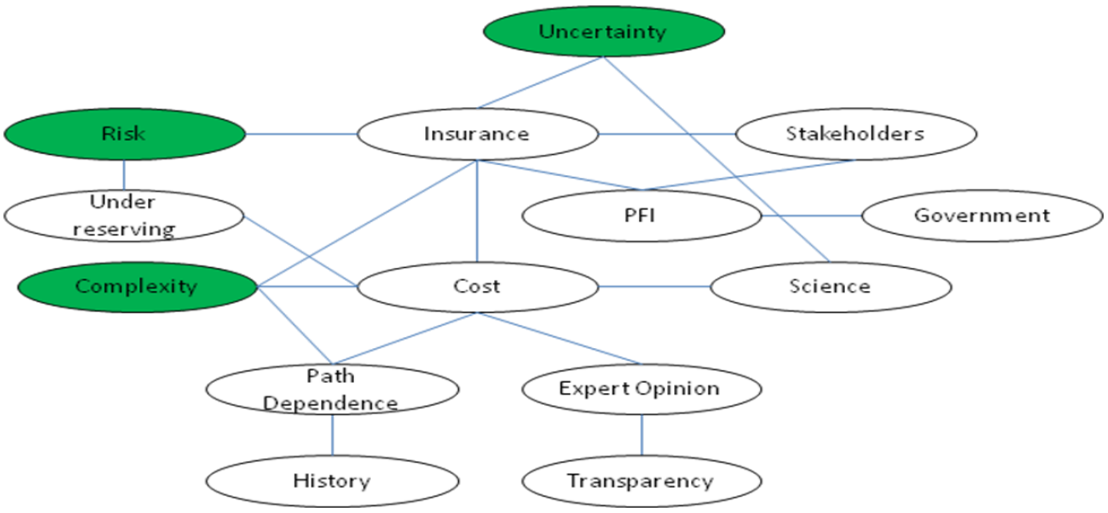
Link 3: Cost - Expert Opinion – Science. Because costing risks is partly a science *and* partly an art - much of the expert opinion, subjective experiences and judgements frequently employed in risk assessments and management along side more statistically rigorous analysis - scientific models cannot be effectively applied to all situations. This conclusion is most relevant to MUTPs when assessing their future risks and risk contexts.

Link 4: Expert Opinion – Transparency. It was found in the context of general insurance that risk analysts *must* understand and communicate the drivers of uncertainty to the consumers of their products/policies and that the expert opinion offering this analysis must do this on the basis of transparent procedures and freely accessible information. It would appear that this requirement is equally if not more important for assessors of MUTPs acting on behalf of the project stakeholders.

Link 5: Risk – Insurance. Spreading risk is at the heart of the insurance industry. IT is especially prevalent since insurance companies can not always mitigate large events. Sometimes insurance stakeholders will mitigate their exposure by limiting the size of their exposure and by buying reinsurance. Little is known/ written about regarding these aspects for MUTPs. It may be that research into this area may offer better insights into more prudent future insurance practices of MUTPs in the 21st Century.

Link 6: Risk – Cost – Under-reserving Fixing the incorrect price on or applying the wrong quantification measures of risk may delude a company into thinking it was operating more profitably and/ or more efficiently than it actually is/was, with the result that these hidden or miss-quantified risks could finally manifest themselves with devastating consequences arising from under-reserving. These matters ought to be of major concern to government sponsors of MUTPs and other MUTP stakeholders.

Figure 10: Treatment of RUC in general insurance: lessons for MUTPs



4.2.5 *Agriculture (J. Mumford, 2008)*

Contagious nature of some risks

- Within the agriculture sector as a whole uncertainties and risk are endemic. It is subject to a host of economic, social, meteorological and climatic factors as well as being prey to pests and diseases. The sector not only serves markets over which it has limited influence, but it is also subject to many natural and man-made influences in an open system that it cannot control The highlighting of the risks and uncertainties brought about by exotic diseases, insects and weeds is particularly interesting not only because of the very high potential costs of uncontrolled outbreaks but because the response to these in the form of pest control poses risks of their own through unintended consequences. This emphasizes the need to appreciate the implications of complexity and critical importance of systems and holistic and long-term thinking in tracing the consequences of decisions and actions, and the potential for some responses to even become sources of new problems and unintended consequences. A lesson that resonates well with MUTP planning.

- Gladwell (2000) likens the spreading of certain ideas, fashions etc. to infectious diseases, and points to specific strategic "tipping points" when ideas either become highly contagious or cease to spread. The premise has much in common with the concerns and challenges raised in the control and management of agricultural pests and diseases. MUTPs as agents of change that 'tip' developments toward one vision (say globalisation) rather than another, and that spawn other MUTPs, can be instrumental in spreading ideas, economic systems and erosion of cultural barriers. MUTPs can also generate tipping points in the impact on the decision-making climate for other decision-makers in that they can create conditions that reduce uncertainty and risk that encourage commitments from these players that can gather momentum in a positive direction.

Risk management and control

- The discussion of the international regulatory framework for managing the risks in the movement of agricultural products, pests and food contaminants reminds us that transport networks (and MUTPs) can be a conduit for the movement of produce contaminated by pests or disease and the means by which they are spread. The move from local to global markets emphasises the importance of international collaboration, agreed protocols for diagnosis and monitoring of movements with common standards, and legislation supported and enforced by international agencies. The power and the exercise of enforcement, control and enablement, are particularly important for MUTPs. The issue of institutional capacity and efficiency in the execution of international and national controls is also significant because weak institutions present no barriers to unregulated channels and patterns of trade which heighten the dangers of the proliferation of such risks. A similar observation was made by Rossetto in the context of earthquake engineering.

- "Despite preventive measures and border inspections pest outbreaks still occur." This suggests that whatever measures are introduced there will *always* be a risk of a negative outcome and that uncertainty *cannot* be eradicated *only* reduced. Key decisions here relate to the scale of resources that should be deployed on preventative measures (including surveillance). With MUTPs, as much as in this sector, it is not possible to know all adverse outcomes, and the law of diminishing returns will come into play. All risks cannot be identified, let alone eradicated, and probabilities are invariably impossible to quantify. Prioritisation may largely be down to judgement.

Use of expert opinion

- The trawling of expert opinions from Workshops is a useful although not a particularly novel method for deciding on important criteria to evaluate risk? The reliance on specialist advisory expertise has been discussed and referred to in all the earlier (and other) contributions reviewed. If we are to believe Surowiecki's premise voiced in his book *The Wisdom of Crowds: Why the many are smarter than the few* (2004) which essentially asserts that if you want to make a 'correct' decision or solve a strategic problem, *under the right circumstances*, large groups of people are often smarter than a few experts. Then the idea of relying on specialist expertise alone for future MUTP planning exercises is clearly inadequate not only for those who subscribe to Surowiecki's premise but also to community and non-government agency groups alike impacted by MUTPs as well as government. However, the degree that one can/ should engage/consult the public about such projects and have non-specialists capable of over-riding the specialist's advice provided/commissioned remains debatable.

- Mention was made by Mumford of the use of a framework of risk assessment in which likelihoods and consequences of introductions of risk are included in a standard format at predetermined levels of acceptability. While it was not fully understood how these levels of acceptability were arrived, nor how the consequences may be quantified, it raised the question of whether an equivalent framework might work for MUTPs or whether this would amount to yet another form of excessive templating/ standardisation that would be too context insensitive.

Commentary on lessons: their identified relationships of relevance to MUTP planning

Complimenting the above, the text below summarises *some* of the relationships/ links among the principal lessons extracted from Mumford's contribution that appear relevant to MUTP planning. These relationships are visualised in Figure 11.

Link 1: International Standards – National Enforcement – Risk – Trust. International bodies provide standards to assess and reduce risks during cross border agricultural movement and for cross-border projects in general. National bodies are responsible for implementing and enforcing systems to meet these international standards. These inevitably rely on much collaboration and trust among national, international and local agencies. This kind of collaborative and regulative framework provides (and will increasingly provide) the context of all future cross-border MUTPs and other MUTPs with trans-national significance. Here the issue of which level of

governance prevails (local or international) and in whose interest are the standards and enforcements introduced is a fast growing issue.

Link 2: Markets – Uncertainty – Knowledge. The high standards demanded by open markets as a result of globalisation reduce the uncertainty and subsequent risks associated with some agricultural (and industrial) products, but vigilance is still needed in the form of monitoring. The amount of vigilance is a trade-off between available resources and risk exposure. Systems are put in place to expand or contract monitoring resources relative to the level of risk which is assessed at regular intervals. These developments must have implications for international freight movements that use MUTPs although quite what these might be needs further thought.

Link 3: Complexity – Novelty (Innovation). The introduction of new, potentially beneficial, artefacts into an (agricultural) system can cause complex reactions which on turn create new risks. A balance must be struck between the risks and benefits of such innovations. These observations are echoed in the general insurance contribution reviewed earlier and very much applies to MUTP planning. There is, however, a tendency in most fields (including agriculture and pest control) to stick with the 'tried and tested' methods as a means to reduce risk, especially when dealing with a complex or controversial context for a project. This again resonates with much MUTP planning practice. Here costs are typically so high that further risks spawned by new approaches are often discouraged.

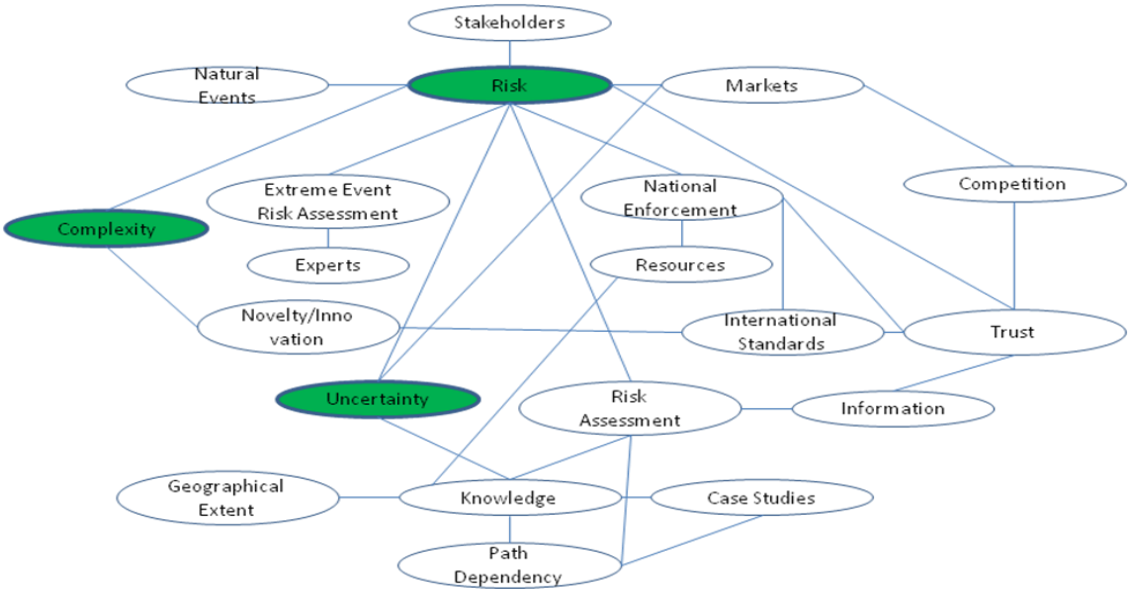
Link 4: Case Studies – Knowledge – Path Dependency - Risk Assessment. Case studies of risk analysis in the agricultural sector tend to identify known threats within a geographical radius of the stakeholders, with pre-defined scales used to calculate risks. Risk analysis for MUTPs employed in this manner would prove enormously difficult to undertake; geographically, temporally and also in a socio-economic sense. Path dependent practices are furthermore of limited value in accurately defining MUTP risks, because of the scale (in cost, time, money and impact) of such projects and the uniqueness of their individual contexts. Thus, perhaps the best we can hope for is to draw our risk assessment envelope as widely as possible in the expectation of capturing both the risk and response to it within this envelope.

Link 5: Risk Assessment – Stakeholders. Risk assessments in agriculture are open to consultation with stakeholders, and acceptable risks are defined after reaching an agreement with stakeholders. This practice demonstrates the importance of gaining consensus amongst stakeholders, and the significance of the constant re-assessment of risk in conjunction with stakeholder interests given that the nature and extent of risk varies over time. These principles very much resonate with MUTP planning.

Link 6: Information - Trust – Risk. There is an implied reliance in the risk assessment process described by Mumford on transparency and the open access to information. However, while the stakeholder initiating agricultural trade has an incentive to disclose information for risk assessments, other competing stakeholders may not be so forthcoming since it is common for people/organisations to believe that 'knowledge is power' and see extensive collaboration as a potential threat or admission of weakness. These issues of access to information, transparency, trust and risk are at the heart of MUTP developments and feature at all stages of their lifecycle.

Link 7: Case Studies – Knowledge – Uncertainty – Risk. Risk assessments of the kind described by Mumford tend to deal with all known threats, often relying on knowledge derived from past case studies, and models formulated using this knowledge. Such assessments do not though provide estimates of potential new threats. This lack of insight can in fact lead to additional uncertainty and risk as pointed out by earlier contributors. It is claimed that it is commonplace today for businesses and government agencies to identify future risks. The evidence to date, however, suggests that this practice is not too advanced which beckons the question whether such organisations are merely paying lip service to this kind of risk assessment or are just bad at it. These issues are all very much alive in MUTP planning. It is, however, typically hard to get organisations to change and speedily and effectively respond to newly identified threats/ risks (such as those associated with climate change) often due to entrenched path dependency.

Figure 11: Treatment of RUC in agriculture: lessons for MUTPs



4.2.6 *Public health and medicine (C. Dora et al, 2008)*

Uncertainty arising from limits to knowledge

- "Uncertainty, arising out of limits to knowledge, is to some degree part of every health decision, whether about the safety of individuals or of populations…. For public health decisions in medicine these same questions are scaled up to the population level … Thus, decisions about public health often entail risk tradeoffs, striking a balance between good and harm when neither the likelihood nor the severity of the outcomes may be known for certain". These issues of intervention, impact and trade-off arising are generic to major public domain decision-making and therefore apply to MUTPs. The scaling up of individual concerns into broader population/community concerns in public health poses problems for MUTP planning as the latter does not (cannot) benefit from the same level of reliance upon scientific evidence that underpins the pursuit of public health.

- "This chapter traces some of the parallels between the fields of medicine and environmental health in the analytical tools, the institutions and decision processes used to frame the issues of uncertainty and complexity, to analyse them, and to communicate them. Both disciplines … have a strong natural science foundation relying heavily on empirical evidence and on the scientific knowledge of disease causation and the effectiveness of treatments or other disease control measures." The question that needs to be posed here is whether some/ many of these key concepts and challenges apply to MUTP planning and if so, to what degree? The reliance in public health on the analysis of the scientific knowledge of causation and effect as a result of interventions may have some parallels in the field of MUTP planning; the impacts and implications of the absence of knowledge similarly may offer lessons and the uncertainty about the influence of interactions on/of complex social systems likewise could potentially prove informative.

Defining terms

- "To understand the strategies that scientists and decision makers have developed to deal with uncertainty, complexity and risk it is first important to *define and understand each term* as it is used in public health applications." As obvious as this statement may appear, it is astonishing how important the definition of such terms is in MUTP planning. This is a particular issue where effective communication among many stakeholders is required in order to arrive at a consensus on action.

Multiple levels/identities of complexity and emergent order

- "*Complexity* enters into public health assessment and management when more and more variables are introduced and/or systems are characterised by more than one cause and effect relationship". It can exist at: at (1) the biological, chemical and physical level that affects the ability to understand and characterise natural systems, and (2) at a societal level where there exists a multiplicity of stakeholders, actors, actions and consequences for a given decision context. "In the latter case, *complexity* can range from the level of an individual making a decision about a treatment choice in consultation with his or her physician to that of a national government making regulatory decisions about complex environmental problems with far ranging implications for health, the environment, and the economy." An MUTP too exists at different levels, as a multifaceted entity: in terms of infrastructure it is a physical entity and may legitimately be viewed as a deterministic closed system; as a service facility it may be regarded as a functional system and therefore more open in terms of being responsive to contextual forces; from another perspective an MUTP influences the behaviour of others ranging from the subtle to the dramatic, from the individual to the corporate. There is a case to make that a MUTP is akin to an artificial artefact that over time takes on natural characteristics and becomes part of an organic changing system within a system creating in a continuous process a newly 'emergent order.'

Ambiguity

- There is a particularly challenging issue "… that arises because of differences in interpretation of results or in fundamental underlying perceptions, values, or

motivations". Some refer to this as *ambiguity* with *interpretive ambiguity*, referring specifically to differences in interpretation of the same information, and *normative ambiguity* referring to when individual stakeholders or actors value the consequences differently. "Differing perceptions of risk can play a powerful role, both in individual and societal decisions ….. Perceptions of the risk of particular technologies … can (also) be extremely influential in public debates as proponents of these technologies can attest….. They need to be openly acknowledged and discussed in the risk assessment and management process even if they may not be resolved." The concept of 'ambiguity' is highly significant to the field of MUTP planning. It is in fact referred to in several earlier contributions. Every stakeholder, individual or group has a distinct agenda and perception of the value of MUTPs and their context. Understanding the nature and causes of 'ambiguity' among many stakeholders of a MUTP is thus an important prerequisite to generating consensus on the way forward.

Precautionary principle

- "The guiding principles in medicine of 'do no harm' or of precaution *cannot* unilaterally dictate the choices decision makers face". This is because they need to strike a balance between what may be described as false negatives and false positives. "Both may have costs, sometimes to different individuals or sectors of society" with the result that many public health decisions need to be considered and debated in a larger societal context. "Communication amongst scientists, decision makers, and stakeholders (thus) plays a critical role" in effective decision making. For MUTPs the precautionary principle of 'do no harm' is highly relevant, as is the challenge of striking a balance between 'false negatives' and 'false positives', Consensus building is also important for MUTPs demands clear communication between technocrats, decision-makers and stakeholders, and open debate about consequences and the distributional aspects of costs and benefits.

- "In the medical context, both (medicine and public health) operate from the basic premise that interventions should first and foremost 'do no harm'. …. The reality is more complicated: 'doing no harm' may actually require 'doing the *least* harm' when interventions for preventing or treating disease involve risks as well as benefits." Some MUTPs may be seen as interventions designed to prevent traffic, environmental, economic and spatial problems that would arise *without* such interventions. This reminds us that for any major intervention not everyone is a winner. The aim with any project must be to plan for, and achieve an overwhelming positive balance of benefit. Part of the problem here is that our ability to predict the wider impacts of MUTPs with any significant degree of precision is limited. But, this should not prevent us from at least attempting to identify and quantify such effects.

- "A common response to uncertainty is some degree of precaution. …. In reality, the answer cannot be simply to ban products or activities simply because they *may* have risks. …. Society undertakes any number of activities that have benefits as well as risks ….. Nor can the answer be to wait until we are absolutely certain before taking action". Principle 15 of the Rio Declaration of the United Nations Conference on Environment and Development, which codified the precautionary approach at the global level, states: 'In order to protect the environment, the

precautionary approach shall be applied widely by States according to their capabilities. Where there are threats of serious or *irreversible damage*, lack of full scientific certainty shall *not* be used as a reason for postponing cost-effective measures to prevent environmental degradation' (UN, 1992)'. These generic principles apply directly to MUTP planning, particularly with regard to their possible environmental impacts. The conclusion here is that there is never scientific certainty, and that there are always risks associated with outcomes.

- "…. the US Supreme Court ruled that that 'safe' did not have to mean 'no risk' but instead 'no *significant* risk'. What constitutes a 'significant' risk can *only* be answered with a better understanding of the science and technology behind each risk and the uncertainties that remain … which "need to be communicated clearly and can then be subject to public debate in order to reach decisions about how much risk to accept." The principal is generic and very relevant to MUTPs, although the practicality of investigating the science and technology behind each may be prohibitive on cost grounds.

Winners and losers

- "Decision making for populations is more complex and can involve tradeoffs in which the benefits and risks of interventions do not always accrue to the same individuals. In some circumstances, the benefits of interventions for populations are higher than benefits to any one individual….. Any of these decisions …rely on a similar framework built from the scientific evidence base itself, the processes used to weigh and characterise it… , and the ways in which it is communicated to and discussed with the other key stakeholders in the process." The understanding that the benefits and risks of interventions do not always accrue to the same individuals is central to appreciating the issue of who pays for and who benefits from MUTPs.

Case studies

- "Throughout much of history, physicians have relied on case histories drawn from their own practices, from the experience of their colleagues, and from the medical literature to inform their decisions about adopting a treatment or a screening measure for patients presenting with a disease or risk factor. ….. With the Internet, the concept of 'grand rounds' has gone global with websites like *Public Health Grand Rounds* as a forum for discussing case studies from around the world." Establishing the extent of the value and importance of case histories in MUTPs world-wide, given their recent proliferation globally, is a high research priority if both positive and negative generic lessons are to be learned. This is *not* a case for arguing the development of a 'best practice' templating approach to MUTP planning, appraisal and evaluation, but rather an appeal to build on lessons learned elsewhere where they are considered relevant. Here the principles and lessons learned will enhance future expertise in MUTP capacity building *so long* as it is acknowledged that each case has highly unique components, contexts and outcomes. The sharing of knowledge world-wide by use of the internet (as in the Cochrane Collaboration scheme) to enhance international collaborative learning provides an invaluable basis for sharing monitored knowledge of the performance

of MUTPs with the promise of offering more parallels than one would perhaps think.

- "Case studies are inherently small samples and, as such, can be inadequate representations of patterns and associations in larger populations. Epidemiology has evolved using the tools of statistics to systematise the design of studies from the methods used for selecting sample populations for study to those used for making inferences about the significance any relationships revealed in the studies" This discussion raises the question of the relevance and value of non-sampled case study findings in MUTP research given that it is very difficult (and expensive) to collect such data on an international basis. This is particularly relevant, for example, when it comes to seeking and citing stakeholder responses to MUTP proposals and impacts. What is the actual population of an unknown number of stakeholders involved in the decision-making?

International regulation

- "Whether or not particular interventions are permitted for use in a society often must rely on *more than* just the presentation of scientific evidence. Such a decision may need to rely on a political process involving a more complex web of stakeholders who want to have a say..... Many countries have seen the development of one or more national agencies to provide guidance and quality control over medical research, the evaluation of the effectiveness of medical treatment, the safety quality and safety of proposed treatments, and the process for considering and balancing differing views or competing interests of the various stakeholders." There are few if no equivalent agencies in the MUTP field both internationally, although bodies such as the US Transportation Research Board in the UK with the exception perhaps of the National Audit Office. This body, however, primarily has an accountancy scope that is far too narrow to be able to offer a balanced overview of what/ is not a successful MUTP.

Participation and consultation

- "Organisational context may also influence the feasibility of adopting a course of action or another, such as resources required for the intervention to be successfully implemented, or whether it will be acceptable for healthcare workers. Different study methods inform these questions, including focus group discussions, or participant observations … rather than relying solely on one type of 'superior' evidence, it is better to identify the appropriate method is used in addressing specific question". The use of focus groups in addition to 'experts' is not new to MUTP planning. However, how the scientific evidence is treated, matched and related to focal group feedback (in the public health field) may offer some interesting lessons for MUTP planning.

Risk assessment

- "The basic paradigm for the risk assessment process (in medicine) incorporates four components: hazard identification; Hazard characterisation/dose-response assessment; exposure assessment; and risk characterisation. …. This paradigm … recognises that uncertainty may exist about any one or all of these components…..

It calls for these uncertainties to be clearly identified in the final characterisation of risk … Though not listed in the original paradigm, *risk communication* has come to be recognised as a critical fifth component interlinking all of the other components and playing a critical role … both prior to and after the results of any risk assessment." For MUTP planning each of these five components may have its equivalent in a risk assessment of alternatives.

- "…. effective risk requires not just clear conversations between analysts and decision makers and careful communication to others of the final outcomes and decisions; it may mean careful involvement of key stakeholders early in the framing of a problem so that significant concerns are identified early on." Here two important points are of direct relevance to MUTP planning: (1) the acknowledgement of the importance of 'framing and resolving a wider policy question is *not* just a technical task, but a social and political process' and (2) the acknowledgement that 'effective communication along the way can often be just as important as the identification and characterisation of risks and their uncertainties.

Transparency

- Clinical medicine and environmental health fields have each pursued approaches that "…reflect attempts to establish more systematic and transparent processes for identifying relevant data, for assessing risks and benefits, for evaluating the uncertainties and ultimately the adequacy of the database for supporting the decisions at hand. They have played an important role in allowing institutions and countries to work more efficiently toward shared and consistent approaches to assessing risk. ….. (and) can be an important factor in gaining public credibility and trust in the institutions and decisions they make." These patterns and approaches to collaboration offer potential lessons for MUTPs wit, indeed something similar is to be found in 2007 UK government proposals for Infrastructure Policy Statements.
- The key generic lessons offered by the UK BSE cattle disease experience include: (1) avoid concealment; (2) avoid risk communication strategies that assert full certainty, or risks to be zero, when uncertainties remain, are unsustainable; (3) responsibility over risk assessment of product safety and commerce/ industry needs to be independent and seen to be so; (4) risk perceptions and different perspectives need to feed into *all* stages of risk assessment and management, by engaging in communication with different stakeholders; and (5) communications *only* after decisions are made needs to be avoided. This overall emphasis on transparency, awareness, engagement and communication is well made for MUTP planning and more broadly for the newly proposed Infrastructure Commission for the UK.

Commentary on lessons: their identified relationships of relevance to MUTP planning

Complimenting the above, the text below summarises *some* of the relationships/ links among the principal lessons extracted from Dora et al's contribution that appear relevant to MUTP planning. These relationships are visualised in Figure 12.

Link 1: Uncertainty – Decision Making - Risk - Cost Benefit (Risks). Most decisions are made with a level of uncertainty that as result pose risk. Decisions are then made with the aim to strike a balance between good and harm. However, neither

the likelihood nor severity of the outcomes may be known for certain at the time of the decision, which itself is a fact that pose risk. Translated to MUTPs, these linkages present the same kind of outcomes.

Link 2: Scale – Populations and Individuals – Complexity. Decision making for populations is more complex than decision making for individuals whether it be in public health or other sectors/ disciplines. This is an obvious but important fact. Furthermore, benefits do not always accrue to a group of individuals but *may* benefit society as a whole. The identification of these (community) benefits is, however, typically a complex exercise yielding, in many cases, no quantitative evidence to support conclusions arrived at. These two observations, although made in the field of public health, resonate in the assessment exercises of the impacts of MUTP on both communities and individuals.

Link 3: Complexity – Scientific Evidence - Stakeholders. Complexity systems are typically characterised in public health by more than one cause and effect relationship. At the societal level, this is where a multiplicity of stakeholders exists. MUTPs too involve a large number of stakeholders, more than most other types of construction project, primarily because they represent the most complex type of transport infrastructure projects.

Link 4: Uncertainty and Complexity – Scientific Evidence. Public health planning employs key concepts in decision-making similar to those of MUTP planning. In the case of the former, there is a requirement for a strong foundation relying on empirical evidence and quantitative analysis and effects of interventions are (where possible) measured by statistical sampling. In MUTP planning scientific evidence is becoming less prominent as the ultimate basis for decision-making, although still very influential.

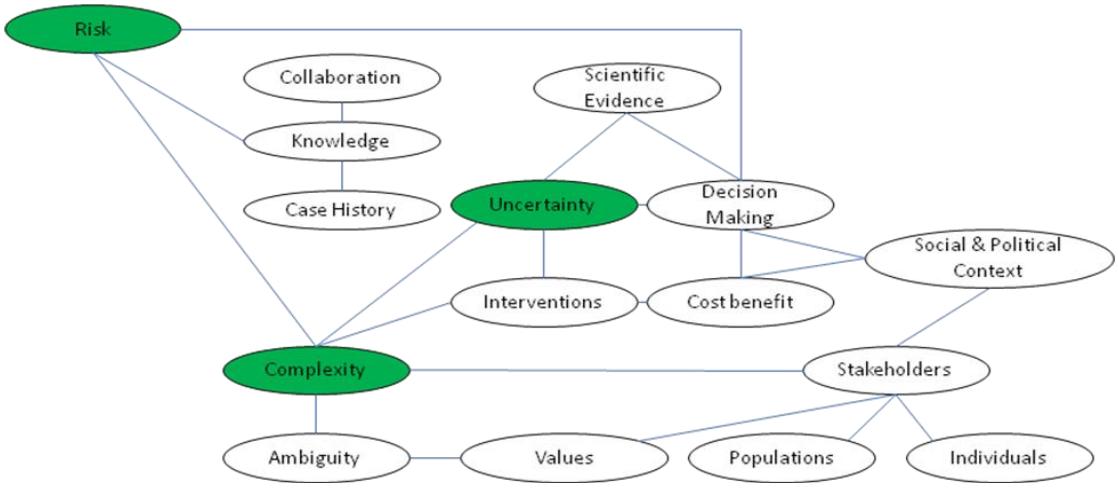
Link 5: Risk – Scientific Evidence - Decision Making and Stakeholders. When faced with risk trade-offs, effective communications between scientists, decision makers and stakeholders become all important. This also applies in the case of MUTPs where stakeholders are typically very numerous and can frequently change leading to the assessment of risk trade-offs becoming very complex (and sometimes costly) exercises.

Link 6: Case History – Knowledge – Risk – Path dependency. The sharing of case histories can provide a rich database of information on risks and complexity. Some professions (such as those engaged in public health and medicine) have well developed systems for quantifying experience of risks and relating them to key contexts so as to provide a valid pool of context-specific knowledge. The system is inevitably path dependent, so the relevance and effects of this evidence are limited by the correct respect for context. A system which has identified the key contexts, potential risks and interdependencies or risks and contexts in public health planning could potentially prove to be of great value to MUTP planning.

Link 7: Decision Making - Complexity – Uncertainty - Ambiguity – Values and Perceptions. Differences in decision-making in the interpretation of risks in public health due to different stakeholder values can cause ambiguity and contribute considerably towards further complexity in the understanding of cause-effect

relationships and uncertain outcomes of interactions of these relationships. This emphasis on ambiguity in decision making highlights the importance of 'perceptions' in risk identification exercises. It needs to feed into all stages of a risk assessment in MUTP planning exercises wherever possible.

Figure 12: Treatment of RUC in public health: lessons for MUTPs



4.2.7 *Corporate world - trust (S. Currall and A. Inkpen, 2006/2008)*

Theorising trust

- Currall claims that "trust remains an under-theorized, under-researched and therefore poorly understood phenomenon" and that this in part is because it has been a fairly Balkanised field. This claim has significant implications for MUTPs because: (1) they involve many joint venture arrangements and different disciplines/professions with their own specified areas of expertise; (2) of the use *and* abuse of rhetoric in promoting visions of MUTPs and their associated developments; and (3) reputation-building and transparency in decision-making is highly important for the promoters of such projects.

Contexts and levels

- The case is made for more attention to be paid to the evolutionary nature of complexity and the dynamics of trust over time (and place) and how it is impacted by organizational context. It is also posited "that trust at one level serves as the organizational context of trust at another level." For MUTPs this argument about organizational context can be extended to national, regional and local government policy contexts.

- The observation that trust 'travels' across levels and involves both 'reliance' and risk where trust is defined as "the decision to rely on another party … under a condition of risk." This identification of the relationships among trust, reliance and risk is of critical importance to MUTPs where trust *must* exist within consortia and joint ventures because of the mutual reliance among the public and

private sectors, and between the project promoters and relevant communities for an MUTP to achieve its objectives and succeed.

- The conceptualisation of trust applies "to persons, groups and organisations …… from the inter-personal to the inter-group to the inter-organisational level." For MUTPs, this works through a mix of informal personal relationships *and* formal pacts, partnership agreements, joint ventures, consortia and contracts. In any agreement or arrangement trust is always a two-way street in which each participant is both a 'trustor' and a 'trustee'.

Measurement of trust and reputation

- "…. in a relationship trust starts around the zero point of neither trust nor distrust because (typically) the parties lack information about the trustworthiness of their counterparts …. the development of trust is often slow and incremental because parties tend to be reticent about trusting". This is especially true of unknown parties or parties about whom there are associated uncertainties. "This theoretical position is not tenable with groups of stakeholders (public, private, individuals, groups etc.) who are already networked in relation to perhaps unrelated matters. They do not here start with zero information about each other, and therefore do not start from a zero point or totally neutral position. Track record (reputation) is often seen as a means to determine the trustworthiness of an individual, group, organisation or network. In reality 'trust' starts not around the zero point but at a positive or negative position, depending on perceptions of each party based on past performance." The history of trust can both make and break partnerships for once a reputation has been seriously tarnished it can certainly be very difficult to recover to a position where trust can once again be established. To an extent more formal contractual agreements can be substituted where trust alone is insufficient foundation for action. All these areas of analysis are totally un-researched in the field of MUTPs especially from a macro perspective and yet most important.

Vigilance and transparency

- It is claimed that in the corporate world "trustors are quite vigilant of the trustee's behaviour and are constantly updating and recalibrating judgements regarding the degree to which another party can be trusted." The higher the dependency on trust the greater the vigilance of the trustee by the trustor. What is strange here, however, is that when forecasts of the performance or patronage of an MUTP is discredited (as they often are) the issue of mistrust (of the MUTP patron for whom the projections are prepared) does *not* arise but instead a new set of figures are requested that 'better fit the bill'. One possible explanation for this is that the models from which such forecasts are derived are seen as impersonal, produced by an independent third-party and not the MUTP sponsor. They (the projections) are, in other words, therefore not objects to which trust can be ascribed.

- It is claimed that in the corporate world "if the board of directors of one partner firm issues a policy that is designed to withhold information from the other partner firm, groups or individuals may see this decision …. as evidence of untrustworthiness." In the context of MUTP planning, this principle must also surely apply, especially in public-private partnerships. Yet, the withholding of

information by the private sector from the public sector in a project they are mutually involved in is common and would (in the corporate world at least) constitute a 'contamination of trust.' A recent case comes to mind where a UK train operator prevented a public sector partner responsive for strategic infrastructure developments from conducting a travel survey on the platforms of the train company's stations on the grounds that the information the public sector agency would gather, if disclosed, *may* harm its commercial future. This is surely 'having your cake and eating it'! For in the corporate world, the "effective flow of information" among parties in a joint venture promotes trust, while technology advancements increase the scope for data sharing. The above tale of the transport operator in a public/private arrangement illustrates the danger of the flow of information becoming biased in one direction. The public partner may have to be wary of this pitfall in MUTP planning in the future if opportunities for lesson-sharing and learning are not to be lost.

Intricacies of the trust construct

- Priorities for future study of "the intricacies of the trust construct and how trust and the inter-personal, inter-group and inter-organizational levels co-evolve over time" include: (1) understanding the impact of organizational context on trust; (2) conducting multi-level empirical analyses of organisational phenomena; (3) capturing information about the complex nature of trust by triangulation measures and (4) identifying where trust is strong and weak, thereby assisting collaboration, flexibility and financial performance . Such research could prove invaluable to MUTP studies given the multiplicity of stakeholders such projects typically involve. It may, however, only really be possible to identify and comprehend these intricacies through less conventional methods if investigation, including story-telling and narrative pattern analysis.

Levels and types of trust

- The point is made that "trust research should move beyond single snapshots of inter-personal, inter-group or inter-organizational trust" but shift toward multi-level analyses of trust and the co-evolution of trust over time from one level to another. This would "reveal reciprocal and bi-directional linkages whereby trust at the inter-personal level may lead to inter-group trust, which may in turn, spawn inter-organizational trust or vice versa … yielding a textured understanding of the intricacies of the trust construct." The challenge here is whether such a theoretical framework could assist in the longitudinal analysis of trust among multiple major stakeholders of a mega project which has been planned and executed by a mix of public and private sector bodies, working within a common planning and regulatory framework. The issue of identifying strategic trust areas , stakeholders, and trustors/ trustees in relation to the many key decisions and events that take place in MUTP planning and delivery remain, however, very problematic.

Commentary on lessons: their identified relationships of relevance to MUTP planning

Complimenting the above, the text below summarises *some* of the relationships/ links among the principal lessons extracted from Currall and Inkpen's contribution that appear relevant to MUTP planning. These relationships are visualised in Figure 13.

Link 1: Trust – Risk – Success. Trust is defined as "the decision to rely on another party under the condition of risk to achieve success". This conceptual construct is critical as it directly links trust to risk and highlights the reliance of success on such trust. It is most relevant to MUTPs given the many parties involved in MUTP planning, appraisal and evaluation abd where trust *must* exist between joint venture parties, public and private sectors, and between project promoters and community representatives. "The degree of trust amongst parties is dynamic and can change during different stages of the project. Success reinforces trust, whilst failure damages it." From recent events in the financial markets we may note that trust and success do not have a linear relationship, whilst the relationship between trust and risk much more likely to be linear.

Link 2: Risk - Trust – Transparency. Hiding information from collaborating parties can be seen as evidence of untrustworthiness in the corporate world. Transparency between stakeholders thus relies on trust; the greater the degree of trust between parties the more likely the transparency. These principles and relationships are most important to MUTP planning where the public sector has engaged the services of the private sector to deliver a major project within the PPP framework.

Link 3: Market Dynamics – Trust and Transparency – Regulatory Frameworks. Market dynamics tend to discourage commercial organisations from sharing information that does not put their product in a good light. This lack of trust is derived from the increasingly competitive world we live in, where information which could help reduce product and project risks and uncertainty is not always forthcoming. Recognising these limitations, governments have introduced regulative frameworks designed to force transparency where a lack thereof is deemed damaging. MUTP experiences have shown that the early flow of information among MUTP partners and the communities regarding their project impacts is likely to promote more trust and reduce opposition to proposals than when concealing relevant information from affected parties. Such projects are also increasingly appreciating the importance of regulative frameworks to help guide their planning and implementation.

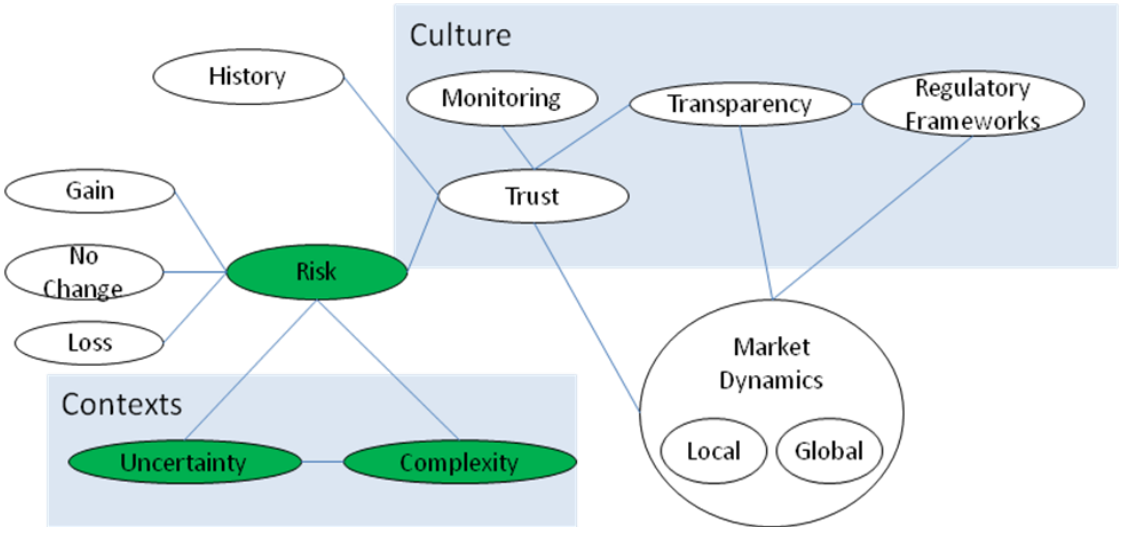
Link 4: Trust – Risk and Uncertainty – Complexity - Trust. Trust is directly related to the relationship of risk to complexity in the following way: the more risks a project poses, the more trust it requires from its stakeholders, particularly leading stakeholders. The greater the complexity of the project, the more uncertainty it generates and the more risks it poses, and the more trust it requires of the parties involved in its planning and delivery. The fact that MUTPs are typically very complex suggests that they are more likely to spawn more uncertainties and risks than smaller more straightforward projects.

Link 5: Trust – Path dependency - History - Trust (reputation). The history of trust is very important in the corporate world. In this sense, trust is path dependent as it is earned through demonstrated qualities or actions from a past context. Trust is therefore in part context-specific in that failed relationships could be attributed to conditions of the past context rather than the quality of the relationship itself, so that trust between the same two parties may fair much better in a new more amenable context. Be this as it may, the low level of trust developed in the old context will

remain as a legacy and take much more effort to overcome than in instances where no such history exists. This problem may particularly occur when old failed projects are rejuvenated into viable MUTPs.

Link 6: Trust – Monitoring – Risk. The corporate world advocates that trustors be vigilant of trustee behaviour and that they should therefore monitor on a regular basis the trustee (transparency permitting), and update judgements accordingly. Cultural and national expectations of transparency can be moulded by history so that a country with a history of limited regulative intervention can make such action more critical than a culture/ country where regulative frameworks are more effectively enforced. This call for vigilance appears not to be heeded to any great extent in the field of MUTP planning practice as overly optimistic forecasts, subsequently proven to be widely inaccurate, do not appear to lead to an erosion of trust in the consultants responsible for their estimation. This is in part due to the large timescales involved in MUTP delivery, the numerous examples of goal post movement, plus the continually changing masks used by many companies within the MUTP industry which make it very difficult for patterns of failure to be recognised and levels of trust to be downgraded appropriately.

Figure 13: Treatment of RUC in the corporate world - trust: lessons for MUTPs



4.2.8 *Corporate world - innovation (O. Sparrow, 2008)*

Knowledge sharing

- The first set of major areas of knowledge-sharing highlighted by Sparrow that is of generic relevance to MUTPs include: (1) the importance of 'insight' to counters business/ project failures; (2) the growing significance of grappling with 'intangibles'; (3) the importance of 'renewal' in a world of enhanced potential and greater competition; and (4) human resource issues posed by the above challenges. All these are central to our critical review of the planning, appraisal and evaluation practices of MUTPs world wide. This is so given that one learns as much (if not more) from failures than successes and because MUTPs involve a multitude of intangibles in decision-making. Also because innovation, together

with a critical appreciation of the context of the need for innovation, is the key to sustained success in a competitive world; and development of social capital and expertise to service and support the above all apply to the field of MUTP development.

- The second set of major areas of knowledge-sharing highlighted by Sparrow considered to be of generic relevance to MUTPs include: (1) his discussion of 'model creation' - i.e. forming an understanding of the operating environment (of commerce/ projects) and being able to interpret events in it; (2) his treatment of 'value definition' – i.e., deciding on what is desirable, what is to be avoided and on setting balances between these; and (3) his examination of 'option identification' in the light of the values expressed and information available, selecting: what is possible, what priorities to set amongst options and what consequent actions to take. Here Sparrow cites the narrative as an invaluable source of knowledge-building and gathering.

Commoditisation and identity

- The use of 'commoditisation' as a term (i.e. the process whereby product selection becomes more dependent on price rather than differentiating features, benefits and value-added services) is similar to homogenisation (i.e. the act of making something uniform in composition). Both processes may be triggered by 'tipping points' (i.e. the point at which a single idea, product or ideology suddenly takes off and is embraced by a very large number of persons to the point it become a force in its own right). Such developments can lead to issues of identity as fashions, beliefs and ideas become increasingly similar, and insensitive to context. MUTPs, especially those which act as major agents of globalisation exhibit characteristics of sameness because they often rely on template thinking of global technical and financial expertise, and are products of their own path dependence. They are, furthermore, frequently generators of economic and social restructuring built around global norms and markets rather than local needs.

The madness of crowds

- Sparrow's reference to the notion of the 'madness of crowds' contrasts markedly with that of the 'wisdom of crowds' as promoted by Surowiecki and referred to by other contributors reviewed in this report. In other words, we may on the one hand have 'the rule of the mob' or on the other hand, 'collective wisdom'. The validity of each, it should be emphasised, depends on context or the point of view of the observer, if not both. The label may also be retrospectively attached on the basis of whether it accords with, or contradicts, the observer's own preferences. Putting these observations into the context of MUTPs, and the extent their planning and delivery should pay more head to specialist expertise rather than non-experts, raises questions regarding the validity of the notion presented by many MUTP investors that excessive public opposition to their project(s) represents 'the rule of the mob' rather than 'the wisdom of crowds' that can only lead to long and expensive delays rather than an improved project.

Definition of 'the project'

- The McKinsey conclusion that in project development "around half of all costs were incurred in 'project definition' is most relevant to MUTP planning for while it may not be literally true for heavily capital intensive projects, there is growing evidence (particularly in the UK) that project definition (and sometimes the lack of it) it is a significant proportion of the total project cost. This is so because MUTPs are prone to long pre-construction gestation periods involving considerable resource expenditure on viability/ feasibility studies and on the preparation of arguments for/ against projects which, for the time being in the UK, proceed through the democratic process. Currently there are proposals designed to 'streamline' the government planning procedures for mega projects and it is debatable whether the UK Government's proposed Infrastructure Planning Reforms will actually reduce such 'costs', or whether they will stimulate a large number of legal challenges.

Sense-making of context

- The statement that an organisation needs to better understand its operating environment is another way of saying it needs to 'sense-make' the context(s) (at different levels) in which it works? This re-emphasis on the importance of the context of any decision-making has great resonance with MUTP planning. MUTP stakeholders need to scan a diverse (and changing) set of contexts in their planning stage so as to develop robust and sustainable strategies for MUTP delivery and the planning of associated developments.

Insights, grand ideas and leadership

- Sparrow calls for a greater appreciation of the value of insights for the better handling of intangibles. This is highly relevant to MUTP planning for insight counters failure. Procedures that generate insight should be a valued part of any planning process or organisation. Lessons need to be learned from the corporate world and beyond what the best tools that create, harness and/ or propagate insight and how to recognise, correct and/ or quash failure in its early stages.

- Much of the discussion in the paper is about the management of change (which is a form of planning) yet the term "planning" is only used once. This may be symptomatic of the prevalence of short-term thinking that inhabits most areas of commercial and corporate life. MUTP planning cannot, however, afford to adopt such a stance. Notwithstanding this most prevalent position, there are powerful global/ multi-national industrial/ commercial concerns that *do* pay a great deal of attention to the 'long view'. Leading analysts in Shell led the way in the use of scenarios in corporate planning with some significant success in the 1970s but with limited lasting impact, it would appear, given recent developments in the oil industry and renewed energy crisis.

- The claim that "it remains the case that relatively little innovation derives from 'the grand, bright idea'" is particularly contentious in the context of MUTPs where many such projects are driven by 'visions' promoted by particular champions. The validity of the claim that the grand idea has limited influence

ultimately depends on how one defines 'grand/ bright' ideas. In the business world, there is a constant appetite for any idea that offers the prospect of competitive advantage. Those that emerge are often sourced and adapted from other sectors or disciplines. A prime example is Business Process Re-Engineering which was seized upon in a wave of enthusiasm in the early 1990s only to be found wanting when its treatment of context came to be revealed as over-simplistic.

- According to Sparrow "as the knowledge economy develops, so much of the efficacy of large organisations will be set by their capacity to create and manage insight." This is an important observation for MUTPs. Many MUTP organisations are not geared up to sharing knowledge about insight. Indeed, parts of such organisations can remain resistant to the sort of change suggested by insights associated with another part of the same organisation or consortia of organisations. People can be very resistant to change because it takes them out of their comfort zone. It is easy to theoretically see organisations as dynamic organic wholes when in fact they are more typically driven by multiple and not always compatible individuals, teams, and divisional agendas. The quality of leadership in this context becomes vital in the alignment/ re-alignment of projects and organisational objectives and aspirations.

- Individual personalities have an influential role to play in determining the success and failure of projects and organisations. "There has been considerable research into the cognitive styles of people who rise and thrive in large organisations. For purposes of discussion, the many types that are found can be collapsed into two categorises, the *Hedgehog* and *Fox* personality types. People who can be classified as Hedgehogs are happiest in a closed problem domain, in which standard tools and focused effort allow them to compete with their peers. Foxes, by contrast, are at their best exploring new terrain, developing alternative strategies. Their goals are largely internal and seldom benchmarked by competition against their peers. Groups of Hedgehogs constitute wonderful engines by which to deliver against unambiguous tasks and tight deadlines. Groups of Foxes neither enjoy such tasks nor perform well at them … Hedgehogs are often baffled, and perform at worse than chance, when asked to extend the borders of their current activities, to predict events and to mitigate new sources of risk. Foxes excel at such tasks". This account of personality types offered by Sparrow is invaluable in understanding the driving forces behind decision-making for MUTPs. Evidence suggests that each personality type has its own important role to play in MUTPs. Both types of personalities are needed to plan and execute these projects effectively. The real question has to do with leadership – i.e. whether to rely on Hedgehogs or Foxes, and when? Many if not most MUTPs are planned as closed system projects, managed and operated largely within a project management culture reliant upon Hedgehogs rather than Foxes. This is despite the fact that these same projects have typically been spawned by Foxes and that Foxes are often called upon to intervene where/ when the project management culture fails or is found to be wanting in dealing with open system considerations such as concerns about the social, environmental and political impacts of MUTPs. Here the qualities of the Fox excel over those of the Hedgehog. Their qualities do not, however, extend to an ability to deal with the multiple technical challenges and schedules of project implementation. This is the

domain of the Hedgehog who ultimately requires the project to be frozen in one point of time for construction purposes until it is completed, after which it may be viewed once again as an open-system, interacting with its environment and the communities it serves.

Commentary on lessons: their identified relationships of relevance to MUTP planning

Complimenting the above, the text below summarises *some* of the relationships/ links among the principal lessons extracted from Sparrow's contribution that appear relevant to MUTP planning. These relationships are visualised in Figure 14.

Link 1: Tangibles – Best Practice - Commoditisation. Concentrating on the tangibles can lead to the formation of what is called 'best practice' – this being determined by a series of guidelines on how things 'ought' to be done to gain the greatest economy or measures of success. Such guidelines are often prescriptive and independent of context. Establishing whether 'best practice' guidelines can be legitimately applied to MUTP planning, appraisal and evaluation exercises and if so to what extent, is at the heart of the research conducted here. The critical underlying question here is when and where can 'best practice' guidelines be followed and when and where should innovation prevail? This evaluation needs to bear in mind the fact that such guidelines can possess path dependency characteristics can contribute to homogenisation and loss of identity. It would seem from our understanding of current MUTP practice that innovation is high in the financing, collaboration and planning stages of MUTP developments and that 'best practice' path dependency practices are more common in the pre-project appraisal and project delivery stages of MUTPs.

Link 2: Tangibles and Commoditisation – Cost Cutting - Competence. Cost cutting is a common form of optimisation of tangibles frequently seen in the corporate world. It can have negative effects if it reduces the size of its organisation and thus the capability of a company, or if the pressures for cost cutting lead to unrealistic performance estimates. A particular problem for MUTPs in that they are typically quite unique. It is consequently difficult to maintain (within a company) the right sort of expertise over lengthy periods, hence the concentration by MUTP sponsors on short-term contracts with experienced (path dependent) consultancy groups approach for the planning and delivery of such projects.

Link 3: Insight – Informed Decisions and Uncertainty. Improved insight into decision-making in the planning, delivery and operations of MUTP reduces risks. The more relevant knowledge gathered, the less the uncertainty and the more likelihood of successful decision-making for projects set in similar contexts/ circumstances. Each MUTP has its own characteristics and very unique context. So the ability to pass on lessons from one project (and context) to another has to be carefully monitored to ensure that 'false' lessons are not transmitted and accepted without challenge.

Link 4: Commoditisation – Innovation - Risk. Commoditisation stifles creativity and innovation and threatens identity. This is especially true where decisions are made by small elite of experts either within of from outside an organisation that lacks insight and innovation qualities. The impacts of the outcomes of such advice can lead to negative effects on the success of the organisations performance and it's

stakeholders as the entities become unresponsive to new threats and risk. These lessons hold good for MUTP stakeholder organisations, especially those that excessively rely on the wisdom of experts.

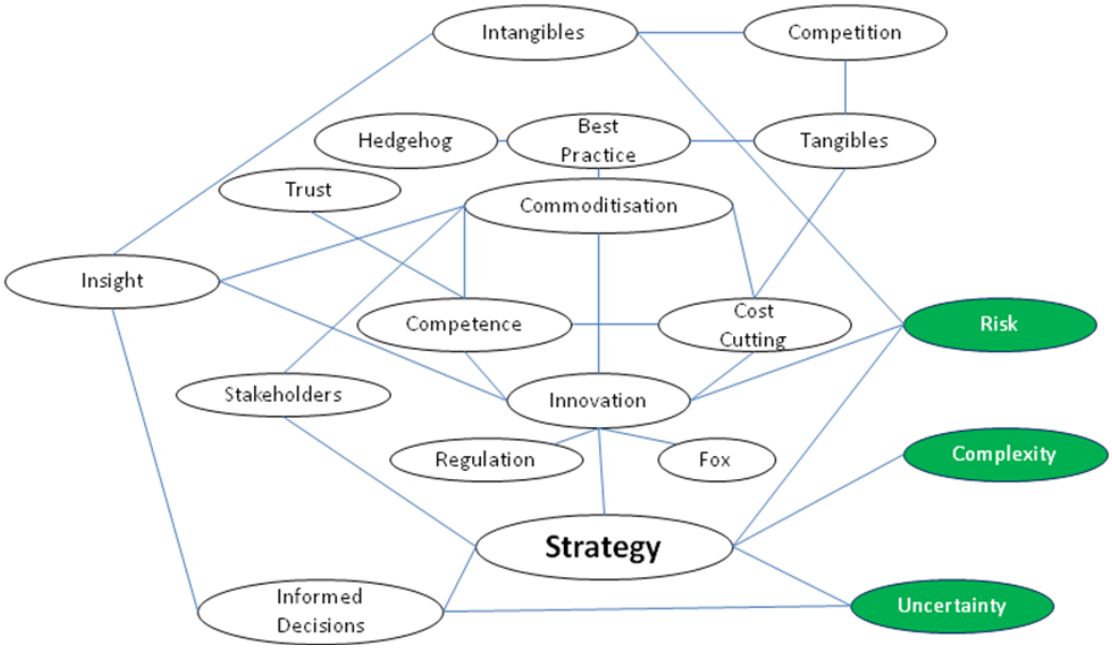
Link 5: Strategy – Risk – Uncertainty – Complexity - Innovation. The formation of a strategy to cope with RUC is key to allowing informed decisions to lead to innovation responses to challenges and to help overcome the effects of uncertainty and complexity. In the context of MUTPs, it is particularly critical that the adopted strategy is practical, understood and accepted by *all* important collaborating players/ stakeholders. The strategy in other words needs to be owned by all key parties and share a common set of goals/ objectives and policies.

Link 6: Hedgehogs – Commoditization – Innovation. Conflicted commoditized organizations are bad at innovation and spontaneous adaptation. Individual character types play a role in this. Sparrow strongly connects the 'Hedgehog' character type with commoditization. Hedgehogs are happiest in the closed problem domain where standard tools, focused efforts, and best practices and path dependency prevails and very often manage/ oversee the planning, appraisal and delivery of MUTPs. The character and personality of such leaders' frequently dominant MUTP outcomes despite dissenting (less powerful) voices within these structures. .

Link 7: Innovation – Foxes - Risk. Innovation comes from individuals within an organisation – that has a personality type characterised by the fox. These individuals operate in flexible networks and make an essential contribution to innovation. They are good when predicting the outcome of new events, and mitigating risk. They are, however, stifled when Hedgehogs dominate. MUTPs have been characterized by a leadership provided by project managers that have a Hedgehog mentality which treats MUTPs largely as closed systems and pursue a risk adverse approach to project planning and delivery. Where/ when this closed approach fails or falters (sometimes as a measure of last resort), the Foxes come into their prime. In other instances, Foxes become the champions of such projects.

Link 8: Competence – Risk - Commoditisation. There is a risk that the most competent parts of an organisation can become its elite, shutting off itself from the rest of the organisation, raising the risks of failure, leading to commoditisation. For MUTPs this dependency on an elite (and its specialist advisors) can lead to a situation where its views are rarely questioned, even when demonstrably wrong, and in a manner that is completely void of wider stakeholder interests.

Figure 14: Treatment of RUC in the corporate world - innovation: lessons for MUTPs



4.2.9 *Corporate world - knowledge management (D. Snowden, 2008)*

Generic assumptions and homo economicus

- In Snowden's identified three generations of thinking and practice in knowledge management, reference is made to the "emergent age" which "rejects the concept of knowledge as existing in tacit or explicit form but instead stress the greater importance of "context" over "content". This statement calls into question the value of generic lessons unless they are couched in neutral terms that are conditional on context. This introduces tensions between advocates of 'best practice' guidelines and project templating, and those who claim each case is unique because of context. The debate, and outcomes of research into this debate is most important for the comparative study of MUTPs where we see "context" (in terms if place, time, culture, ideology, government etc.) as being critical to differentiating what lessons may be considered generic and what are context-specific.

- The belief that the reasoning of 'economic rational man' (*homo economicus*) who primarily makes decisions based on an economic assessment of available data on the basis of personal self-interest prevails over all other kinds of human behaviour is challengeable. It is a proposition that many academics, technocrats and policy makers alike ritually follow even though they are uncomfortable with the realities of this premise. In the context of MUTPs, the question must be posed why this is the case, what adaptations to the planning, appraisal and evaluation processes do MUTP stakeholders make to modify this theoretical (ideological) premise and at the end of the day what kind of rationale generally prevails in such decision-making?

Ordered systems

- In 'ordered systems' repeating relationships between cause and effect these relationships can often take on a life of their own – much like credit cards (as in the case of traffic growth leasing to the self-fulfilling prophecy of generating a need for more infrastructure). There is food for though here for MUTPs, for *if* we consider such projects as 'ordered systems' (as opposed to emergent ones) there is evidence to suggest that MUTPs both spawn subsequent MUTPS and contribute toward the homogenisation of their context and movement characteristics. This of course depends on the scale, cost and controversy factor surrounding particular types of MUTPs?

Knowledge management

- The point about "physics envy" and the "confusion of correlation with causation" is well made. It is especially prevalent in the traffic and transportation/engineering field and even in some aspects of urban and regional planning, and most definitely in MUTP planning, appraisal and evaluation. There is an interesting contrast here though between those who see planning as a 'science' versus those who see it as an 'art'. Planning does *not* sit firmly in either camp – it is a mixture of the two. The 'art' component is the realm of judgement, vision and insight. Whereas, science has its part to play in the delivery of spatial development, the 'art' is in understanding the social, environmental, and economic impacts of that development.

- The claim that "the resolution of a problem in (terms of) quantum mechanics *cannot* be achieved by more diligent attention to detail in the application of Newtonian physics" and that "numbers have pseudo-objectivity … (and) often lack interpretative context" because it confuses correlation with causation" poses major problems to the state of the art of MUTP planning. The lessons here are two fold. Firstly one has to employ analytical tools and techniques that are appropriate to the specific situation. Secondly, humans do not rely at all heavily on traditional data in the form of facts and figures but rather on gut feeling and awareness of (particularly political) context(s).

Hindsight and best practice

- The reference to "retrospective coherence" (hindsight) and "best practice" is highly relevant to MUTP research. Looking back it is possible to attribute causes that could not have been predicted beforehand. The point here is that one can only learn so much by looking back at past history if one accepts that context is all powerful. So, we might argue that the value of past history is to give you insight into the type of: systems that *might* be valuable in processing or delivering future MUTPs, the impacts that *might* be encountered, the type of stakeholder reactions that *might* be faced; spatial and policy-based plans that *might* be effective in association with a MUTP; and so on. Past history can *never* be a prescriptive force if one accepts the power of context as a given.

- The two statements regarding hindsight and best practice are most important for MUTPs. 'Best practice' has its place. This place is, however, *restricted* to highly-ordered stable situations. The 'evolutionary pressure' to deal with high levels of uncertainty has meant that "the avoidance of mistakes is a more effective strategy than the imitation of success." This tells us that whilst we can replicate physical MUTP infrastructures, we *cannot* reproduce their impacts and outcomes as the context is *always* different and in a constant state of flux.

Correlation and causation

- The "heavy dependency on correlation techniques and the subsequent danger of confusing correlation with causation" as highlighted by Snowden is endemic to the field of infrastructure and spatial planning practice, and especially so in forecasting exercises for MUTPs.

- The premise that "humans make decisions on a first fit pattern match, either with past experience or hypothecated future experience" and that they choose a 'satisfying' rather than an 'optimising' strategy which represents a "first fit" rather than "the best fit" solution is pertinent to MUTP planning. Few, other than politicians perhaps, would ever claim that a particular solution is 'optimum' in the face of changing contexts. The claim that 'chasing the 'optimum' solution is a futile exercise. And that "it is more appropriate to devise robust strategies that can remain relevant in the face of change, or that are resilient and can be readily adapted better to fit the changed context" resonates with the practice of prudent MUTP planning.

Path dependency

- The importance and influence of peer group pressure and perceptions is most important in the professional worlds of engineering and planning, particularly as applied to MUTPs. This tends to generate path dependency, perpetuated through professional education and institutions that leads to 'templated' solutions and visions for the future, and a set of circumscribed expectations. In the UK in particular, control from the centre typified by the setting of multiple targets by Government together with frequent changes in policy have led to a situation where few in the public services feel they have a reasonable degree of freedom to derive solutions that are anything other than a 'template' compliant. This contrasts with earlier decades when planning authorities had rather greater local autonomy.

The narrative

- The assertion that much of our social history (and knowledge platforms) is most effectively captured through the narrative and that "these stories are fractal in nature" adding to "…the complexity and importance of understanding" suggests that sense-making from the richness of narrative is one route to better understanding complex decision making behaviour. Within this we can include MUTP planning.

- The pursuit of narrative methods based on scientific principles suggests: (1) naturally occurring stories come as fragmented anecdotes (and thus have their

limitations); (2) a story is always told in a context which is typically under-acknowledged (sometimes out of convenience); (3) the researcher first looks for patterns in the metadata using statistical or visual tools, and (4) that these are less likely to be biased by content and prematurely to converge on a specific interpretation. The implications of the above for the collection and analysis of narrative materials regarding MUTP decision-making and the use of such information for compare and contrast analyses of case studies pose major challenges in research methodology.

- The claim that "the narrator and listener assume shared context for any statement to have meaning" and that this is difficult to support since no two individuals perceive the same context in precisely the same way. This challenge to the basics of compare and contrast analysis become relevant to MUTP case study research and efforts to disentangle generic from context-specific lessons

- "The rejection of the supposed independence of hypothetical-deductive approaches to investigations in favour of engagement" is a significant step in the study of behavioural systems and very relevant for MUTP decision-making analysis. It suggests that pre-hypothesis research methods and the use of the narrative represent important sources of new knowledge. The narrative researcher's response to challenges of lack of objectivity is not to attempt 'objectivity' but to argue that "meaning is a social construction in which the researcher engages" and this is an important repost to the techno-rationalist engineers, economists and planners.

Complex adaptive systems

- The concept of a "complex adaptive system" (CAS) and its inherent unpredictability (given that "it will *not* return to an equilibrium state after it is disturbed") is at the centre of the debate about the impact and outcomes of MUTPs. The design of an MUTP evolves as requirements, opportunities and constraints are moulded through the intervention of an array of stakeholders. Eventually a design is 'frozen' for construction to begin, and changes to the design are kept to a minimum to minimise disruption to cost and the schedule. The MUTP in this sense becomes a component of the complex adaptive system into which it is placed. There is continuous two-way interaction between it and the rest of the system, and its environment, that generates impacts and outcomes that are different from those that would have otherwise occurred. The problem lies in isolating and attributing those differences. Here (CAS) systems adapt to proximate interactions with other agents and their environment, and "any order or structure is 'emergent' and *only* repeats itself, if at all, by accident not design" while no linear causality *inevitably* exists between two seemingly related events. Such correlation errors "tend to attribute cause where no cause exists." These two propositions, turn any form of path dependent thinking on its head, and, more particularly, orthodox thinking about MUTP developments and practices in traffic and revenue forecasting.

Weak signals and unintended consequences

- The concept of the "weak signal" is where "something after the event is seen to have significance that is missed at the time" signals are emitted. This concept is most important to MUTP research as such signals, and the magnitude of their subsequent impacts, are notoriously difficult to spot before decisions are taken. Their existence and identification may not be a tenable reason for 'doing nothing' situations in the face of political and societal imperatives.

Commentary on lessons: their identified relationships of relevance to MUTP planning

Complimenting the above, the text below summarises *some* of the relationships/ links among the principal lessons extracted from Snowden's contribution that appear relevant to MUTP planning. These relationships are visualised in Figure 15.

Link 1: History – Causation – Knowledge - Best Practice – Risk. There is a general assumption within many areas of science and management of the existence of a history of repeatable and discoverable relationships between cause and effect within systems. And that this generates knowledge which allows for the definition of best practice and the creation of repeatable recipes for achieving pre-stipulated goals (the normative approach) which helps to reduce future risks. This premise is widely embraced by traditional MUTP planning practices and yet is challenged by Snowden on the grounds that it generates confusion between correlation and causation, and in so doing spawns additional new risks in decision making.

Link 2: Innovation – Tools – Decision Making – Risk and Uncertainty. The claim that through innovation, new tools can be constructed which give us new insights into uncertainty and decision-making which contribute to improvements, therefore reducing risks from poor decision making, is potentially highly relevant to MUTP planning. This claim comes with a health warning since not all such methods produce new tools that live up to the challenges they are intended to address. Nor do they necessarily posses the longevity required to enter into widespread practice. In fact, there are reasonable grounds to suggest that they are prone to 'fadism' and simply replace one set of path dependent tools for another thereby.

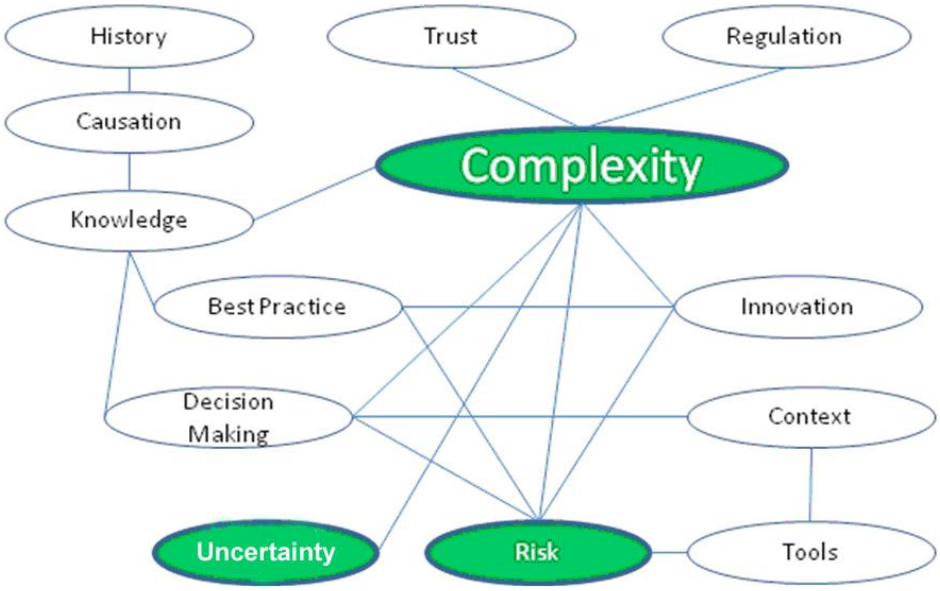
Link 3: Context – Tools - Decision Making. Tools can identify critical contexts which, via the process of knowledge management, can be used to establish shared contexts within organisations. Such shared contexts can improve decision making within an organisation, so long as their application recognises that contexts are fluid and can change rapidly over time. Shared contexts are often subject to a finite time limit and should be reassessed at regular intervals.

Link 4: Regulation – Emergence and Complexity. MUTPs can be vulnerable to political intervention in the form of regulation. Research in complexity science has found over regulation of an ordered system can cause conditions whereby the system shifts to being complex, or collapses into chaos. In a similar way, Political intervention introduced into an apparently closed system, typically attributed to an MUTP, may have unintentional effects beyond the borders of such a system, creating a new set of challenges within the open MUTP system.

Link 5: Decision Making and Innovation – Complexity. All decisions made within a system can have an effect on the system, by changing the boundaries of a complex system, or introducing new rules into the system, we can directly affect the complexity of the system. By the nature of a complex system, any changes to the system may not manifest themselves immediately. It is therefore important to continually monitor a system to understand the outcomes of rules applied to the system

Link 6: Experts - Distributed Cognition – Complexity –Trust - Risk. Experts are often used to assess and quantify risks within an MUTP project, but there are certain conditions under which distributed cognition can be used to solve complex problems, and reduce risk with much higher levels of success. A financial institution can transfer risk by lending to a self–regulating group of contractors who guarantee each others loans. Often such a system relies heavily on trust for success in such complex situations but there is potential for reducing project risks using such techniques.

Figure 15: Treatment of RUC in the corporate world - knowledge management: lessons for MUTPs



4.3 *Working Paper #3*

The summary/ discussion below of potentially transferable lessons in the treatment of RUC for planning MUTPs is derived from six commissioned contributions contained in 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. It is important to stress here (as in the case of Section 4.2) that although clustered under sub-themes of relevance to MUTPs, the quotations/statements and comments offered are *not* presented with any pre-diagnosed structure in mind but instead represents an *ad hoc* collection of observations provided in an attempt to seek out/ identify any emerging patterns where they exist.

4.3.1 *City systems - complexity: (M. J. Batty, 2007)*

The case for less invasive planning

- This paper advocates a "less invasive" type of planning, recommending a switch from thinking of cities as artefacts to systems that evolve. This conceptual shift it is argued represents a "slow march from the physicalism which dominated city planning …. to a concern for social process." The question of import here for MUTP planning (indeed any type of infrastructure planning) is how does this intellectual shift impact on the understanding of major infrastructure developments, especially those intended to stimulate the re-structuring of territories and economies, and the creation of 'new places'? Our interpretation here is that this new perspective does *not* deny the influence of large scale infrastructure developments but instead places more emphasis on the need to better understand their impacts and outcomes and accept that they are likely to be multidimensional, emergent and to a large extent unpredictable and most probably, unquantifiable in many instances. An MUTP is a case in point. It may introduce such a large disturbance within the 'city system' that it acts as a significant agent of change resolving some uncertainties but also creating new ones. It can also impart confidence and stimulate commitment from other decision makers and therefore becomes a key component in the context for other decisions/ actions, rather than being subjugated by the context into which it fits.

- The point is well made and accepted by us that the past practice of "casting most urban problems into …. narrowly defined (systems thinking) domains was simply not sensible or feasible" for city and regional planning as this in effect employs a 'closed systems' paradigm, albeit broader than that adopted by the traffic and transportation planner. The uncomfortable juxtaposition, however, and poor fit of this looser conceptualisation with that of mechanistic conceptual paradigms employed in the real world by most traffic and transport specialists and civil engineers in planning and constructing MUTPs represents the reality, and the source of many problems.

- It is claimed that "the order we observe 'emerges' from actions and decisions where individuals and agents respond to both their environment and each other, competitively and collaboratively from the bottom up." For MUTPs this highlights the need for such projects to be planned *both* from the top-down and the bottom-up, and that the scanning of their context(s) need to be continuous to enable judgements to be made about whether MUTP proposals remain appropriate in the face of changing contexts.

- Batty differentiates between planned interventions designed to attain goals of 'optimality' and those designed to attain visionary goals that go well beyond concerns of mechanistic operational efficiency (and the myths of equilibriums). This is most relevant to the appraisal of MUTPs where a balance needs to be struck between the role MUTPs have in contributing to future visions (of sustainable development, for example) and the strategic such projects might have in enhancing the operational systems efficiency of the overall transport network of which they are part.

Dynamics of systems, notion of equilibriums and tipping points

- If understanding 'bottom-up' evolution is crucial to complex systems, so too (Batty claims) is the comprehension of the dynamics" of such systems. In the simulation models of the 1960s and after, temporal dynamics were always acknowledged/ strived after and the concept of 'equilibrium' "in some senses regarded as a convenience." While we welcome the case for a 'bottom-up' approach to systems thinking that de-emphasizes any equilibrium concept, we contend that the notion of an 'equilibrium' still prevails within many/ most transport-land-use/ traffic modelling exercises. Accepting the equilibrium argument for MUTPs raises three questions: (1) whether the introduction of MUTPs would disturb what may be seen as 'acceptable' states of equilibrium; (2) whether they would help generate new levels of equilibrium; and/or (3) whether would represent the source of continuous forces of disequilibrium by virtue, for example, of the excessive traffic growth they may generate? Of course the answers to these questions much depends on how 'equilibrium' is defined - e.g. at what 'scale' in the city planning milieu. Change, and consequent movements away from a perceived state of equilibrium, could be argued to be taking place *all the time* as individuals/ groups/ organisations respond to changing circumstances (contexts). It may be that such change is very small and therefore hard to detect. Returning to Batty's premise, one could on the other hand conclude that any notion of equilibrium is necessarily transient when dealing with human and ecological systems – so transient that in some ways it may obviate the concept.

- The talk of 'system dynamics' causing turbulence which generates 'phase transitions' refer to circumstances that can often occur abruptly, "implying some form of threshold which if a system reaches or breaches, leads to qualitatively different structures and behaviours." These thresholds or 'tipping points' are a function of complex behaviour. They are inevitably 'emergent' and cannot be designed, nor can they be predicted with any degree of confidence. It is stated that 'phase transitions' are "associated with qualitative changes such as that generated often endogenously within the system … (including) the development of 'disruptive technologies' or dramatic switches in human behaviour and preferences" (p12§2:16-19). The question here is how does all this translate into MUTP developments?

Complexity of project, project impacts and network stakeholders

- Batty asserts that "complex systems can *never* precisely be defined" and that its components may be defined in a variety of states - with this number of combinations capable of elaboration in countless ways. On the case of MUTPs the multiple complexity is reflected in: (1) the composition of the project itself (sometimes so complex that its boundary defy clear definition), (2) the multiplicity and complexity of impacts in space and over time, and (3) the number and variety of complex stakeholder networks reacting to MUTP proposals.

Darwinian evolution

- Three important claims are made by Batty: (1) that "evolution from the bottom-up is a hallmark of complexity," (2) that the "kind of (complex) diversity we see

around us could *only* be generated by genetic variations that are consistent with neo-Darwinism," and (3) that "there is *no* way one might fabricate … such complexity." What Batty is seeking to explain here is that the growth and change of cities can be explained by a theory akin to Darwinian evolution and that the built environment is part of, and *not* outside that system. It is though important to appreciate that not all the built environment is 'fabricated' and that the physical infrastructure is a component of the complex system. Every element here takes its chances and survives or dies according to how well it performs within or adapts to the prevailing context. A challenging question this raises for MUTPs is whether the kind of change(s) spawned by the introduction of a major piece of infrastructure such as a MUTPs are *not* purely organic but instead "fabricated" bio-mechanical reactions akin to the impacts arising from biotechnical surgical implants which over time are either accepted as part of a new 'natural' development or alternatively are rejected with in the latter case, sometimes dire knock-on consequences for other parts of the whole?

- The claim by Batty that "we are scared of evolution, we find it (too) complex, and (are thus) reluctant to disturb something we do not understand" can lead to efforts to impose excessive direction and control over change. On the other hand, unfettered evolution *can* evolve into chaos, unsustainable outcomes and an implosion/ collapse of the system. Planning must therefore be part both of the machinery to ameliorate and mitigate the worst excesses of laissez-faire, and be an enabler of positive developments. This is important for MUTP planning because their impacts can be very far-reaching and are not always immediately apparent (i.e., they are frequently difficult to detect). They are, furthermore, capable of knock-on effects that may not arise for a number of years downstream, as systems evolve in response to the MUTP itself.

Path dependency and context

- According to Batty, 'non-ergodic' systems lack any kind of probable behaviour over the long term" and are characterised by "exogenous shocks that affect long-term behaviour …. often said to generate path dependent behaviour". He further claims that "such systems can also 'lock in' on end states ….generated through such feedbacks" and that in "economic terms, path dependence through positive feedback is sometimes called 'increasing returns'." The term 'path-dependence' here describes how the set of decisions one faces for any given circumstance is limited by the decisions one has made in the past, even though past circumstances may no longer be relevant. The 'circumstances' then are the context. For MUTPs, history is critical. There is in other words no 'clean sheet'. Decisions in the past inevitably constrain options for the future; one only has to look developments in railway and motor car technologies and their infrastructure to appreciate this.

Features of universality

- It is claimed that the feature of 'universality' – a characteristic defining the degree of order in a complex system - is measured by "a number of different signatures that show how the order in such systems is manifest at different spatial and temporal scales." It exists according to Durlauf (2005) if "its presence is robust to alternative specifications of the micro-structure of the system." This discussion of

'generic relevance' (over time and space) is highly relevant to MUTP comparative research and the selection of appropriate criteria to help define the universality of any findings. If we accept that each MUTP is planned and delivered against the background of somewhat different/ unique (and changing) contexts, we must then also be aware of the limitations of universally applicable generic lessons.

Context and perceptions

- Three different *but* linked system exemplars identified by Batty are helpful in seeking to understand MUTPs and their interaction with their environments: (1) *generative systems* that build order and patterns from the bottom; (2) *network systems* that link locations which are represented by "simple models based on networks in analogy to the properties of graphs which focus on their connectivity" and (3) *positive feedback systems* which involve thoughts and premises about how systems evolve in time and grow as a result of feedback." They offer, among other things, a degree of explanation for technological change occurring in spurts.

- These exemplars produce a process that "have all the elements of complexity: phase transition or thresholds at which innovation occurs and pushes the system into a new regime, novelty and surprise ….. and a sense that the usual state of the system is far from equilibrium." Growth in these situations "is only locked into an equilibrium between discontinuities …… over time these changes might be considered to be a perpetual series of avalanches." This perspective offers an invaluable lens through which to interpret developments over time of MUTPs and their transport hubs.

- "When we act in making plans about cities, or consider any form of decision-making which takes place either in cities or with city developments in mind, then perspectives change and with this so does the way we construe complexity." Batty supplements this argument with the claim that the perspective employed here are "more akin to designers but will also broach complexity in other ways – from top-down controllers (which imply a management perspective), from the perspective of the citizen, and from a more general somewhat detached social science perspective." With the rise of a more realistic appreciation of the limits of influence that planning actually has over city and regional development (and related infrastructural support) Batty argues that there has been a move away from regarding 'planning' as essentially a 'controlling' exercise, to one that is more 'enabling' or on occasions mitigating in character, with greater emphasis on bottom-up rather than top-down strategies. This has relevance for MUTPs and our earlier discussion about which the Cynefin framework domains represents the most appropriate one when considering 'planning' based interventions.

Strategic planning

- It is claimed that "as we learn more, we intervene less" and that the notion of finding critical leverage points in complex systems is an endorsement of strategic planning which itself can *only* be undertaken with the aid of systems thinking and an appreciation of ('wicked problem') challenges of coping effectively with complexity. Chasing solutions to wicked problems posed by MUTP challenges can be very consuming of resources and pose little or no prospect of a positive

result. The difficulty is that 'wicked problems' are not labelled as such; they can often *only* be identified retrospectively, or at least part way through their evolution. This realisation could lead to a deluded search for that mythical clinching piece of evidence, or reluctance to act at all through fear of failure. Yet MUTP planning is overtly political and *must* respond to political agendas and imperatives that often cut across even contradict expert analysis. Put simply, 'intervening less' may appear wise, but is not necessarily an option.

Winners and losers

- The claim that "social systems and cities, like biological systems, are generated through a process of tinkering, through trial and error mutation which increases fitness and reduces error in the phylogeny" and that interventions are subsequently potentially destructive *unless* we have a deep understanding of their causal effects tells us that we *must* be alert to the negative, as well as the positive impacts of MUTPs, and that there will inevitably be 'winners' *and* 'losers', gains and losses associated with such projects which will inevitably lead to the need for mitigation and compensation measures.

City systems - complexity and emergence (M.J. Batty, 2008)

The case for monitoring

- In understanding cities it is emphasised here that the 'whole is more than the sum of the parts' (Simon, 1962) and that we *cannot* merely assemble the whole by simply adding up the parts. This is so, Batty argues, because classical science through its reductionist strategy simply fails us here. Translating this assertion into the context of MUTP planning suggests a need to (*inter alia*) acknowledge that we simply *cannot* hope to precisely identify *and* quantify all potential impacts that an MUTP might produce over time, whether they are beneficial or otherwise. But notwithstanding this it is imperative to constantly scan the horizon to identify and attribute for impacts even *after* the MUTP has been implemented so as to gauge the need for retrofit actions.

- It is claimed that **"**the abruptness of change in cities depends very largely on the scale at which we observe it and the time interval over which it occurs. For example, traffic jams simply build up as density increases with wave effects due to differential acceleration and braking happening over minutes while stock market crashes usually happen over days and weeks, sometimes months. Booms and busts in the housing market with respect to prices as well as effects on subsequent mobility usually happen over months, rarely over years, while gentrification and related migrations take place usually over years. Sea changes forced by technological innovations happen over centuries or parts thereof portrayed for example as Kondratieff waves over half centuries or more. All these events can reveal abrupt change in terms of their measurement if observed at particular scales and time intervals but averaging over time and space certainly smoothes this abruptness." The notion "what can appear as abrupt change at one level becomes gradual at another" is fundamental to understanding the exposition of change over time that affects the contexts of MUTP developments, their impacts on the territories and societies they serve and traverse, and their very own

development. This warrants the continuous scanning of context and impacts as part of a monitoring exercise of any MUTP.

Dealing with the 'unknowable'

- It is argued that traditional planning practice "cannot reconcile itself to dealing with more than one (urban) core, so competing cores or market places are problematic" with the result that this kind of planning handles "travel and transport in far too simplistic a way in a world now full of alternative communications paths. Little wonder that simulating cities using these kinds of theories and making decisions based on them leads to unrealistic plans." This discussion highlights the damage than can be caused by adopting, and acting on, a model of simplistic 'structured order' based on concepts of optimality that is a grossly misleading and potentially a dangerous paradigm. The influence of MUTPs as agents of change should be examined with the above new perspectives in mind. Having said this, employing such perspectives has us straying into the realms of the 'unknowable'. We not only lack the skills/ tools to deal with the complexity associated with multiple (often competing) cores but also that (in the UK in particular) we do *not* have a properly resourced institutional framework to deal with 'planning' at this level. Fundamentally, dealing with competition between multiple cores also has a critical political dimension which no amount of analytical tools can supersede.

Dynamics of systems, notion of equilibriums and tipping points

- The types of planning models that impose concepts of order based on notions of optimisation (of transport systems, for example) are static and "based on a world in equilibrium". Batty states that while at first sight, "cities look as though they *might* (could) be in equilibrium, this can *never* be the case" for what might appear to be in equilibrium "is their physical artefacts, their structures, buildings and streets, but the economic and social rationale for what goes on inside them is in continual flux." The implication for MUTPs is that such projects will never reach optimality either because the very concept of optimality may have altered from the time of the design of the project to its operation and/or because of changes in the context of the project's operation which will have exerted forces/ pressures on it not previously predicted/ foreseen at the time of planning the MUTP.

- What Batty is also alluding to here is that there are differentiated rates of change, indeed life cycles, associated with different classes of agents within cities viewed (as complex systems). Within a city, a physical structure, a building, is designed and built to fulfil a purpose within its contemporary context, over the years in use it absorbs (behavioural) changes by its occupants, or a succession of occupants, until such time as the fabric is beyond economic repair, or until it can no longer respond adequately to the degree of change it is required to accommodate to suit any occupant. At that point it no longer has a beneficial use. If there is sufficient demand, it will then be demolished, to be replaced by a new building designed to fit the new contemporary context. There are vast differences in the ability of different buildings to respond to changes of context. Take dockland warehouses for example: built in the 19th century temporarily to store vast quantities of goods and materials carried by cargo ships travelling the world. There is no way the

warehouse builder could have predicted this emergent outcome all those years ago. The question that needs to be asked here is how come some major MUTPs of the past century still perform valuable functions today whilst others do not. What makes such projects adaptable to new times and other so redundant?

- It is claimed by Batty that city growth can be analysed through three related perspectives on change: (1) *continuity* - which contrasts with discontinuity and bifurcation; here slow and gradual change suddenly but subtly reveals that bifurcation might have occurred; (2) *transformation* - where forms and functions evolve from one pattern to another; here systems are resilient at certain thresholds; and (3) *emergence* - which concerns the way qualitatively new and novel structures arise. In some sense, these three sets of dynamics imply processes operating at different temporal rates and spatial scales. Continuity, transformation and emergence may be a useful framework for the analysis of changed inspired by MUTPs and their contexts.

Features of universality

- According to Batty, the fact that it has been argued that the city "has grown in some directions rather than others is largely due to a combination of physical and accidental historical factors and does *not* imply any differences in the way growth has occurred from one time period to the next". This kind of change has "convinced many that cities are comparatively simple structures whose urban form and pattern is explicable in general terms that apply to many time periods of their growth. Whether large or small, the same bottom-up development processes are at work, and large structures are correspondingly similar to small." The question which needs to be posed here is what new perspectives would such a stance offer analysis of the impacts of MUTPs and what role would path dependency play in this?

Regular patterns of order

- It is argued "We have barely scratched the surface of the study of complexity in cities for at every twist and turn, and from every perspective, there are signals that indicate surprise, novelty, innovation, and emergence in the way cities grow and change. Symmetry is *forever* being broken and urban processes display a bewildering variety in terms of the reversibility and irreversibility. In all of this, what is very clear is that we *cannot* take at face value what we observe superficially. If there is one message that Complexity Theory forces on the social sciences, it is that the search for an understanding in terms of regular pattern *must* be viewed with suspicion for beneath such patterns often lay volatile change and unstable processes of the most extreme nature. This understanding of city growth (and by implication its transportation infrastructure), offers an exposition of change that will greatly inform if not radicalise the analysis of the impacts of MUTPs if accompanied by the new perspectives outlined above. It will pose challenges to temptations to too readily ascribe pattern, order and causality where in reality (after further investigation) none are found to exist; correlations per say are no proof of relationships and harbour the danger of misleading conclusions.

The case for less invasive planning

- The quest of this contribution has been "to show that complex systems *must* be understood from the bottom up and that prior reductionist strategies simply fail to grasp the way such systems work". It also argues that "Process rather than product, function rather than form, time rather than space are *all* important for a better understanding" of city growth and related infrastructure but that missing from this argument "is the notion that cities like many other social systems *might* be becoming more complex, certainly more complicated as they evolve through time". It is concluded that as a result theories and models (about city growth) *must* inevitably adapt to embrace new forms of thinking and categories of growth "that get invented and which are not intrinsic to the system when we observe it at anyone time or even over past time periods". This logic can be directly transferred to the field of MUTPs planning and impact analysis. New models and theories need however to be disseminate, understandable, capable of being realistically applied and be understood by all stakeholders.

Commentary on lessons: their identified relationships of relevance to MUTP planning

Complimenting the above, the text below summarises *some* of the relationships/ links among the principal lessons extracted from Batty's contributions that appear relevant to MUTP planning. These relationships are visualised in Figure 16.

Link 1: Risk - Science – Knowledge – Complexity – Horizon Scanning. MUTPs are open systems which are vulnerable to high degrees of complexity. Science through reductionist strategies is however failing with systems which exhibit complexity. Decisions based on inaccurate models are creating (rather than reducing) risks. MUTPs need to be viewed in a different way than afforded by traditional scientific method. However tools and techniques which can be applied to complex systems are still in their infancy. Horizon scanning as a means of observing outputs from complex systems offer a way forward.

Link 2: Closed Thinking - Equilibrium Theory - Science – Knowledge. Classical science is grounded in closed thinking, equilibrium theory and maximisation/ optimisation. This may *appear* a good fit to the urban reality but the economic and social drivers are in such continual flux that upon closer scrutiny the concept of the 'equilibrium' is unsubstantiated and is more a product of analytical convenience than reality. This presents a challenge for MUTP practitioners, the majority of which will have been educated using traditional modelling approaches reliant on premises of Newtonian Physics, which begin to break down in the MUTP realm.

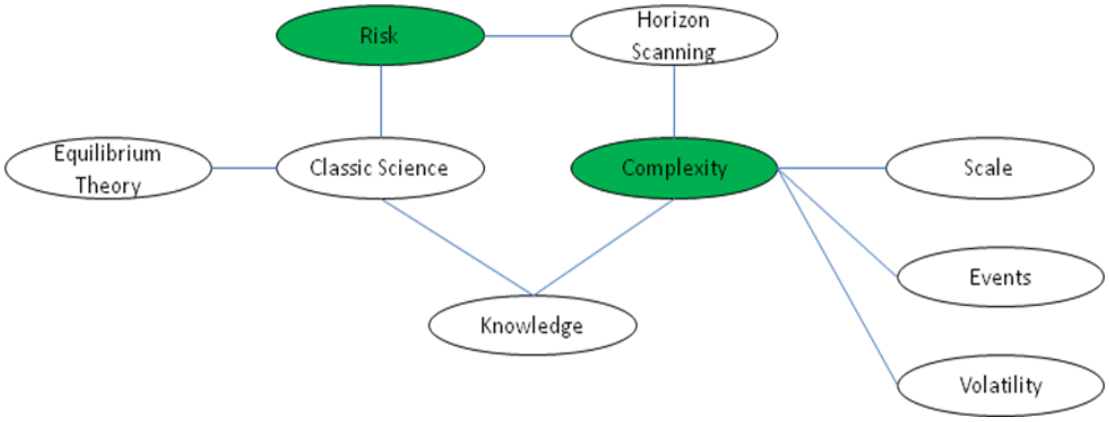
Link 3: Complexity – Emergence - Events. A structure will grow using the same underlying principle rules, but its shape may be dictated by 'mega events' that happen through the history of this growth. If simulating the development of an MUTP according to complexity theory, a number of underlying rules can be assumed at the micro-level which can contribute to patterns observed at the macro level. However it is only by including the projects contexts – the most influential perhaps being 'Mega

Events' in the vicinity of the project (vicinities including: Spatial, technical or political or temporal etc.) that the overall shape of the project can be explained.

Link 4: Complexity – Scale – Events. Cycles related to, or have an impact on MUTPs are observable at different spatial and temporal scales. The analysis of such cycles can yield different conclusions depending upon the scale of the chosen study. Direct observation at fine scales can reveal abrupt changes, which average out when observed at more coarse scales. The study of MUTP timelines at varying scales can yield conclusions which can be either complementary or contradictory.

Link 5: Evolution – Systems – Complexity and Chaos – Control. Bottom up evolution can be seen as playing a dominant role in the development of urban systems, in which MUTPs are a part. Evolution is a hall mark of complexity, where different systems interact in unpredictable ways, with some systems being reinforced and growing stronger, whilst others die. Certain unpredictable events can tip complex systems into chaos and planning controls must find a balance between defining the boundaries of the system and exerting direct control on the processes within the system.

Figure 16: Treatment of RUC in city systems: lessons for MUTPs



4.3.2 *Strategic and regional planning (H.T. Dimitriou and R. Thompson, 2007)*

Features of universality

- As Mintzburg *et al* (1995) point out, theories and conceptual guidelines are useful since "it is easier to remember a simple framework about a phenomenon than it is to consider every detail you have ever observed." …. Even when a strategic prescription 'seems' effective in a given context, they argue, it requires a full appraisal of the new context to which it is to be applied and how it may function before it can be deemed effective.". This claim highlights the importance of the need to theorize why MUTP developments occur in the way that the way they do, and what subsequent guidance such analyses can offer simultaneously acknowledging the added strategic importance of context.

Origins and agents of change

- Basil and Cook (1974) argue that "while change is readily apparent, its magnitude and consequences are relatively unknown" and that the 'dysfunctions' of change in planning mainly lie in: inadequate environmental (read contextual) scanning, the lack of change responsiveness capabilities in organizations, and/or the excessive reliance on crisis-management." This statement emphasises that the inadequate sense-making of the context(s) of MUTP developments can provide the source of later dysfunctions. To better predict these we requires a clear and consistent definition of what we mean by 'sense-making' and most probably an enabling generic framework such as the Cynefin framework to assist us in this task.

- "Basil and Cook (1974) identify three 'origins of change': *structural-institutional*, *technological,* and *social-behavioural.*" This categorisation *could* provide the basis of a useful analytical framework for the study of developments that both impact on MUTPs and arise from MUTPs.

- "Most significant of all in the last two decades has been the phenomenal change in 'technological developments' especially those associated with communications, including transport and information technology. According to Basil and Cook (1974), the feeding of such forces one upon the other, produce complex reactive forces of "an additive or multiplicative manner to create even greater change." This well explains the multiple and cumulative impacts of potential change brought about by the technological forces released by MUTPs and spawned by the interactions of change brought about by such projects.

- Drivers of change are broadly based - they include economic, social, environmental and technological change. Any plan's strategic objectives "are shaped to manage the spatial impacts of these drivers in an effective and sustainable way. In this (strategic) approach the planner does *not* seek to impose a strategy upon the (city or) region, but rather tries to identify and influence underlying forces that are seen as too powerful for the instruments of strategic and regional planning to shape in any significant way". In the context of MUTP planning it is important here to understand which of these forces of change the project is harnessing and which it is unleashing, as well as recognise that MUTPS are themselves technological agents of change by virtue of their scale and influence. MUTPs are not only capable of spawning social, economics and physical impacts but are themselves subject to change and rapid development (and are thus in need of constantly monitoring). They also, most importantly, contribute to changes in the context for other (future) decisions.

Strategic planning

- Just as it is "*imperative* for strategic planning to have regard to three facets of change management: the origins of change, the transitional responses to change and the development (and testing) of new strategies for change responsiveness" so it is also critical for MUTP planning to have regard to these same facets since the complexities of MUTP planning can *only* be undertaken effectively as a strategic exercise.

- Strategic planning requires at least two things: Firstly, the appreciation of the concept of complexity as the *context* of strategy making - where 'complexity' may be defined as "the condition of being tightly woven or twined together" (Mason and Mitroff, 1981). Secondly, the development of a 'sense-making' capability of complexity in the strategic plan–making process (Snowden, 2004). If we accept the first point with regard to MUTPs, it has profound implications for planning and the management of expectations on outcomes in particular, as predictability and control do not always accord to the theory. On the second point, sense making seeks to provide new and richer sources of data needed to bring greater insights into the specific nature of the complexity. In the case of MUTP planning, the strategy formulation process *must* have at least half an eye on what is likely to be acceptable politically and therefore engage in consensus building.

- Planning is, for the first time in England, given a statutory purpose in the Planning and Compulsory Purchase Act 2004 and this is fundamentally for the purpose of managing strategic change. MUTPs by their scale and systemic influence are potentially powerful instrument in steering change, acting as strategic anchors they can create a context for other decision makers in which uncertainty is decreased and confidence grows. Their weakness in the past has been the lack of clear, consistent and effective spatial planning strategies that can accommodate and make the best use of opportunities afforded by MUTPs.

Institutional capacity

- An imperative of contextual analysis for strategic planning "is the capacity for agencies (and regions) to accommodate 'transitional responses' to change". Basil and Cook (1974) explain that this concerns how (well) institutions (including national, regional and local governments), other organizations *and* individuals have developed a capacity for 'change responsiveness' ….. including measures to introduce ….. developments that engender greater co-ordination and transparency." This statement is of fundamental significance for MUTPs as the institutional arrangements for their planning, construction and operation are often fragmented and frequently continuously in flux leading to the absence of a sustainable framework with which to see such projects through from their planning to implementation and monitoring.

Strategic gaps

- It is claimed by Basil and Cook (1974) that 'strategic gaps' can develop in both industry and government "as a result of organizational inflexibility, ignorance of complexity and open systems effects" and that where such gaps represent "the shortfall between the actions of organizations and institutions and the objective of an orderly adaptation to change" this significantly contributes to the misallocation and waste of resources producing an urgent need for proactive strategic action on many critical fronts. The importance of this claim (if true) is that the failure to fully comprehend the complexity of the open-systems effects of MUTPs can lead to the serious misallocation of funds and therefore contribute to both inefficient and ineffective MUTP solutions.

- The argument by Basil and Cook (1974) that the costs of traditional crisis management, as a result of the failure to introduce strategic thinking is "a cost that society, organizations and individuals cannot ignore" nor afford is very persuasive. Three observations are important here for MUTPs: (1) once again, the critical importance of context sense-making; (2) the need to see MUTPs as 'change agents' and (3) the cost of crisis management arising from the absence of possessing a strategy or perhaps having the 'wrong' strategy!

Path dependency

- Many policies, especially transport policies, have largely pursued a 'predict and provide' trajectory which contradict government proclaimed aims at promoting sustainable development. These are often reflections of path dependency where path dependency has been the norm. MUTPs offer the opportunity to break out of this with the potential for a radical steer to a new path(s). They are also, however, fraught with uncertainty about their impacts – both intended and unintended – and as such need to be carefully appraised before execution.

Ambiguity, risk, uncertainty and complexity

- Basil and Cook's desire to see 'twenty-first-century man' "educated to accept and manage ambiguity, uncertainty and complexity" is profound (1974). They argue that the only way to do this effectively is to introduce a series of new 'proactive strategies' that cope better with ambiguity, risk, uncertainty and complexity of the kind advocated *some thirty years* later by post-modernist sociologists and geographers such as Adams (1995), Beck (1992; 1999; 2000), and Lash et al (1996). This vision/ pre-requisite for 'twenty-first-century man' is highly relevant for MUTP planning on two counts: (1) it illustrates how some critically important ideas and advice *do not* tip into acceptance despite their wisdom and (2) that the true value of wisdom is not eroded by time.

- The point made by Mason and Mitroff (1981) "that a major problem with connected systems of complexity is that deviations in one element can be transmitted to others (and that) … these deviations can be magnified, modified, and reverberated so that the system takes on an unpredictable life of its own" is highly pertinent to MUTP planning as care needs to be taken to avoid the outcome of policies developed to resolve one problem spawning others, thereby generating too many unintended impacts as the dynamics of the problem(s) unfold. The same incidentally can be said for apparently 'benign' or straightforward decisions taken during the MUTP planning process.

- Mason and Mitroff (1981) suggest "that organized complexity can in fact become a major obstacle to problem resolution, on account that while there is a range of techniques available for taming simple problems, there is *only* a few methodologies for tackling complex ones. This is highly significant for MUTP planning and in part underlies the *raison d'etre* of MUTP research of the kind written about here.

Wicked problems

- Problems of organized complexity are referred to by Rittel and Webber (1973) as "wicked problems" in the sense that the more one attempts to tackle them the more complicated they become. Paraphrasing Mason and Mitroff (1981), such problems have no definitive formulation so that every formulation of a wicked problem corresponds to a statement of solution and vice versa. They see no single criteria system or rule that determines whether the solution to a wicked problem is correct or not and liken the task of tackling such problems to a "Faustian bargain, requiring eternal vigilance." MUTPs confront numerous wicked problems both in terms of the problems they themselves confront in their planning, implementation and operation, and in terms of the impacts they have. The very existence of wicked problems, however may in itself, not be an appropriate reason not to take an MUTP action of the act/ probe-sense-respond type, especially given the existence of other political/societal imperatives which demand responses to critical problems.

- 'Wicked problems' exhibit six characteristics: (1) *Interconnectedness;* (2) *Complicatedness*; (3) *Uncertainty*, (4) Ambiguity; (5) *Conflict*; and (6) *Social constraints* (Mason and Mitroff, 1981). These have two major implications for MUTP planners. Firstly, they require a broader participation of parties affected either directly or indirectly by planned outcomes. Secondly, they need to rely on a wider spectrum of data from a larger and more diverse set of sources. The arguments postulated by Mason and Mitroff are reinforced by the much later work of Gladwell (2003), and Surowiecki (2004) commentating on phenomena that are rooted in complexity. The work of Snowden is also consistent with the participation and data spectrum arguments prescribed in this much earlier work. Complexity theory offers a full explanation of wicked problems. MUTPs interact with a complex environment within which outcomes are generated.

Dealing with the 'unknowable'

- Yet another important observation that emerges from the work of Mason and Mitroff (1981) is the need for the strategic analysis of contexts to both incorporate a healthy respect for 'doubt', and a method of identifying *and* assessing it. They see the systematizing of the analysis of doubt as a critical part of the strategic planning process, best provided through dialectics and argumentation that entail: (1) making information and its underlying assumptions explicit; ...and readily available to all potential stakeholders; (2) raising questions and issues toward which different positions can be taken; (3) gathering evidence and building arguments for and against each position; (4) arriving at some final conclusion (5) and.....acknowledging (explicitly) that there are some things (especially impacts) that cannot be predicted. For 'doubt' we can read 'uncertainty'. What is missing here is a step to understand the sources of specific doubts - are we in the territory of the 'knowable', in which case further investigation may be prudent depending on its criticality, or the territory of the 'unknowable' where explicit assumptions are appropriate. The steps above could equally apply to each stakeholder, and not just a top-down planning agency.

- Mason and Mitroff (1981) suggest that identifying *and* assessing doubt (uncertainty) calls for a new set of criteria with which to design, appraise and evaluate strategies that are: (1) *participative* – given that the required knowledge to solve such problems is drawn from a variety of sources; (2) *adversarial* – on the assumption that doubt in the context of opposition is seen to be the guarantor of the best judgements; (3) *integrative* – so as to ensure the bringing together of diverse knowledge as a basis of coherent action; and (4) *supportive* - of a managerial predisposition in a way that efforts to expand insights into the nature of complexity and developing holistic views at problem-solving are undertaken as continuous process. These criteria are appropriate for a strategy orientated around an MUTP. They could be seen as an early manifestation of the 'wisdom of crowds' which is perhaps more a re-branding of a long established notion whereby the 'wisdom of crowds', 'tipping points' *and* 'wicked problems' are all one phenomena explained by the characteristic of 'emergence' that is present in complex adaptive systems. Here, the wisdom of crowds may be seen as a direct antidote to the so-called 'expert view' often based on path dependent experiences.

New regionalism

- The description of the 'new regionalism' re-configuration of the region which highlights "the role and impact of international trade on regional development and its spatial outcomes, and reflects an increasingly 'innovation-led economy' with entrepreneurship and competition as its main sources of economic growth" (Porter, 1990) is potentially a very important contextual framework for MUTP developments and their proposals if one views such projects as agents of change and facilitators of international trade. This is especially the case if these projects are the outcome of increasingly organized international efforts to restructure domestic sub-national regions to give way to regions of the global economy.

- The argument that "current challenges to strategic planning within the realities of the new regionalism agenda bring with them: (1) a growing importance of global business as a non-state actor in governing the political economy (Spindler, 2002) with reduced transparency of decision-making; and (2) an introduction of concepts of 'corporate social responsibility' as a potential antidote to unrestrained market forces and profit-making, with scepticism growing as to the sincerity with which this is practiced are very pertinent to MUTP planning. They are relevant since they *can* transform the role of such infrastructure from important links to service and integrate domestic communities and regions to agents of competitiveness that pitches one region, city and/or community against the other as witnessed in the political bidding war for intermediate stations on the CTRL.

Three horizons of growth

- Research conducted regarding what it takes for private business ventures, as important drivers of growth and change, to achieve sustained profitable growth and turn-around failing businesses in today's climates of increased deregulation, competition and globalization reported in *The Alchemy of Growth* by Baghai, Coley and White (1999) concludes that: (1) executives must discuss as much about future aspired horizons as where they have been; (2) very few companies sustain above-average growth for their industry year after year; and (3) sustained

economic growth can *only* be achieved by the pursuit of 'three horizons' of growth simultaneously and a 'staircase to growth strategy.' These conclusions are profoundly important for MUTP planning as they imply the private sector (increasingly relied upon to plan and deliver MUTPs) is typically too short-termed in its thinking for them to deliver sustainable infrastructure and outcomes. Equally, the private sector requires developmental frameworks established by the public sector in order to plan and deliver resource allocation against the background of 'certainty'.

- Baghai et al (1999) make it clear that understanding growth is a *pre-requisite* to achieving sustained development and that the principles underpinning the three horizons analysis of economic growth they present are crucial to effective strategic decision-making and planning. Together they allow one to "distinguish between the (1) embryonic, (2) emergent, and (3) mature phases of a business life cycle." What they argue is that: (1) it is very significant to understand that each horizon pay-offs over *different* time frames; (2) successful industries are much better at tackling the challenges of Horizon 1, are less skilled at addressing the challenges of Horizon 2, and are distinctly poor at confronting the challenges of Horizon 3; and (3) the art of achieving sustained growth is to engage in the challenging of the three horizons concurrently and *not* sequentially. The implications of this 'staircase to growth strategy' are profound for MUTP planning as private sector bodies charged with delivering MUTPs will respond by requiring a certain/ fixed regulative framework against which to deliver in the long-run or concentrate on quick returns, or take measures to ensure that they have flexibility in terms of cash generating project components such as real estate (or indeed take all measures).

Public-private partnerships

- The claim that "with many public bodies entering into partnership relationships with the private sector, the public sector has felt obliged to increasingly 'fall-in line' with Horizon 1 priorities and synchronise its activities more with those of the short-term focus of private enterprise", and that this paradoxically "has taken place at a time when business gurus such as Baghai et al are just discovering the importance of more forward thinking strategies" does *not* bode well for MUTP planning given that "the public sector (in the UK) has recently gone through a period of being encouraged to shed its institutional capacity for forward thinking at the very time it is needed most**".** These developments potentially have major negative implications for the development of appropriate planning capacities for MUTPs and can perhaps be attributed to the frequent changes in emphasis on policy/ targets that have characterised UK Government initiatives over the past 10-15 years. There is a case to be argued here that it is hardly surprising that both the public and private sector choose to give undue attention to the short-term for this is the only timeframe that they feels able to predict/ control.

- The conclusion that "the private sector *needs* a strong public sector to succeed and deliver what is expected of it; is a conclusion supported by *The Economist* (2005) and one that is contrary to much of the conventional thinking about globalization and new regionalism." It has profound implications for the building of institutional frameworks to plan, execute, deliver and operate MUTPs both in the

short-run and long term, as much of the value of such frameworks has to do not only with the protection/promotion of public sector interests but also with defining the bounds of competitiveness and thus providing greater certainty for the private sector in an increasingly uncertain world.

Power of context, tipping points and wisdom of crowds

- "The understanding of the origins of the notion that the private sector does *not* need a strong public sector to assist it attain sustained growth and the belief that *minimum* public sector intervention is preferred" partly lay in Gladwell's book, *The Tipping Point* (2000), which provides "invaluable insights into the pivotal role certain parties and individuals can have in changing or perpetuating trends, ideas and policies …… (and) sheds light on the rules of what he calls "the epidemics of ideas" that make certain ideas and visions …. ignite and stick, and others fade." While most of the examples Gladwell cites have to do with marketing products, many of the principles he identifies are directly transferable to the practice of MUTP planning where 'big ideas' such as sustainability, privatisation, public-private-participation (PPP), regeneration etc. have been promoted extensively by government and other interest groups in association with MUTPs, and have become important driving forces of planned change, albeit accompanied by much rhetoric in some instances.

- Also acknowledging the importance of the 'power of context' in strategic decision-making and policy-making is Surowiecki's book *The Wisdom of Crowds* (2004). "The controversial premise of this publication is that if you want to make a 'correct' decision or solve a strategic problem, *under the right circumstances*, large groups of people are often smarter than a few experts. If true, this premise has profound implications for how we plan and run our cities and regions, and how we structure our political systems and think about the future. Interestingly, some of the ideas presented by Surowiecki lend support to Gladwell' critique of the current ways by which new products, ideas, visions and policies are promoted and allegedly rely on 'a few that matter.'" This premise potentially has amazing implications for MUTP planning, environmental management and for those involved in efforts to make regional policy-making more effective, democratic and decentralized. It invokes the question of trust and highlights the tensions involved in public participation and consultation exercises between the MUTP promoters and those impacted by the project.

- We conclude that Surowiecki's premise fits certain circumstances, circumstances of high ambiguity and complexity, with many stakeholders with different perspectives and where wider participation is appropriate and richer sources of data required as argued by Mason and Mitroff (1981) and Kurtz and Snowden (2003). These are we contend the circumstances and contexts of MUTP planning. The 'wisdom of crowds' has a place in decision making in open complex behavioural systems, whereas, closed systems are more the realm of experts and are thus less accepting of non-specialist inputs. The problem is that the engineering and construction aspects of an MUTP are deemed an area for experts. The design brief for such projects, however, typically calls for a degree of consultation and therefore may lend itself to the 'wisdom of crowds' thesis. In reality, however, this call is a limited one - either by necessity or in some cases by

virtue of ideological standing. Some MUTP promoters argue that consulting the 'wisdom of crowds' is fine so long as it does not become the 'mood of the mob'.

Sustainability and rhetoric

- "The 'soft' process by which concepts such as sustainable development reach a tipping point and become accepted wisdoms carries some major difficulties". This is no more apparent than in the case of MUTPs. Here, it has been argued that this and other strategic concepts such as sustainable communities have emerged "without sufficient rigorous analysis and testing. Sustainable development, furthermore, so the argument goes among such sceptics, "manifestly means different things to different people. For most people within the community, they argue the concept carries little or no meaning and has been introduced into conventional wisdom through the domain of policy-makers and professionals and often used in a self-serving manner to further their own ends.

- The vision of sustainability is seen by the cynics as 'motherhood and apple pie' and by the environmentalists as the foundations for building a future. The sceptics see the concept as easy to sign up to while it remains surrounded by rhetoric. Both parties encounter problems when the vision is translated into action. It is here that the going gets tough. This is no more apparent than in the case of MUTP developments where such projects are declared contributors to sustainable development. Here conflicts and incompatibilities emerge, when/ where decisions about difficult trade-offs between short and long-term objectives have to be made and new sets of 'winners' and 'losers' subsequently emerge. It is very significant that the lack of a common consensus about what 'sustainability' actually is (let alone the content of any policies to deal with it) means that as a concept it can easily be exploited in the context of MUTP planning.

- The report that "a lack of shared vision of what 'sustainable development' means (for a particular region or city) threatens to undermine the potential to deliver sustainable development" in the UK (2004) raises a number of challenges for MUTPs, including: whether they (the MUTPs) effectively: (1) meet the needs of intra-generational equity; (2) are adequately geared to address globalisation issues; (3) promote and advance the principle of socio-economic equity; and (4) contribute to environmental and inter-species equity.

Commentary on lessons: their identified relationships of relevance to MUTP planning

Complimenting the above, the text below summarises *some* of the relationships/ links among the principal lessons extracted from the Dimitriou and Thompson contribution that appear relevant to MUTP planning. These relationships are visualised in Figure 17.

Link 1: Risk - Context – Analysis – Change Responsiveness – Transparency - Stakeholders. The quality of data collection and interpretation is directly linked to project risk. The more up- to-date information available, the more risks can be reduced. The more diligence used in analysis the data, the greater the risk reduction. The poor detection and analysis of changing contexts in MUTP projects can lead to the build up of increased uncertainty and subsequent risks. Even when good quality

data and analysis is available, a system needs to be in place to allow response and adaptability in the face of changing contexts. This change responsiveness can be achieved through greater transparency and coordination/cooperation between stakeholders. Furthermore, without adequate appraisal of context through good quality data the appropriate strategic interventions cannot be made for an MUTP.

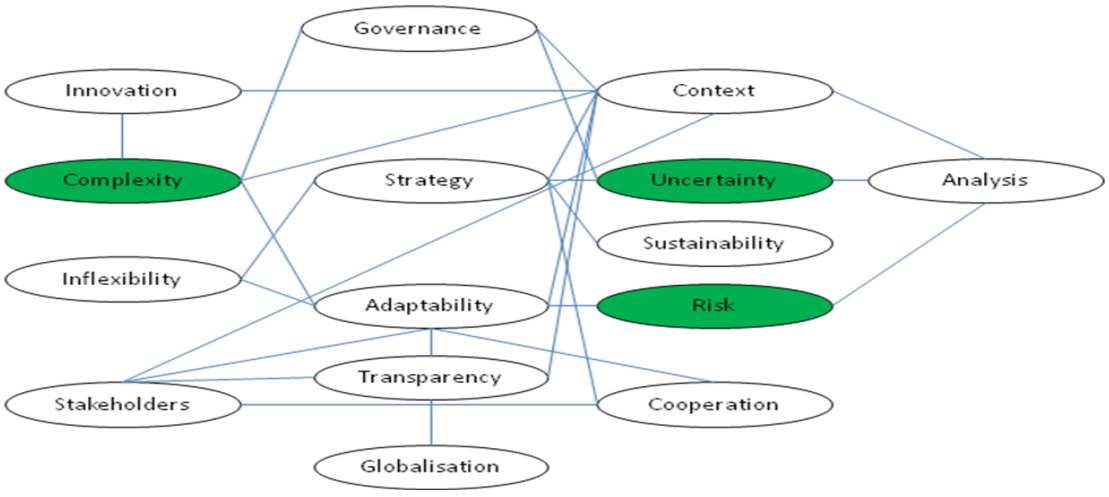
Link 2: Innovation - Governance - Stakeholders – Power – Change – Influence. Three important drivers of change in MUTP contexts are identified as technological developments, social behavioural shifts and structural/institutional changes such as governmental forces. The ability of an MUTP to monitor, recognize, respond and influence these powerful underlying forces is important for project success.

Link 3: Closed Systems Thinking – Complexity – Strategic Shortfall - Inflexibility - Inefficiency – Risk. A project progressing without adequate understanding of the underlying forces which create change and without the ability to sense and respond to change will be inflexible and subsequently vulnerable to risk. Closed systems thinking coupled with ignorance to the causes and effects of complexity can particularly create a shortfall between a MUTP's current adaptability and the required adaptability. This shortfall creates inefficiencies and is therefore damaging.

Link 4: Governance – Path Dependence - Complexity – Risk – Innovation. Governments which adopt closed systems thinking, and disregard the effects of complexity can introduce path dependent policies and interventions which through complexity inadvertently yield unintended impacts, including increased project risk. Despite these dangers, there are few tools available to help project decision makers tackle complexity with the result that MUTP projects are currently highly vulnerable to the adverse effects of such developments.

Link 5: Strategy – Sustainability – Power - Co-operation. Long term strategies are critical for MUTPs to deliver sustainable growth. Co-operations between stakeholders in the public and private sector can however result in the shift of public sector strategies towards the short term, more in-line with the private sector objectives. It is important for co-operations between sectors to respect differences in Strategy.

Figure 17: Treatment of RUC in strategic and regional planning: lessons for MUTPs



4.3.3 *Transport policy - hypermobilty (J. Adams, 2008)*

Promotion of unquestioned mobility

- John Adam's idea that the promotion of mobility globally is "the biggest mega transport project that subsumes all others….. creating problems of unprecedented complexity, risk and uncertainty … (and) transforming the way in which these problems are perceived and managed" is of paramount importance as the global context for the demand for more complex, bigger and better MUTPs. Its significance is heightened by the fact that MUTPs typically stimulate increasing (and unquestioned) demand for movement – especially long-distance travel – spawning many sustainability issues. On this basis alone, there is a case to argue that the need for every MUTPs needs to be carefully questioned from the outset.

- Adams acknowledges that "Mobility is a liberating and empowering" force but that "…. the huge growth in the numbers (of motor cars) exercising their freedom and power is fouling the planet and jamming its arteries." Many MUTPs are part of what Adams describes as "prodigious scientific and technological efforts … to 'solve' the problems of traffic congestion and pollution caused by the growth of motorised and other types of mobility.

Motorisation and globalisation

- Adams sees motorisation and the spread of 'McCulture' as a product of globalisation which contributes to both the loss of local identity and the speedy transformation of place like other places. As often strategic pieces of infrastructure that link local areas to global economies, the role of MUTPs in creating McCulture needs to be more thoroughly investigated and responded to. Lest we forget, there are disadvantaged parts of the world that are striving to achieve McCulture and all the *apparent* goodies that go with this.

Equity and mobility

- The claim by Adam's that "even when they live in close physical proximity to each other the 'mobile wealthy' and the 'immobile poor' live in very different worlds….. The wealthy can be seen and heard flying overhead, or driving along motorways (one kind of MUTPs) through the ghetto, or on television, enjoying privileges that remain tantalisingly out of reach. To the wealthy, the poor are often invisible; because of the height and speed at which they travel, the wealthy tend to see the world at a lower level of resolution." These images concur with images of elevated (or depressed) MUTPs traversing areas of the lower income communities and airport projects blighting residential areas left for the poor to inhabit. There's also the point that for much of their length MUTPs offer mostly 'pain' in the form of noise and air pollution, while at the hubs they offer 'gain'. There is finally the important questions of equity and wealth (re)distribution resulting from MUTPs and how this can be best strategically directed/managed?

Governance and increased centralisation

- Adams' prediction that in the hypermobile world "individuals will have less influence over the decisions that govern their lives" as they spread themselves ever wider and thinner in their social and economic activities the geographical scope of political authority must expand in order to keep up with the growing size of the problems that require governing. Political authority migrates up the hierarchy from Town Hall to Whitehall, to Brussels and ultimately to completely unaccountable institutions like the World Bank and the World Trade Organisation". This resonates with the thesis presented by Dimitriou in his 2005 TRB award-winning paper on MUTPs as agents of change increasingly 'directed' by less democratic international regional bodies in the interests of the new regionalism agenda.

Typology of risk

- Adams presents a typology of risks that provides the basis of a helpful framework for managing risk in MUTPs. This framework identifies risks: (1) as perceived through science, (2) as experienced directly and (3) as virtual risks. The field of *virtual risk* is seen to contain the complexity, uncertainty and chaos that are the subject of this and the preceding Working Papers and which "contain Harold MacMillan's "events dear boy" and Donald Rumsfeld's "unknown unknowns." It also contains "all the long-running arguments about the risks of hypermobility" as virtual risks are liberating; if science cannot settle the argument people feel free to argue from their beliefs, preconceptions, prejudices or superstitions. The most intense and heated debates are usually to be found at the intersection of all three circles of risk types." MUTPs encounter all these three types of risks at different stages of their development and at different levels. They are often seen/ resented as a 'technical-fix' to simplified problems … but as we have seen they raise their own issues in terms of risk, especially when the scale, longevity and distribution of their impacts are hard to determine with precision, indeed in some instances hard to predict at all!

- As Adams explains "Most people feel strongly about the direction in which 'events' are leading, and whether they are positive or negative. They bring to the discussion personal experiences, scientific evidence that they have read about, and "hunches", things they feel in their bones. One frequently encounters the distinction between "real" or "actual" risk (what the experts know) and "perceived" risk (what the rest of us believe). But *all* risk is perceived. Risk is then a word that alludes to an uncertain future – that exists *only* in the imagination. The mix of types of evidence, and the different standards of proof to which people appeal, usually makes for messy, inconclusive, debates about how the future should be managed." This conceptual analysis encapsulates well situations of uncertainty typically experienced both by those impacted by MUTP developments and those who have stakes in such projects and as such could potentially contribute to the development of an analytical framework of how to manage such circumstances. As we see can see from Snowden's work – we only see a small proportion and can only deal with a small proportion of the evidence available, and make decisions based on our analysis of this.

- Adams points out that "reference is frequently made to 'public' or 'societal' perceptions of risk. He explains though that with respect to reactions to risk, there is *no* such thing as society (or community). This conclusion potentially has very significant implications for MUTP appraisals and evaluations as many of the proclaimed benefits are made in the name of the community**!**

Management of risk

- Adams sets out a six-step simple model of how we manage risk. Under a different name, 'moral hazard' this model has long been recognised by the insurance industry." However, "what this stance failed to acknowledge was that accidents could only be eliminated by eliminating risk taking, which would *also* eliminate the rewards of risk taking. Most institutional risk managers, as distinct from individuals crossing the road, exhibit (this) bottom-loop bias. They are often enjoined *not* to have their judgement about what is safe or dangerous compromised by contemplation of the rewards of risk taking". This traditional approach is now meeting a strong challenge and it would be invaluable for the implications of this challenge to be examined in the context of MUTPs (both regarding risks within such projects and the areas they impact).

- "Imposed risks are less tolerated than voluntary risks. Less tolerated are risks whose imposers are perceived as motivated by profit or greed." This statement is highly relevant to MUTP developments where private sector parties take the lead and are often considered to put their interests above the communities their project impacts and the clients they serve. Profit and greed as motivations, however, is *not* the sole province of the private sector! The same can be said of governments trying to get the 'best deal' out of MUTP delivery.

- "Up to this point we have been discussing individual responses to a range of risks. Terrorism targets *governments***.** Terrorists pose a threat not just to individuals but to the social order – *and* to those who purport to maintain it. Murderers and careless drivers are not seen as threats to the ability of the government to govern. This suggests a need to fit the 'risk thermostat' with perceptual filters. The operation of risk thermostat might be considered a form of cost benefit analysis (CBA) *without* £ or $ or € signs….. The *rewards* and *accidents* boxes contain too many incommensurable variables. In addition to money the rewards of risk taking can include power, glory, food, love, sex and rushes of adrenalin, and the accidents box the loss of such things. Numbers collectable by actuaries play only a small part in most risk management decisions." This discussion raises very interesting questions regarding the risks that politicians (especially MUTP champions) confront when supporting such projects through 'thick and thin'. Once they have been seen to publicly back a project it is very difficult for them to subsequently *not* support it. From a government perspective, furthermore, it is critically important for the politician not to have a project 'fail' while on his/ her watch.

Typology of risk-takers

- Adams presents four archetypes of risk-takers: (1) *Individualists*, (2) *Egalitarians*, (3) *Hierarchists* and (4) *Fatalists*. One could argue that this typology both

characterizes the very wide spectrum of risk-takers that may be found on any point in time among MUTP stakeholders *and* offers a helpful framework for disaggregating the risk-takers in such projects. On the other hand, it may be legitimately argued that such individuals/ organizations rarely remain consistently in any one of the above categories as time passes and that as a result new risks, relationships/ networks and other risk contexts arise that undermine the above typology.

- Adams concludes at the time of writing that "the centre of gravity of the debate about transport futures appears … to be shifting." He argues that for most of the *past* century the principal drivers of growth in mobility have been Individualistists. The freedom offered by the car and affordable air travel, and latterly the internet, have greatly liberated individuals from the constraints of old-fashioned geographical communities and allowed them to lead their lives in aspatial "communities of interest." This individualistic appetite was energetically catered for by big business: the builders of cars, planes and infrastructure, the providers of fuel and the disparate collection of electronic entrepreneurs who developed the Internet. "All of this has taken place with strong hierarchical support. Legislators, regulators and planning authorities paved the way, sometimes literally, for the twentieth century growth of mobility. The force of egalitarian concerns about the 'side effects' of this growth was however by and large brushed aside for most of the last century". These concerns have however increased in force during the latter decades of the last century and now, with the dramatic increase in anxieties about global warming, appear to be offering significant resistance to historic trends. According to Adams, "to date these anxieties have focused on the security of energy supplies and the damage caused by emissions, principally carbon. From the Individualist quadrant come promises that technology and markets will solve the problem. The Hierarchist corner offers regulation and legally-binding targets. But only the Egalitarian corner, with its call for demand restraint addresses, not only the concerns about energy consumption and emissions, but also the social consequences of hypermobility sketched out at the beginning of this essay. …. Hypermobility breeds fatalists. Without egalitarian restraint of present trends, dystopian science fiction appears likely to provide our best guide to the future." The framework offered here presents a highly innovative and invaluable method of understanding the driving forces and stakeholders behind MUTPs.

Leadership and major projects

- Adams asks the very legitimate question of who is in charge when it comes to "the mega projects subsumed by the Hypermobility Project – TENS, airports, motorways, high-speed rail lines etc – all of whom have directors, commonly with the rank of President, Prime Minister or CEO"? The Hypermobility Project itself, by contrast, he points out "has no one in effective command, no supreme manager of all the risks that it entails." The question Adams poses here is a highly intriguing one. The main driving force(s) behind MUTPs and their champions are *not* always clear. They furthermore typically change over time, especially with projects that have long gestation periods (which is most if not all MUTPs). The question of how the leadership of such projects over long periods of time is sustained - through different governments, economic climates and technological

developments – can only be appreciated if one looks on at such leadership as akin to a relay race whereby the MUTP baton is passed on from one party to anther over time with each bringing their own style/ strengths and perceptions. It is very rarely the case that the leadership of such projects prevail from project conception through the project life-cycle to its completion. At the preliminary planning stage we may note multiple 'leaders' in quite a 'flat' organization/ association, from politicians to technocrats in charge of feasibility studies etc. all discussing ways forward. Once the project is in the construction phase there is usually a simplified, more hierarchical structure, as is the case during the operational stage.

- Adams points out that "the goal of the mega-project is unbounded" - it often presumes "more mobility is better than less". While occasionally it is argued that 'access' should be substituted for mobility and that "the purpose of the mega project should *not* be to generate more movement but to provide people with access to things at a distance that they desire**".** In practice it makes little difference" as much of this is often rhetoric. The UK's Government's own Planning Policy Statements, however, refer specifically to the need to prepare spatial planning and other policies that *reduce* the need to travel with the result that it is essential that rhetoric is *not* allowed to prevail in MUTP planning. .

Commentary on lessons: their identified relationships of relevance to MUTP planning

Complimenting the above, the text below summarises *some* of the relationships/ links among the principal lessons extracted from the Adam's contribution that appear relevant to MUTP planning. These relationships are visualised in Figure 18.

Link 1: Globalisation – Context -Risk and Uncertainty – Complexity - Knowledge. Increasing demands for global mobility using contextually insensitive development can create unprecedented levels of Risk, Uncertainty and Complexity. The spread of globalisation and its accompanying aspirations for MUTPs are challenging the way projects are conceived, implemented and managed, demanding practitioners with new skill sets.

Link 2: MUTPs – Globalisation – Ideals – Path dependency – Sustainability. MUTPs are part of the globalisation process both as a means and an end. Globalisation is in part driven by perceptions of ideals and desires for liberation and empowerment. The desire for globalisation linked to a specific set of ideals and path dependent implementation is resulting in badly conceived and unsustainable transport infrastructure. The link between ideals and sustainability needs to be strengthened in order to mitigate the negative effects of path dependent globalisation.

Link 3: Risk - Globalisation – Inequality – Sustainability – Strategy. There is a danger path dependent globalisation produces MUTPs which tend to provide further positive effects for the wealthy and exaggerate negative effects for the poor. MUTPs can cause disruption, noise and pollution along most of their length with positive benefits to the nodes only leading to unsustainablity. It is important inequalities are managed by effective strategy for MUTP.

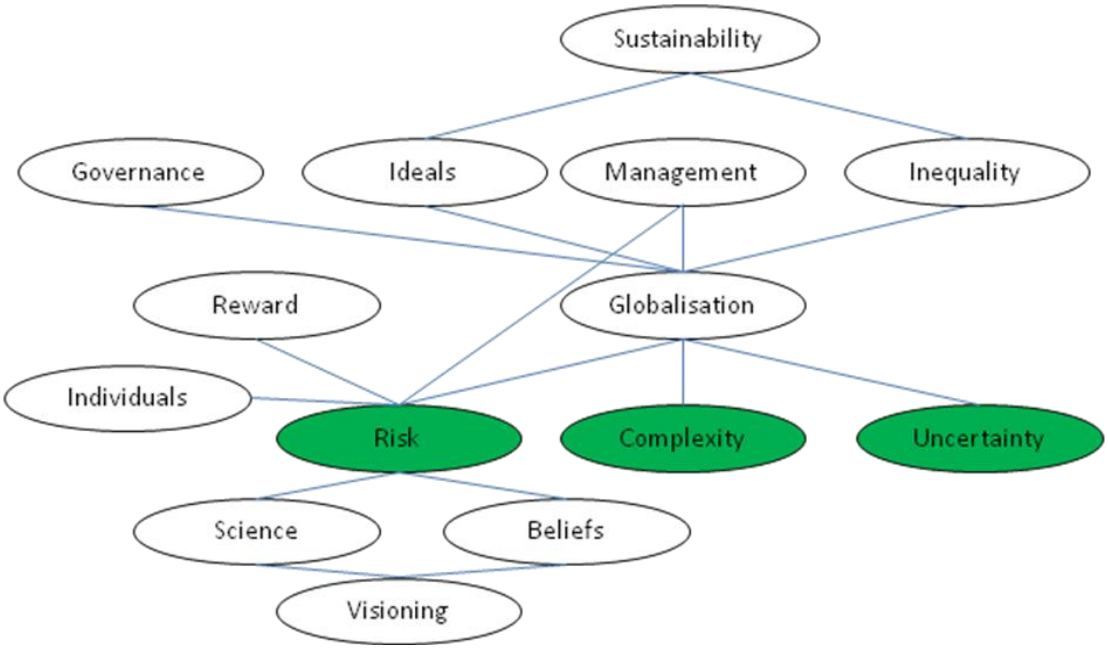
Link 4: Globalisation – Governance – Control. Although in the short term government tends to control transport, in the longer term transport can shape the

structure of government. Physical and social expansion from increased mobility will require the expansion of political authority. The authority will subsequently migrate upwards to less accountable organisations. New regionalism will become more influential.

Link 5: Risk – Science and Beliefs – Visioning. All risk is perceived and when discussing risk people tend to bring disjointed scientific evidence mixed with personal opinion – this combination leads to messy inconclusive debates about how the future should be managed. More structured methods are required.

Link 6: Risk – Management - Stakeholders - Information and Transparency. When assessing MUTP project risk it is important to understand the driving forces of stakeholders. These goals and aspirations of individuals are not always clear and they are liable to change during the project life cycle, but they can have large effects on project success/failure. The changing goals and aspirations of champions should be understood and monitored, with changes in goals and aspirations updating risk assessments.

Figure 18: Treatment of RUC in transport policy – hypermobility: lessons for MUTPs



4.3.4 *Great planning disasters (P. Hall, 1980/2008)*

Defining success and failure

- Definitions matter. In Hall's book and *Futures Journal* article on great planning disasters he describes 'large planning decisions' as those which involve considerable public investment. He emphasises that 'planning' refers *not* merely to physical layouts but to *any* kind of decision that involves conscious forecasting, modelling, design of alternative solutions, and evaluation. He describes 'planning disasters' as possessing two kinds of outcome: '"positive disasters', where the

decision to develop is implemented but where many informed observers later criticise the outcome; or 'negative disasters', where the plan is aborted at a late stage after considerable resources have been committed." These definitions are important, useful and applicable to MUTPs. What is significant here though is that the term 'disaster' is not actually defined. For whom is the disaster? When, furthermore, does a mere 'mistake' become a disaster? A disaster at best suggests a dramatic failure of decision or a decision that has spawned totally unforeseen outcomes that matter a great deal. In the context of MUTPs one needs to be very clear for whom, where and when the disasters are deemed disasters.

- Hall cites as 'positive disasters': Concorde, the San Francisco Bay Area Rapid Transit System, and on grounds of cost escalation and delay, the Sydney Opera House. …. As 'negative disasters' he includes London's third airport, the London motorway system and many other abandoned or half-abandoned projects, e.g. freeways in San Francisco and Toronto, Manchester's rapid-transit system, and the redevelopment of Covent Garden in London." Looking back, what is interesting here for MUTPs is (1) that some of these postponed projects were actually built later and (2) what constitutes a disaster (failure) in one context/time may later be hailed as a great success in another – the BART and Sydney Opera House comes to mind. This highlights the importance of 'context' when appraising/evaluating projects and the values that accompany them.

- "The failure to take action *in time* to grapple with a problem" is seen by Hall as a 'planning disaster'. He cites on this basis the abandonment of the motorway plans in 1973 and the decision *not* to build the third London airport as illustrations of such disasters. The problem though with the notion that some unimplemented projects being presented as a 'planning disaster' is that this case *could* be argued potentially for all MUTPs by their principal sponsors. There is clearly needed here some kind of independent objective judgement and more transparent and realistic measures of 'success' and 'failures' for such projects before once can be comfortable with Hall's argument.

Typologies of uncertainty and errors

- Using Friend and Jessop's (1969) definitions, Hall defines uncertainty "in the relevant planning environment (covering) as everything out-side the immediate planning system …. . which expresses itself in bad forecasts of behaviour (i.e. errors) within the system that is being planned for." He goes onto explain that there are two notorious types of error. "First, many planning disasters prove to have been based on bad forecasts of effective demand." Recounting research undertaken by Merewitz (1973) "which shows definitively that cost escalation is 'a fact of life' for almost every major project." Hall argues that the real question "is whether final costs fall above or below the magical average of about *1.55 times* the original estimate." Friend and Jessop's work remains valid to day for MUTP – its successive editions are most important. Similarly the work of Merewitz still resonates today. Flyvbjerg (2003) has shown that cost-over runs remain common in MUTPs and a reoccurring concern.

- Hall explains that uncertainty which at first appears 'environmental' (i.e. contextual) often turns out on closer inspection really to belong to other types of

uncertainty. According to Friend and Jessop (1969), these include uncertainties in related decision areas that may be attributed to "other people in other organisations, and even other parts of the same organisation that may rebound on the decision in question." In the context of MUTPs this in effect differentiates between the 'greater (global) contexts of the project and the more local contexts of the group of organisations involved in the planning, appraisal and operation of the MUTP in which key judgements are made. All are subject to frequent/ rapid change.

- Following Friend and Jessop's lead once again, Hall points to a third type of uncertainty. This includes the uncertainty in value systems which "frequently emerge as the most significant of all." This is important for MUTPs since such projects typically have long incubation periods and lifecycles with changing values, opinions and changing events that over time mould/ alter judgements about MUTP developments. Hall cites the sudden shift in the UK in the late 1960s "from high-technology, comprehensive solutions to incremental, managerial, conservationist ones" as illustrative of such changes in value systems. We can also see this in the dramatic shift towards a greater reliance on the market to finance, run and direct public services introduced by Thatcherism in the 1980s and further developed and promoted by New Labour in the 1990s. These developments represent yet another major value shift that would have been difficult for any observer to predict that has greatly affected MUTP developments.

Stakeholder interests

- Hall points out that that the above analysis of uncertainty and the impact of changing values offers a "theoretical explanation which assumes that everyone works in a rational, disinterested world where-in a process of Athenian debate-the right decisions will eventually be taken. In practice, decisions are made by *actual* people who may have various motives." This issue of understanding the motives of stakeholders is most important in the context of MUTP planning, as is the appreciation the power (and access to power) such stakeholders may have to promote their interests. This, we contend, is critical to understanding why some MUTPs get implemented despite their escalating costs and others do not. It enters into the field of *real politik*.

Models of decision-making

- Citing Allison (1969), Hall presents three alternative models to decision-making: (1) *The rational actor paradigm* - here the decision maker "reaches a solution by analysing goals and objectives, setting out options, calculating the costs and benefits of each, and making the choice that gives maximal excess of benefits;" (2) *The organisational process paradigm* – here it is assumed that "most behaviour results from established routines within organisations: the actors will be seeking to guard the interests of these organisations, and all change will be marginal and incremental". (3) *The governmental (bureaucratic) process paradigm* – this is based on "the notion that government decision making results from conflict, compromise, and confusion among individuals whose behaviour must be understood in terms of game playing. Each person struggles for outcomes that advance his perception of national organisational, group, or even personal

interest. Solutions represent immediate answers to problems, often with poor communication and limited understanding." We contend that there would be much merit in stakeholder decision-making in the planning, appraisal, delivery and evaluation of MUTPs being examined with the aid of all three paradigms.

- Hall claims that "No one model will explain all of reality" but that instead "it is necessary to develop an eclectic theory that will embody different insights and different aspects". Hall goes onto suggest that, in fact, "planning decisions result from complex interactions among three groups of actors: the community … the bureaucrats and professionals within government; and the politician at every level of government." In the case of MUTPs one should also add private sector stakeholders that have a commercial interest in the project and its outcomes. This group will commission (at their convenience) professionals and make agreements with government (at all levels) and community groups alike, where mutual benefit is derived or potentially expected. Conversely, adversarial relationships may develop among these parties with third party arbitrators or the law ultimately resolving conflicts.

- Hall explains that "analysis, through dissection, *merely* reveals the pathology of past decisions" and that most decision-makers, indeed most people affected by decisions, typically would like something more to be derived from such an analysis. They would welcome, for example, "an attempt to suggest better rules for decision-making." While realising that any such attempt, will not be easy, Hall strongly recommends that both analysts and decision-makers alike *must* "recognise the existence of all the constraints to rationality revealed by the pathology." This is highly relevant for MUTPs. The desire to "suggest better rules" is in part the driving force behind the research in MUTPs conducted by the OMEGA Centre at UCL. Such 'better rules' need, however, to be very contextually aware.

Forecasting

- Hall argues that better forecasting should at least recognise the three types of uncertainty described by Friend and Jessop. "It should also recognise that apparent irrationality may in fact be uncertainty in related decision areas or in values." He goes onto explain that "the heart of the problem is to produce scenarios that show how events: technological, social, cultural, political will unfold and interrelate in the future". This he suggests is "the stuff of history; it will need a good historian to capture it and to write history in reverse". Hall points out that while "conventional forecasting techniques and mathematical modelling, morphological analysis, cross-impact analysis-will provide an invaluable structure to the process, much decision-making will be intuitive and judgemental." Once again this statement is highly relevant to MUTPs. It not only highlights the importance of scenario planning for MUTPs but also acknowledges the power of (historical) context (including path dependency) - which might well *not* be repeated in future and therefore prove to be of little value unless one sought to replicate the past!

Social welfare function

- Hall argues that "it is impossible to devise a true social welfare function that would permit a rational calculation of gains and losses to individuals. This fundamental problem has plagued some distinguished thinkers, but seems entirely to have escaped the attention of most professional planners, despite the fact that they should have been centrally concerned with it. Without such a function, it is clear that the vital evaluation stage in the planning process must be meaningless." Today's evaluation of MUTPs confronts the very same dilemma and despite us being almost 30 years on we content that not too much progress has been made here.

Changing contexts

- Hall explains that "the present balance of forces will change, and not necessarily at a constant pace or even in the same direction. In struggles between powerful forces, equilibrium is *never* more than temporary." He goes on to argue "it seems *inevitable* that the forces of economic development are going to gain strength as against, say, the forces representing environmental protection, though not the forces of energy conservation …. the meaning of the term 'economic development' could (furthermore) profoundly change during the coming decade." We contend this again is all about changing contexts and the outcome of power struggles producing new contexts with new values. It is also about changing definitions of key concepts (such as economic development) over time, place and in changing culture. All these points are most important for MUTPs. The prediction by Hall that "the forces of economic development are (always) going to gain strength as against, say, the forces representing environmental protection may well in the 21st century become less valid, although certainly the statement was valid throughout the 20th Century." The recent Eddington Report (2006) in the UK presents the case for reducing carbon emissions on the back of economic growth pre-requisites. This suggests that economic development imperatives, touted as a means to 'pay' for environmental initiatives may yet prevail in the 21st Century.

Timing and inaction

- Hall argues that "we should also develop a better sense of timing". He argues this on the basis that "a negative disaster can be said to have the virtue that *even* if time and money were spent, much was saved compared with the outcome of a positive disaster (and) that might suggest that for most public projects, the answer is to *make haste slowly*." There can however be costs in inaction too. "Costs and benefits should be analysed at various points in the future, and should always be compared with doing nothing or, more accurately, doing the minimum. There is a time of doing very little, and a time when only positive, even unpopular, action will be right" The matter of timing is critical for MUTPs both in their planning and implementation. It represents a sensitivity to the 'temporal context' and has to do with the notion that on certain occasions 'all ducks are in a row' and that as a result this situation offers a major 'window of opportunity' to take action that will possibly not avail itself again.

Commentary on lessons: their identified relationships of relevance to MUTP planning

Complimenting the above, the text below summarises *some* of the relationships/ links among the principal lessons extracted from Hall's contribution that appear relevant to MUTP planning. These relationships are visualised in Figure 19.

Link 1: Assessment - Context – Value Systems – Time. Some MUTPs and large projects are often considered planning disasters during their implementation, or early operations stages but have subsequently been re-evaluated as planning 'successes'. The temporal effects of changing value systems can have a profound affect on assessment criteria and evaluation procedures. Value systems are underpinned by current political, environmental and social contexts and can change significantly over time. The link between time and context and assessment is highly relevant to the research of the OMEGA Centre at UCL and for MUTP planning in general**.**

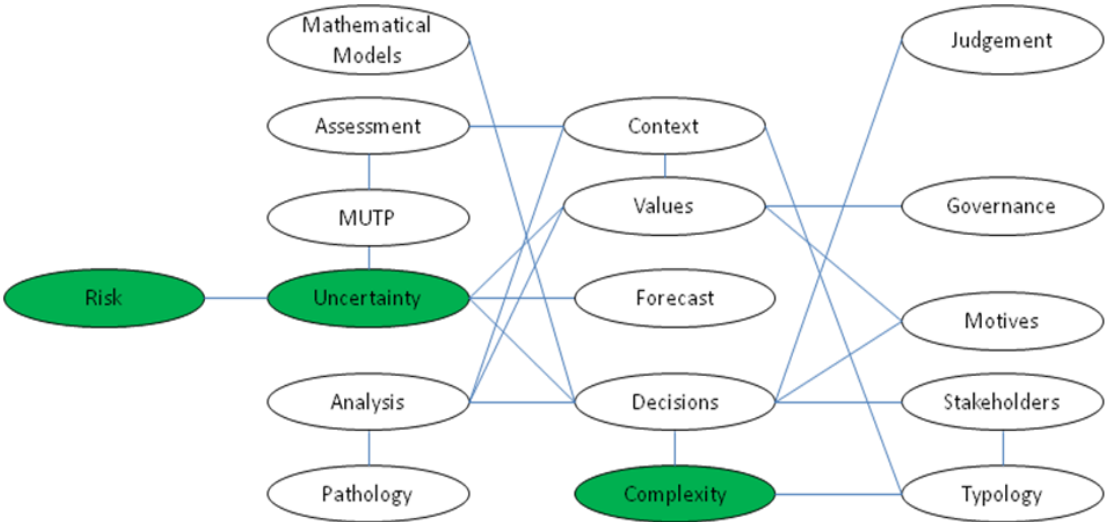
Link 2: Uncertainty – Demand Forecasts - Complexity- Equilibrium Theory. Significant uncertainties surrounding MUTP projects can be linked directly to a reliance on forecasts to validate project proposals. One of the most common forecast errors related to MUTPs is poor forecasts of effective demand. The use of path dependant mathematical models based on theories of equilibrium commonly break down when applied to model events incorporating the levels of complexity found in an MUTP project. A more measured approach to the use of such models is required.

Link 3: Uncertainty – Decisions – Stakeholders Networks – Complexity - Transparency and Team working – Control. Uncertainty can occur regarding any project decision due to the form and function stakeholder relationships and networks. A decision made by an actor on the basis of current information may detrimentally affect a decision made in parallel by an actor in another organisation within the same decision space. The combination of the two decisions can cause complex interactions, which reverberate around the project triggering a whole chain of further decisions and complexity. Good decision networks with adequate controls and transparency are required to limit this form of uncertainty.

Link 4: Uncertainty - Decision – Context - Motives – Risk Assessment. Decisions are seldom made in a rational disinterested world – decisions are made by powerful individuals according to motives which can have a large effect on MUTPs. It is important to understand an individual's motivations and include in project risk assessments, allowing for motivation to change over time

Link 5: Decision Making – Analysis and Pathology – Path Dependency - Context - Models and Judgement. The analysis of decision making tends to lead to a pathology of the patterns of decision making and therefore a path dependent insight into the decisions made. It is more valuable for understanding decision making to create contextually aware rules which can be informed by mathematical modelling, but should also be linked to intuition and judgement (which implies the input of an expert).

Figure 19: Treatment of RUC in great planning disasters: lessons for MUTPs



4.3.5 *Property development – major projects (K. Perry, 2008)*

Defining 'major'

- Perry "shows that major projects create specific issues that the traditional market approach is not always appropriate to resolve. …. A major project in the property sector will be enveloped by political issues, at local, regional, and *even* the national level. The broader perspective of economic development issues, social capital and environmental impacts across a larger canvas is a new challenge for the property industry more used to playing out issues at a local or neighbourhood level." Two points are important here for MUTPs: (1) the acknowledgement of the frequent failure of the traditional market approach for major projects, and (2) the acknowledgement that the property sector is less well equipped to look at its sector beyond the local/neighbourhood level. Notwithstanding this claim, there are increasing signs in the UK that property interests now employ very capable lobbyists/ advocates (often planners) to address these 'broader issues' at least at the local and regional level.

- Perry's definition of 'major' for the property industry "is measured in terms of floor space area, and would be schemes in excess of 1 million square feet such as a major shopping centre or office complex." He explains that "the private sector (in the UK) is increasingly being encouraged by the government to 'think big' and advance much larger projects in excess of 5 million square feet. Each of these mega-sized schemes - if sited in a reasonable successful economic location - will have a developed value … of at least £1.5bn" (at pre- credit-crunch levels). The measure of 'major' here is useful and could provide a basis for to correlate with indicators of size for MUTPs with major property project developments. It is also useful to have another sector confirm the trend observed by the OMEGA Centre at UCL of the UK government increasingly thinking big.

Knowledge transfer

- "There is currently widespread acceptance in government that the private sector should be brought into these mega-sized schemes at an early stage. ……". Perry suggests that "this may, in part, be because PFI has its origins in HM Treasury, major government departments and the Construction/ Services industry, whereas in property the participants are more often property developers, house builders, local authorities, regional development agencies and (other) government agencies." The knowledge transfer between these two quite different industry groupings has simply not yet had time to happen." The desire by UK government for the private sector to become involved in large-scale projects (including MUTPs) follows from the simple fact that the public sector cannot afford to fund the number of such projects it wishes to promote and because it also wishes to transfer as much of the risks related to such projects away from the government's balance sheet – at least for the duration of the government's minimum four year tenure. The observation that the transfer of knowledge about private sector funding between/ among the different agencies has not had enough time for it to be fully comprehended by all parties is especially important for MUTPs which increasingly rely on associated real estate returns to help finance/ fund the infrastructure.

Longevity of project lifecycle

- Perry explains that: "Major projects undoubtedly take significant time to deliver……. A major mixed use scheme or regeneration scheme is therefore likely to be developed over 20 years or longer. Such projects will be highly complex in terms of the number of statutory processes that will need to be followed ….. and the number of stakeholders to be consulted with, and agreements to be documented. These include local residents, local planning departments, local employment and learning and skills departments, environmental officers, health and safety officers, utility companies, sub-contractors, joint venture partners, shareholders, employees, tenants, visitors, suppliers to name a few)." The questions here is whether a combination of a MUTP and major property developments will lengthen the delivery time or accelerate it as the combined development becomes more complex? The sequence and dependency of each project component, one upon the other, is critical here; the dependency of the rail service and other transport infrastructure being provide *before* the commercial and residential development is for example in the case of CTRL critical. There is also the very real issue of the risk associated with projects that take a long time to deliver being especially vulnerable to changes in context - notably changes in market conditions overall, and changes in the demand for different types of accommodation. This is especially where developers come into direct conflict with local authorities that have an 'agreed vision' for an area that is unresponsive to changes in market conditions.

- "The hurdle that major (property) projects face is that their delivery …. is too protracted for most opportunity funds who would typically match the risk profile." These opportunity funds are Perry explains "often intended to liquidate after around 5–7 years during which time significant project risks will still exist and exit may only be possible to a limited number of investors. In addition,

opportunistic funds favour *gearing* to enhance returns – given that the fund itself does not offer the same repayment capability of say, a corporate borrower. Such bank funding is usually project-specific and again with long term high risks, major projects are often unacceptable for the banking market." Perry goes on to explain that "major projects in their early phases are very high risk and, therefore, require as much as 90–100 per cent equity funding. These levels of equity are often too high for the opportunity funds that require a higher debt level to enhance their returns." These are very important considerations that MUTP planners need to take into account when looking to the real estate sector supporting/ subsidising infrastructure investments. They also need to look at the degree of 'certainty' that they can offer developers in the delivery of infrastructure (be it transport infrastructure or other types) who generally require a certain future before committing funds to the project.

Understanding interdependency

- Perry makes the point that it is important to make a distinction between "a developer …. seeking to use skills and capital to create an asset of value to be sold on to an investor, and the investor. The onward sale will typically be secured even before building commences in order to reduce certain risks. The investor (typically a listed property company or pension fund or life fund) looks to hold property over the medium to long term as part of a wider investment strategy." Perry goes on to explain that "property investments are often seen as (1) core investments (i.e., relatively mature assets at the lower risk end of the spectrum), (2) enhanced investments (with some element of a 'new market' risk remaining as in the case of a major refurbishment project or new tenant) or (3) opportunistic investments (i.e., a project where the investor will still be exposed to letting risk or final construction cost out-turn)." An understanding of the inter-connectivity, inter-dependence and complexity of these relationships is most important as they can make or break a MUTP project and its associated development. Under very strenuous circumstances the failure of one critical component to perform can have nock-on effects throughout the entire financing arrangements and even call the project to a halt or lead to a 'bail out' by government as in the case of the CTRL.

- Perry explains that: "The one investor who is often prepared to accept some element of major project risk is ironically the individual consumer who will buy residential property in a new major project. This willingness is born from the widely held individual belief that the UK housing market represents a sound *long term* investment analogous increasingly to a pension planning tool. It is fortuitous, therefore, that most new major projects e.g. Greenwich Peninsula, Ebbsfleet Kent, Wembley, and even Stratford contain a significant residential component driven over the last 5 years by government planning or social engineering policies responding to greater the urbanisation of existing areas both to maximise the efficient use of existing infrastructure (particularly transport) and to minimise the cost that would otherwise arise of investing in new infrastructure in areas where today none exists." Given the increasing dependency on real estate revenues of MUTP developments in projects such as CTRL, the critical question here is what impact will the global credit crunch have on these investors *and* the investment viability of such major projects? Apart from highlighting the drawbacks to

interdependency of sectors what these developments emphasise very significantly is the critical importance (*and fragility*) of context.

- "Infrastructure is one key element of construction that is a problem area for developers. Not only is this typically a large upfront cash-flow issue but the specification, and even delivery, of some elements such as roads and some utilities is outside the control of the developer." Perry expands on this point by explaining that "a project timetable is thus beholden to government or in some cases recently privatised public sector bodies that do *not* have any real alignment with the objectives of the developer." Two important points emerge here of relevance to MUTPs: (1) since infrastructure is such a key element for successful property development projects, one could argue that the provision of such projects and supporting infrastructure/ service by 'others' is a considerable 'leg-up'/ risk-reduction measure (for the developer) for which government and the service provider should receive some kind of reward, and (2) clearly, much advantage can be gained through the alignment of objectives of the property developer with those of the infrastructure providers. This is reinforced by the fact developers in Ebbsfleet urgently sought reassurance that the CTRL domestic services would be delivered on time prior to committing themselves to going ahead with their plans.

- Perry explains that: "The involvement of the property sector with major projects has expanded in recent years both in the UK and world-wide." This is despite the fact that some high profile major projects have failed at the expense of the first owner, only to succeed in subsequent ownership. "Canary Wharf is a prime example where the delay or absence of certain infrastructure improvements (the Jubilee line) is generally understood to be the key contributing factor to the financial failure of the project in it first incarnation. This infrastructure risk, and its inevitable interaction with political risk, is recognised by the market though it has not been seen to attract a clear risk management or mitigation strategy." Today, newer uncertainties are coming to the fore. "Flood risk now comes much higher on the agenda in considering development locations in the UK as a result of major inundations in recent years, and the expectation that such events will become more frequent and severe with climate change." The two major observations of note here for MUTPs are: (1) that the gains of major property developments can be similar to the resort industry norm whereby they typically accrue to the 'third owner' (not the first), and (2) that the infrastructure risk and its 'inevitable' link with political risk has yet to attract a clear risk management or mitigation strategy except that PPP/ PFI consortia necessarily jack up the price to reflect this risk and often has the public sector as the guarantor of last resort.

Capacity constraints

- Perry points out that: "the role of developers is *more important* in major projects than that of investors". He goes on to explain that "typically the traditional developer (in the UK) operates parochially and is poorly capitalised. Most developers will progress a scheme to planning approval and then maximise borrowing to gear-up their investment when security is available from the traditional property lending banks. The pool of sufficiently well capitalised developers to undertake large projects in the UK is limited to no more than 25–50 organisations. ….. Developers are also typically small organisations in terms of

human resources. This reflects the complexity of the development process and numbers of processes involved". Perry also explains that "developers often prefer the lower fixed cost base of employing a few key individuals and resourcing from the market the remaining skills, as and when required" because a high fixed cost base may encourage organisations to take on marginal and therefore high risk work at the wrong time in the property cycles." These facts must surely place a ceiling on the number of MUTPs that can in reality be built in the UK and financed at any one point in time if such projects are indeed reliant upon UK developers to take the lead? The question here is whether government – in launching so many mega projects (in several sectors simultaneously) - is fully aware of this constraint and of the implications of relying on more international developers to fill this gap in the construction period up to the London Olympics?

Risk pricing

- Perry claims that "developers have a fairly unsophisticated approach to risk pricing. Traditionally a developer would look for a target return on cost, where cost includes interest from bank lending during the development period. This target has historically been between 15 per cent and 20 per cent profit margin on total cost." He goes onto to explain that "the key for most developers is the need to recycle their capital *as soon as possible* given their low levels of capitalisation, hence the need to forward sell projects where possible or secure limited or non recourse finance. The low level of capitalisation reflects the lack of interest from the equity markets in this type of business, where profits can be very volatile, lumpy and forward profits hard to forecast without a very secure new project pipeline." These facts have an important bearing on MUTP projects that rely on the real estate sector to support/ subsidize the infrastructure project expected to spawn the real estate developments. It raises the question as to whether the rates of return will remain sufficient to entice investors/ developers into such projects, especially if there are higher and more attractive returns promised elsewhere in the world or during economic downturns.

Land value uplifts, capture and the planning system

- Perry points out that: "the essence of development often comes down to evaluating the value of land. Land *only* has value in a property sense when the end value of a land use is understood and from that is deducted the total costs to develop the 'asset' and due allowance is made for an appropriate profit for the developer. The residual sum or 'residual land value' is in theory then the maximum sum any developer should pay for the land." Perhaps the biggest single risk that a developer encounters is that he overpays for the site either because the developer overpays for the site or the landowner sells short - i.e. one of the parties gets it wrong. Perry argues that "a more equitable and better risk sharing model ….. is to agree the land price at a later stage in the (development) process …. either when planning is achieved or even later, when total development costs can be better estimated. Some models go further where the land payment is linked to end sales value." The critical questions here are what uplift in land and property values does a successfully operating new MUTP bring to an area, how can this be supported, and how much added value can sympathetic/ supporting real estate and

urban planning initiatives generate over and above what the MUTPs might spawn?

- According to Perry, for major projects, *the* major hurdle to overcome is planning, "not least because the processes demanded in order to allow consultation locally (and even nationally) requires time and considerable design and project development work in order adequately to describe a project and the impacts (both positive and negative) that it will have on economic, social, and environmental issues." Perry goes on to argue that "the laying out of the net benefit case and the total cost thereof is often left as the obligation of the developer with varying levels of support from local, regional and national government." He concludes by arguing that "it would seem that prior generic debate on these issues, when setting regional or local plans, *could* significantly improve this position" and that from his experience "interested parties *only* appear to demonstrate an active interest when a scheme begins to be presented in 3-D". Local political concerns he goes onto to argue also arise at that point, which is when local opinion is better gauged. "The developer can then be left arguing the merits of the development *per se* rather than the more specific impacts of their proposed scheme compared to other options." In the context of MUTP related developments, the above is well illustrated by the experience of the Kings Cross development. The system of negotiating planning benefits arising from development is often fundamentally applied on a case-by-case basis - despite the existence of national planning guidelines/practice notes. This leaves considerable room for manoeuvre on the part of both the developer and the local planning authority - which somewhat works against the notion of 'certainty' which developers appear to desire most. It also begs the question whether local planning authorities possess the requisite skills to negotiate effectively.

- According to Perry, the longest delay with major projects in the UK will often be the s106 agreement negotiation. Such negotiations, he explains, inevitably seem "to become a debate between local authority and the developer on what a scheme can afford". Whilst it would appear to Perry that an approach of this kind "may or may not correctly assess the 'impact' of the scheme on the public infrastructure, it seems to be *inadequate* for ensuring a well planned development and maintenance of public facilities, particularly as the initial capital contribution from any development can *only* ever contribute a small percentage of the whole life cost of infrastructure." There is growing evidence in the UK to suggest that s106 agreements are especially inappropriate for MUTP purposes, both because they were not designed or intended to be used for such major public works project and also because they often reduce the transparency of decision outcomes.

- Perry claims that "failure to achieve a coherent model for the planning design delivery and on-going maintenance of infrastructure in the widest sense … is a major obstacle for the private sector's involvement in large-scale property projects intended either to deliver regeneration of failing areas or to accommodate the impacts of growth arising from economic success. He goes on to explain that government has sought to bring innovation in this area through, for example, The English Partnerships agency in Milton Keynes, which has in effect acted as a promoter and banker of the required infrastructure. This planned approach to infrastructure development he argues "gives confidence to developers, and also

end-investors, that infrastructure will be delivered *and* maintained, thereby removing a major risk obstacle." This model, he goes on to explain, "is harder to operate in the regeneration sector where the cost of upgrading infrastructure may well exceed 10 per cent of the development value of the new property. Here, the business financial case for funding will require a view on longer term economic growth value capture, or indeed the social and financial cost of not intervening." The most important observations for MUTPs here are two well known facts: (1) the failure to provide adequate infrastructure (of all kinds) to support a major property development constitutes a major risk, and (2) that it is harder to upgrade existing infrastructure rather than introduce/ build new infrastructure**.**

- "The property industry is notoriously reluctant to engage in assessing and evaluating qualitative issues … (that might) have huge impacts on the built environment." Elaborating on this point, Perry explains that "a project initiated today with a 10 year time lag surely needs to try to address this for unlike other industries, the time to market and inflexibility of changing the product during its delivery puts more pressure on getting it right upfront." To some extent one could argue here that the property industry might say/ believe it can rely on the planning system to protect it, which it does, in that competing products will always be some time behind. However, Perry argues "this is an *inadequate* instrument with which to drive efficient resource allocation in the economy." These concerns are equally (if not more important) in the case of transportation infrastructure, especially where alternative technology and energy policies can alter the viability of a MUTP, almost over night, and make the future it offers immediately outdated or even unaffordable. For large developments it is often the case that developers will hedge their bets by attempting to build-in flexibility over the quantum of different types of floorspace to be provided - usually through phasing - where initial phases are presented as 'firm' and later phases are cited as 'subject to review'. This, however, can only be a partially successful guard against downside scenarios.

- "Given the increasing timeframe for major projects, the probability of a changing legal framework, including planning, is a risk not factored into traditional property projects." Expanding on this point, Perry argues that generally, planning changes have tightened future planning approvals in the UK and that "this tends to add value to existing schemes, assuming that they are grandfathered against new changes as it seeks further to restrict future property supply." The point made here that the probability of a changing legal framework, including planning, is a risk not factored into traditional major property projects is of great relevance for MUTPs. The fact that new planning frameworks are seen (by the property sector) to reduce risk and uncertainty on the proviso that they tighten future planning approvals is an interesting and important observation for MUTP planners. The question that this raises is, contextually, where and how do MUTPs drive such planning changes and vice versa?

Design quality

- "The quality of design is critical to all major projects" claims Perry. The design process he argues explores the options for a major site and is especially influential at an early stage in the planning process by establishing the vision for the scheme. He furthermore argues that "good design does *not* necessarily cost more as it will

create more project value and may lead to a simpler more efficient delivery process." The most important point made here of relevance to MUTPs is that "good design does *not* necessarily cost more as it will create more project value and may lead to a simpler more efficient delivery process." This assertion is also, incidentally, reflected in the recent drive by developers to build/ further their image through design.

Catalysts for job creation and training

- According to Perry: "major projects have been successful catalysts for better public/ private co-operation in job creation and training". He cites the Bluewater experience in Kent is a prime illustration of this claim. "Here a £750m development project created some 7000 jobs during construction of the project and on into the retail centre operational phase of the project." The illustration of the Bluewater experience illustrates the job creation potential that MUTPs can bring to an area. Whether these concerns are *routinely* brought into the evaluation of such projects is something that needs to be further investigated. It was for example belatedly (even begrudgingly) acknowledged by the National Audit Office when investigating the value for money of the CTRL project.

Public-private partnerships

- Perry points out that Public-Private-Partnerships (PPPs) "are project contract delivery models, similar to BOT projects which have been used in numerous major infrastructure projects around the world..… they are typically subdivided into key elements, such as: design and build, operational and finance, each element of which is best provided by specialist entities that come together in a consortium, specifically for that project." These projects are "*built* by the private sector, *operated* for a period (or concession) and then *transferred back* to the public sector at the end of the concession, usually for a nominal financial sum." Each element is priced with a collective 'unitary' price quoted to the client by bundling all the services, capital cost and revenue, into one in the form of a unitary price (per litre of treated water, or number of hospital beds available etc.). In this model the consortium team "analyse risks related to the project and allocate them to that party best placed to manage the risk at the most competitive pricing." According to Perry, "for the client, the (claimed) advantage is a significant (perceived) risk-transfer, particularly the interfaces between these activities." The emphasis and the crucial element for success here is a clear statement of the 'successful' outputs. "The private sector then, in effect, works backwards from these estimates to determine the optimal design and operating environment." It is imperative that government MUTP planners and community groups fully comprehend these models the implications of their use (both long term and short term) as there is growing evidence in the UK and elsewhere that many such vehicles do *not* offer the cheapest or best value solutions for the delivery of projects – primarily because the private sector typically charges dearly for it taking over many/ most of the major risks. This is in large part, it could be argued, a reflection of the fact that the private sector is not entirely in control of the timing/delivery of the project.

- According to Perry, "long term management is an area where the property industry is still relatively immature. The PPP/ PFI market created a better understanding of whole life cost issues, although the jury is perhaps still out on whether the private sector successfully priced and planned for the extent and nature of costs to fully maintain and limit the depreciation of a property asset over say 25–30 years." This in part can be explained, he explains, because "technology and operational changes will have been very difficult to predict, plan for and design in at the project inception" and on this basis building in future flexibility (which is hard to value anyway) "will *always* appear very expensive." The observations made here are very important for MUTPs if we accept that both the public and private sectors have limited (albeit growing) experience of PPP/ PFI projects and that lessons are being learned as we speak. The acknowledgement that the private sector in property development may not have priced its involvement correctly to date in PPPs/ PFIs and that "building in future flexibility is hard to value (and therefore) will always appear very expensive" suggests that much still has to be learned.

Issues of wider collaborations

- Perry points out that: "developers are well aware they need to gain neighbour support for their projects … through the planning process, potential rights of light issues, and at a practical level for operational issues such as access and agreement on construction working hours. What is often missed (however) is the opportunity for a wider group of stakeholders to collaborate on an enlarged scheme which may have the potential to generate a more successful outcome (for example it might support a greater investment in new infrastructure)". This wider collaboration, he goes on to explain, "is a weakness of the property industry that traditionally has been disinterested in joint ventures and indeed suspicious of working with its competitors". It is made more difficult Perry argues "where land owner investors have incompatible objectives at any one point in time. …. It is the challenge of finding a balance of these potentially conflicting objectives that often is too complicated for a developer to reconcile, particularly when under time and financial pressure to deliver the base major project." Given the above observations, the real estate developments now taking place around the CTRL transport hubs may be seen as successful innovative approaches which, one way or the other, look to overcome many of the limitations cited above. Part of the problem here however, is defining, with precision who the stakeholders actually are, what their motives are, and how to accommodate them.

New technologies and risk

- Perry claims that property is "a slow adopter of technology which leaves retrofitting issues at a later date." Elaborating on this point he asks: "if local combined heat and power generation and distribution is part of the 'carbon answer' should the property industry not have seen this 5 years ago and planned such systems in; retrofitting would require a new land assembly/ planning/ delivery cycle all over again." Despite the fact that many MUTPs are promoted with visions of a more high-tech future, their financing rationale often favours tried-out technology rather than new innovations principally because new technologies are perceived to add more risk. There appears to be a preference for

MUTPS to get the project up and started with already tested-technology and then retrofit as technology allows/requires, rather than offer a new high-tech major new project. In this way, the use of tried and tested technology is employed as an explicit means to mitigate risk.

Capacity building and better communications

- According to Perry the skills required to deliver a major project should *not* be underestimated. He explains that "skills are required in *both* local authority and the whole property industry" and stresses that "all successful projects need a visionary in order to begin" whether he/ she be from the public or private sector. Perry sees "an explanation of this vision and (the role of) good design as essential to act as a quality control to keep that vision maintained through a process which under cost, time and complexity pressure will often drive to a simplified or watered down version." These observations resonate with the preliminary findings of the OMEGA Centre at UCL where the role of a sustained (albeit evolving) overarching vision promoted over time by political champions, to be of *paramount* importance for MUTP implementation. The concept of 'good design' acting as a quality control vehicle to avoid the vision from being diluted is a very important point for MUTP development not encountered before.

- Perry believes that developers (and in due course investors), as well as various government departments and agencies, "need better to understand each others' aims, methods of working and at the simplest level, each other's language(s)." We concur with this view and see that a reasonable degree of consensus must be obtained at the outset of all MUTPs so as to reduce the impact of changing agendas/ attitudes/ fashions which have the potential to scupper such projects. This level of understanding is especially needed at the project inception stage of MUTPs, where often the idea for a major project is initiated by the public sector but needs to secure a delivery partner.

Complimenting the above, the text below summarises *some* of the relationships/ links among the principal lessons extracted from Perry's contribution that appear relevant to MUTP planning. These relationships are more fully visualised in Figure 20.

Link 1: Stakeholders – Collaboration - Markets – Scale - Complexity and Risk – Government Intervention. MUTP Projects bring stakeholders together to collaborate in a highly complex project arena, one in which their previous experience will not be entirely adequate. For example the traditional market approaches typically used by an organisation at local scales are *not* always valid when transferring skills to work on MUTPs. The larger scale of MUTPs bring new challenges to companies outside their comfort zone of local scale developments, thus increasing project complexity and risk as companies struggle to find their way in the new environment. Furthermore market intervention by government to encourage developers to 'think big' and to get involved with MUTPs at early stages to help finance the initiatives heightens the problem.

Link 2: Experience – Knowledge Transfer – Time – Risk. There is a need for knowledge to percolate through the MUTP system and more efforts are needed to expedite the process. It takes time for lessons to be learnt, and knowledge to transfer

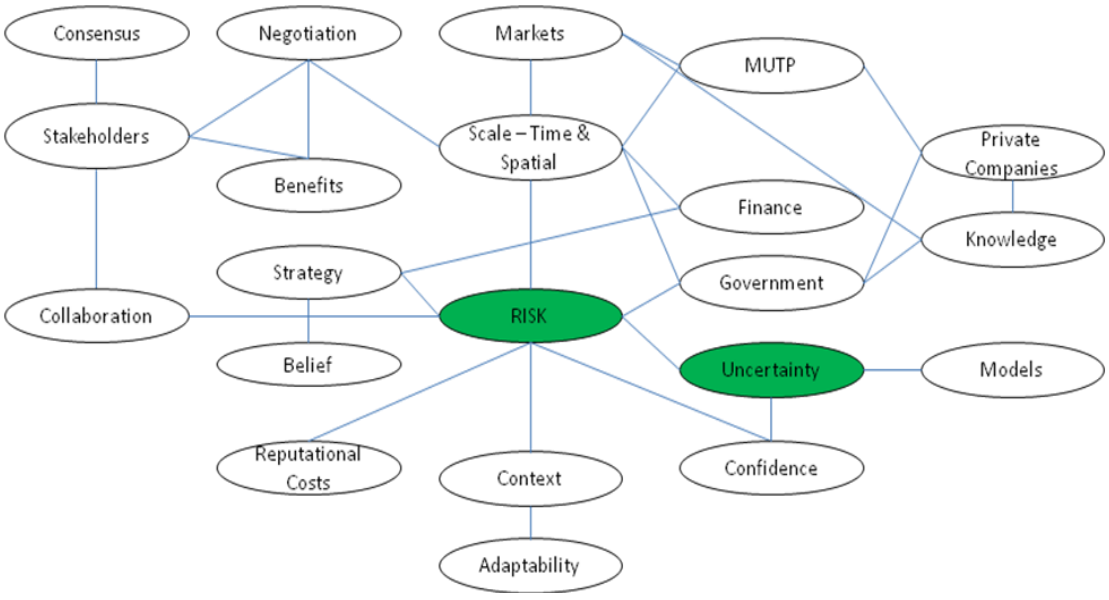
and help to reduce project risks. Some stakeholders feel there has not been enough time for the transfer of knowledge about PPP from one sector to another. The lack of expedient knowledge transfers maybe a missed opportunity to reduce risks in MUTP funding.

Link 3: Temporal Scale – Finance – Strategy - Risk – Scale – Certainty. The longer project times associated with MUTPs result in them being more vulnerable to contextual changes from social, political and economic cycles. This long term nature of an MUTP effects the finance options available, with short term opportunistic funds unwilling to lock their capital into such a high risk venture. Many funds are also limited to how much they can invest, so resources must be pooled. Lack of financial options puts pressure on the system which may be improved with greater project certainty

Link 4: Stakeholders – Negotiation – Legislation -Timescale – Benefits – Inefficiency. Negotiation between stakeholders over project benefits linked to legislation (such as s106 agreements currently used in the UK) can lead to long delays. The negotiation process can be highly inefficient as the significant time which is often expended by debates can lead to sub-optimal solutions for many stakeholders.

Link 10: Stakeholders – Collaboration –Trust – Risks. Trust is an important element of a business relationship which helps to reduce perceived risks and subsequent MUTP blockages. Collaboration amongst same industry stakeholders during a large scheme could help to reduce risks, but general suspicion of working with competitors prevents this, increasing risk and delaying projects.

Figure 20: Treatment of RUC in property – major projects: lessons for MUTPs



4.3.6 *Construction and project management (J.M. Kelsey, 2008)*

Commodification of projects

- Kelsey argues that "to understand the behaviour of those managing construction projects, one first has to understand construction outputs as consisting of economically, technically and environmentally complex products which both influence and are influenced by the non-construction environment." For the MUTP this statement is very significant for it acknowledges that whatever the type of project it will be seen by those delivering/managing the MUTP that it is essentially seen as a commodity and a product of a complex construction industry and *not* as a service. This suggests that MUTPs are perceived as different things to different people, depending on their responsibility/ involvement with/ in the project and their training and interests. These different perceptions impact on judgements made about the 'success' and 'failure' of such projects; even their very definition.

Treatment of risk

- "The recent and relatively long, prosperous period for construction is a relatively rare phenomenon ….. most construction businesses have grown with the highly volatile market in mind. This has tended to focus the mind of firm managers on the avoidance of downside risk which has been managed in various ways." Understanding and appreciating this stance is most important for MUTPs in light of their heavy reliance on the private sector to deliver such projects. It suggests that the frequent exposure to uncertainty (of the construction industry) generates on-going skills in the avoidance of downside risk. This is reflective of the fact that the private sector is obliged to absorb its own risk from its own resources, whereas, the public sector manages the resources on behalf of 'faceless others' – the public, the tax payers - with the result that the sensitivity to risk is perhaps less compelling. Public sensitivity to risk is in some ways different in nature - it is more about not being seen to perform badly and not being the target of blame.

- "One of the ways in limiting risk is to minimise fixed or overhead costs so that a firm can shed labour relatively quickly in a recession. …. Another strategy is to join a construction firm with some other firm with a more stable demand for its output. ….Yet another is to have interlocking relationships both with other firms having relatively stable output demand and financial institutions which will support the construction firm during recession. A further strategy is for large firms to have powerful lobbies in government partly so that counter-cyclical increases in government contracts can offset falls in non-government demand." An appreciation of these risk reduction strategies (and how they work) is important for the overall MUTP sponsor since it provides an insight into how private sector entities manage their contractual capacity and related risks in the planning, delivery and financing of MUTPs.

- "In property crashes, the downside risk often ends up with the providers of finance. The developers may become insolvent but may re-appear in other guises at a more favourable date. …. The problem is that for individual decision makers, the downside risk is effectively capped by the limited liability status of a

corporation, whereas the upside opportunity is not so capped. So here is a potentially risky area where the production of new buildings may actually be a by-product of speculation in land prices." This observation by Kelsey is very important for MUTPs and related developments because the lifespan of the MUTP is so long (from conception to execution) with the long period of maturity giving time for many stakeholders to enter and leave the investment arena, willingly or otherwise which in turn can delay/accelerate progress.

- Kelsey presents the built environment as a 'complex product'. He argues this on the basis that "the output of the construction industry is a *joint* product of a built output plus a piece of land with fixed location". The value of the land is thus "effectively a 'residual' arising from the difference between total development value and total non-land development cost." In a rising market, this allows large profits to be made "by buying land in anticipation of increases in construction output value. Similarly large losses can be made" if a downturn is unexpectedly experienced. In the case of MUTPs, it is not so much the land on which the piece of infrastructure is built that gains 'residual value' but the land and property which it impacts on and serves. This 'residual value' is, however, rarely arrested by the public sector in the UK where it has been the principal investor/ risk-taker of the project. This differs from Hong Kong where the government in effect claws-back residual values through subsequent development premiums charged on future planning permissions.

- Understanding the dynamics of a project's investment climate is paramount. As Kelsey emphasises, relatively small changes in initial conditions can generate non-linear and/ or significant change elsewhere in investment climates. "Two of those relationships encourage 'risk-loving' behaviour and the other encourages 'risk-averse' behaviour. These relationships may also cause wider disruption to market stability and even democratic political processes. While most construction project supply chain actors are in the risk-averse category, developer-clients and certain types of property companies can appear in the risk-loving set." MUTP promoters and planners need to understand better the psychic of these two different types of behaviour as they are both involved in MUTP developments. These very different types of stakeholders will seek to enhance their risk protection and take advantage of windows of opportunities that risks can offer in very different ways and at different times of the project's lifecycle. It is thus very difficult to ascribe generic characteristics (*vis-a-vis* treatment of risk) to such a diverse set of organisations, groups and individuals.

- "Risks can be transferred to another party through sub-contracting or insurance. Risks can be shared through, for instance, agreeing to do so contractually or by working with another company in joint venture Risks can also be mitigated by working to reduce the probability of an adverse event happening or the impact if it does. Risks can be accepted which is best done by those best able to manage them. Risks that cannot be transferred, shared or mitigate are referred to as *residual risk."* This clear presentation regarding the transfer of risk by Kelsey is highly relevant for MUTPs generally and resonates with the content of the paper by Gibson.

Changing contexts

- "Lenders, typically, are willing to lend high proportions of value in the case of many properties because they are generally considered as a relatively safe security in case of default by the borrower. So high risk behaviour by the borrower is *not* perceived as such a high risk to the lender…... it is similar to margin trading in stock markets which carries similar risks and plays a significant role in market volatility." Kelsey's account *may*, however, have to be changed permanently as a result of the current credit squeeze if it proves to be more than a cyclical correction. For this dramatically changes residual value expectations and would negatively impact future fund raising for MUTPs in a serious way, requiring new funding methods and sources to be identified and used. This illustrates the critical importance of placing conclusions derived from past experiences into context and the need for these contexts to be scrutinised for their validity in current climes.

Treatment of complexity

- "A civil engineer once said to the author: "engineers solve complex problems by breaking them down into a simple one". What Kelsey points out he did *not* say was that "simple solutions require re-assembly and integration into a complex product" and are therefore not what they might appear. Kelsey concludes that "a building and many other technologically complex products thus require integrated solutions" which call on skills that go beyond those required of simple engineering solutions. This claim/ statement is most important for MUTPs given their complexity and their pre-requisite need for integrated solutions.

Innovation and control

- Citing Keegan and Turner (2002), Kelsey suggests that the "rigid application of traditional project management controls can actually *inhibit* innovation in project-based firms and work against the many other features of project-based organisations which are conducive to innovation." He goes on to argue that "innovation needs a certain degree of slack resources and the availability of these can be inconsistent or non-existent" with/ in tightly controlled environments. In such environments innovation is seen as an additional source of risk and project management takes priority over innovation management to the detriment of the latter. Kelsey concludes by noting that a problematic attitude to innovation particularly exists where it either did not show short-term gains in profits and/ or market share. This suffocating impact on innovation is also observed in the corporate world (see earlier contributions by Sparrow and Snowden). It is furthermore consistent with emerging impressions arising from the work of the OMEGA Centre at UCL which increasingly sees mechanistic closed-system management approaches to MUTP developments as inappropriate for evolving projects in their planning and subsequently in efforts to integrate them into their dynamic physical, environmental, social and economic settings. Here there is evidence to suggest that MUTPs are more like evolving organic phenomena (see Batty's contributions) requiring explicitly innovation and flexibility in thought and action rather than restrictive practices. In this case innovation will be needed both by those who 'deliver' projects and by those who administer the processes by which they are endorsed/ given approval.

- In a presentation on the management of the Channel Tunnel Rail Link (CTRL) one of the specific stated means of risk reduction was to 'minimise the use of untried technology' (Jago, 2004). Kelsey makes the comment "to be fair CTRL is part of a larger rail system using earlier technology and opted for the basic French TGV systems which had been well-tried and tested. However, it does suggest that the quote from Keegan and Turner (above) is *not* an isolated viewpoint. Perhaps the bad experiences quoted from other projects may be seen to justify this approach." The choice of technology (in construction and operation) in MUTPs is often a critically important decision for such projects. This is so because, on the one hand, these projects present ideal opportunities to break the mould with the past and introduce new technologies that can contribute to quantum leaps in development deemed strategically necessary. On the other hand, the very high cost of MUTPs magnifies any additional risks that untried technologies might bring with it.

Regulation and corporate social responsibility

- Kelsey cities Bonke (2000) who looks at two processes within the Great Belt Fixed Link (Denmark-Sweden). "The first is the 'social construction of the fixed link'. He recognises that the proposal of a very large new technical artefact will have social consequences and that the view of the project from all stakeholder viewpoints needs to be understood through the concept of the 'social construction of technology'. He understands the choice of technology *not* as an engineering decision but as a political one with the expertise of engineers as but *one* of the inputs." The acknowledgement of this conclusion and the twin approach highlighted by Bonke is most important for MUTPs as is the appreciation of the complexities it brings with its implementation.

- "Construction projects create assets and infrastructure which give rise to environmental risks and uncertainty. Stakeholder concerns bring pressure to bear on government which often (but not invariably) leads to regulation". Kelsey notes that in the UK, government has responded to environmental concerns by introducing tighter regulations on new buildings (see ODPM 2006), "although the preparedness of the UK industry to implement them and the likely effectiveness of enforcement is open to question (Tshakilov 2006)." This raises the matter of the level and extent of corporate social responsibility (CRS) of private sector parties involved in MUTPs and their associated developments. It also raises questions regarding the rhetoric employed by such parties (and government) as to the realities of this declared responsibility and the enforcement powers that exist within government and its agencies to implement regulative measures.

- On a more international front, Kelsey points out that: "the international position is less clear cut. Perez (2002) argues that international construction contracts are almost oblivious to environmental risks posed by construction activities. As variations and contingent events emerge during the course of a large construction or infrastructure project, it is important that these are constrained by environmental considerations which may not have been addressed in the original (and extra-contractual) Environmental Impact Assessment. Therefore there may need to be some new forms of contract which allow for public engagement and/or

intervention". These circumstances hopefully may change rapidly in the near future for MUTPs as concerns about climate change, carbon footprints and energy shortages increasingly become international top priority concerns of both international agencies and national governments.

Flexibility

- Kelsey claims that: "buildings are currently only complex adaptive systems within rather narrow limits. If they are to adapt (Leung 2007) to what is now recognised as a changing environment, they need to be made more adaptable." He goes on to explain that "flexibility, however, comes at a price and may require more radical thinking by clients, architects, project managers and governments (since more external regulation may be required)." This statement very much supports the view that infrastructure and building developments (especially MUTPs) need to be seen as evolutionary artefacts in their planning and management which require innovative thinking rather than the unquestioned implementation of repetitive past practices. It also, however, begs the question as to how much flexibility can realistically be inbuilt into an MUTP and its associated real estate/ regeneration/ economic development initiatives, whilst retaining the very real *raison d'etre* for which it is being built.

Conflict of interest and optimism bias

- "Although the ability to evaluate risks to an acceptable degree of precision may be questioned, *more serious* is the willingness to do so. Flyvbjerg et al. (2003) point out that many projects are sponsored (not surprisingly) by those who stand to gain the most from them. Often such firms are likely to be included in the supply chain and have the technical expertise to press their case against which it may be difficult for those without such expertise to produce counter-arguments. The proponents can make a perfectly convincing technical case for estimates which appear to generate financially feasible projects. It sometimes turns out that such estimates are a combination of both deception and wishful thinking which ignores or underestimates downside risk." The jury is still out on whether deception or wishful thinking is the driving forces behind over-optimistic forecast for MUTPs. The evidence so far collected from interviews conducted by the OMEGA Centre at UCL for the CTRL suggests that wishful thinking is more the driving force than deception, although it should be noted that one can merge into the other as an exercise of self deception spurned on by rhetoric. Heseltine was very persuasive, for example, in pressing for the East London route to the CTRL despite all BR's so called facts and figures obtained from modelling.

- "This 'Optimism Bias' needs to be countered and following work done by Mott MacDonald (2002) the UK Treasury issued appropriate advice in a supplement to its Green Book (H.M. Treasury 2003). The bulk of this guidance is taken up with showing various degrees of bias that might occur in the estimation of both cost and schedule. …… The list of factors (employed) suggest that either those carrying out feasibility checks on behalf of other parties have some way to go in achieving 'due diligence' in their assessment of risks *or* all parties have actually got to be more open (transparent) about the real degree of uncertainty and ignorance. This may also involve a greater degree of education of stakeholders. In

project risk evaluation, the Emperor may not be in a situation of total nudity but may, nonetheless, be rather scantily clad." Here the issues of 'transparency' and 'due diligence' clearly are very important for MUTPs as the bigger and more costly such projects are the more complex they typically tend to be. This in turn calls for more transparency in the decisions made and greater diligence in contract execution in the planning, construction *and* operation phases.

Adversarial frameworks and trust

- A fundamental problem cited by Kelsey with the construction management industry in the UK concerns the current structure of the country's construction industry. He argues that the industry requires much more co-operative behaviour and "an explicit recognition of task duration variability within a no-blame culture." He goes on to argue that "the legal structure is one of adversarial contractual relations. As far as the law is concerned, task duration variability does *not* exist. If a contractor promises to deliver product x within a period of y weeks then that is what has to be done. In construction, legal practice allows for the use of a deterministic CPM-based argument to back up claims by and against contractors and subcontractors (Carnell 2000)." This issue of the adversarial atmosphere, framework and practices in UK is an underlying issue for MUTPs where the strength of any team planning, delivering and operating them (and their associated developments) rely much more on collaboration and on consensus building than competition.

- Kelsey explains how trust is a considered a risk response in construction management. He points out, however, that the adversarial culture in the UK between client and contractor, as well as contractor and sub-contractor is damaging to the industry as it is both costly and inefficient. He goes on to explain: "Various larger contractors and clients have tried various forms of arrangement whereby trust is made an explicit or implicit part of the process. Various forms of co-operation, alliancing and partnering have emerged, as well as client procurement arrangements involving longer-term procurement covering a number of contracts which allows a relationship to be developed and managed with the contractor." Here we see the issue of trust as being very important (also see Currall's contribution), especially in an adversarial culture such as that which exists in the UK construction industry and legal system. Both these aspects are of critical importance to MUTP planning, execution and delivery in the UK. A question that arises here is what would the differences be in less adversarial climates and what role does heritage and culture play in all this?

Motivation and moral hazard

- "Contractors need to be motivated to do their best to prevent adverse risk events from happening and to mitigate their impact if they do. Where that motivation is absent, there is a problem of *moral hazard*, whereby the contractor may act against the interest of the client." Kelsey adds "that unproven and unreliable contractors may offer to carry out work at a cheaper price than their rivals. Regardless of whether they intend to carry out the contract, there is a competence problem which means they represent a risk to the client with a greater probability of failure than their rivals. In this situation … the client has bought a bad risk and

is in a situation of *adverse selection*…. These problems give rise to transaction costs originally explored by Coase (1937) and Williamson (1975)." These are very relevant concerns for MUTP planners and managers that resonate with parts of Gibson's paper on general insurance.

Complexity of contracts and financial models

- "Given the fragmentation of the construction industry and the maxim that risks should be borne by those most able to manage them, risk ends up being widely distributed between a large group of separate firms. This group can be described as a 'project coalition' and the interfaces between them are traditionally managed by contracts. These might be described as 'complex contract." The complexity of contracts associated with MUTP planning, implementation and operation is sometimes *so great* that it has been reported by lawyers in the field that they do not actually know what the legal outcome would be if some aspects of these contracts were contested. These are circumstances akin to the financial models that were built by international banks which were so complex and dynamic that their operators could not predict the extent of the fall-out if/ when such models mal-function. In the case of MUTPs, there is today in the credit-crunch environment that currently prevails, a possibility of a failing MUTP having to cope with the lethal combination of *both* a highly complex legal contract that is not understood in terms of the implications it might spawn if contested, plus funding arrangements based of forecasting models which could well fail against all expectation as the model itself is "too clever by half."

- **"**The separation of responsibility for ownership, finance, operation/maintenance, design/ construction adds to the complexity of project management and creates risks which pose potential *moral hazard* in that different parties are not always fully affected by the impact of their own failures. Accordingly, a new type of procurement has emerged variously referred to as the Private Finance Initiative (PFI) or Public-Private Partnerships (PPP) Design-Build-Finance-Operate (DBFO) in the UK and Build Own Operate (BOO) and/or Build Own Operate and Transfer (BOOT) elsewhere." A full understanding of these different set-ups as the context for MUTP implementation and operation is *most* important. It is important to appreciate that this context not only addresses certain risks but *also* generates new ones.

Commentary on lessons: their identified relationships of relevance to MUTP planning

Complimenting the above, the text below summarises *some* of the relationships/ links among the principal lessons extracted from Kelsey's contribution that appear relevant to MUTP planning. These relationships are visualised in Figure 21.

Link 1: Private Sector - Risk – Volatility – Evolution – Accountability. The private sector is prone to risks related to market forces and volatility. Industries in the private sector have therefore evolved in such a way as to cope with volatile environments where they are accountable for their actions, and ultimate success and failure. In contrast with the Private sector which must absorb its own risk, the public sector manages resources on behalf of faceless others and is seemingly less connected

and accountable to risks and uncertainties and the consequences of poor decision making.

Link 2: Risk – Regulation – Limits – Speculation. Regulation can interfere with market systems and create behaviours which are counterproductive. The legal entity of a company, whilst being one of the drivers of capitalist success creates imbalances under extreme events. During crashes in the economy, the risk often ends up with financiers as downside loss is capped by limited liability status. Upside gains are not capped, so production of new facilities can be driven by speculation and not demand

Link 3: Risks – Individual Character – Complexity – Risk Assessment. Risk adverse and risk loving characteristics of individuals can cause complexity and instability to markets and democratic political processes. It is important for risk assessments to include details on such characteristics to help manage project risk. For example construction chain actors are generally risk adverse, but developer clients and property companies can be risk loving – these characteristics of individuals should be understood to help risk analysis and protection

Link 4: Innovation – Path Dependency – Resources – Communication – Management. Projects need innovation, however traditional project management controls can stifle innovation as some degree of slack resources are required. However any innovation must not only develop new capability, but must also organise accompanying horizontal communications across departments to overcome opposition which commonly occurs when innovations are introduced.

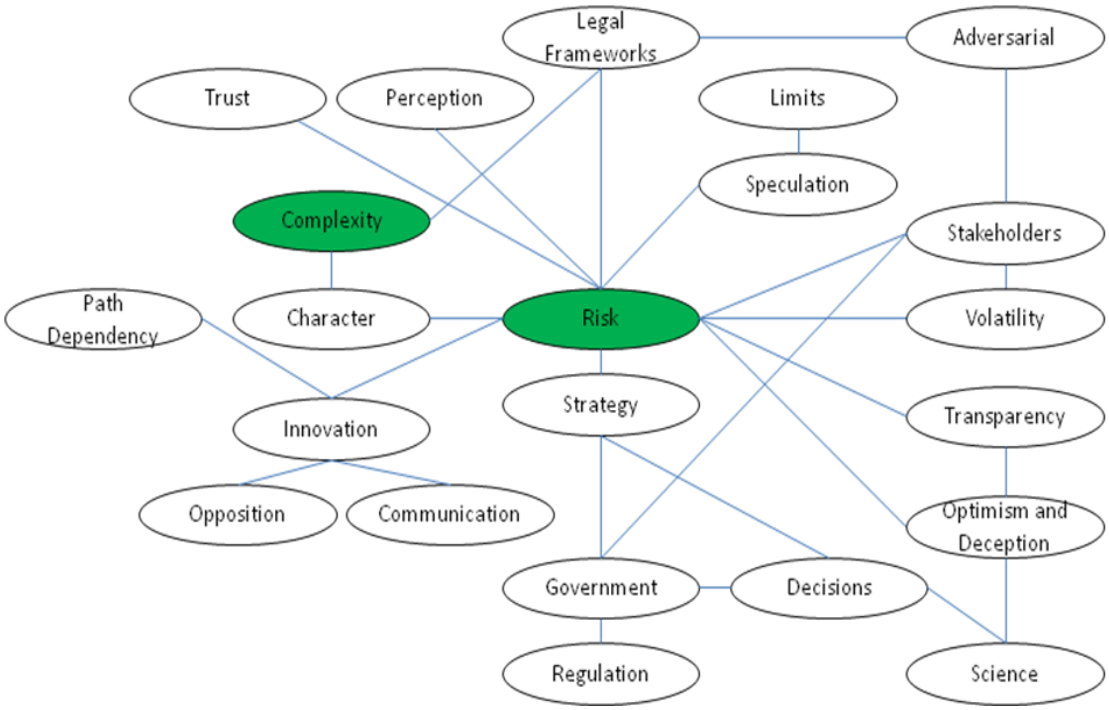
Link 5: Innovation – Risk – Perception – Strategy. Innovation can be perceived as an additional source of risk, and is generally not welcome within the context of more traditional construction where it cannot demonstrate short term gains – bad experiences associated with innovative techniques can be a major block to innovation. This is especially true of technological risks – many technological solutions are perceived as fads. This focus on short term payoff surrounding innovation is to the detriment of Strategy, which would require more long term investment into innovative ideas.

Link 6: Risk –Stakeholders – Management - Transparency and Trust - Government – Legislation. MUTPs create both perceived and real environmental risks. Without effective discourse with and management of stakeholders at an early stage in the project, pressure from stakeholder lobbying can lead to Government initiating new legislation. However effective discourse with stakeholders requires transparency and trust, the later of which being difficult to establish by a specially formed company commonly heading MUTPs.

Link 7: Risk – Tools - Optimism-bias and Deception – Transparency – Trust. Project sponsors often use scientific tools to justify their case for a project. Such justifications introduce risk to the project as they are often optimistic and in some cases deceptive. There are also issues of transparency as the use of specialist consultancy and custom tools makes mounting an opposition difficult without access to similar tools. The lack of transparency surrounding the use of scientific tools also erodes trust. More transparency is needed in the project evaluation stages to counter the optimism bias often evident in project proposals.

Link 8: Risk – Legal Frameworks – Adversarial atmospheres – Trust – Power. MUTP projects are heavily entangled with contractual agreements. Legal frameworks are relatively inflexible and do not recognise duration variability common during large projects, therefore relationships between client and contractor are often adversarial which is damaging to the industry, being both costly and inefficient. The current way contracts are tendered for also created imbalances which require high degrees of trust between the client and contractor. Once contracts are signed, power can swing from the client towards the contractor. Furthermore legal contracts become so complicated, lawyers cannot predict the outcome if contracts were tested.

Figure 21: Treatment of RUC in construction and project management: lessons for MUTPs



4.4 *Comparative analysis of findings*

The synthesis of links outlined above for Working Papers # 2 and 3 reveals a number of common themes which are of direct relevance to decision making undertaken against a background of the effects of RUC within the field of MUTPs. The insights from each author have been grouped together and are presented below as separate sections relating to each theme. It should be noted that these are by no means mutually exclusive – there are many interdependencies linking the themes as will be evident from the discussion below.

Overall, and as confirmed by the work in Appendix 2, Working Paper #2 has been a rich source of transferable lessons concerning RUC, whilst Working Paper #3 defines the framework and highlights the subtleties of the planning MUTP paradigm which should be taken into full consideration for these lessons to be effectively transferred.

4.4.1 *Path dependency*

One of the most common themes found within the contributions is that of Path Dependency. There are many definitions of this concept, but here we consider it as the process by which the choice of decisions available for any given event is restricted to those which have been made in the past, even if the context of the past events may no longer be relevant. In other words, decisions influenced by path dependence are vulnerable to 'lock-in by historical events' (Arthur, 1989). Such second degree path dependence (Leibowitz and Margolis, 1995) often leads to outcomes that are regrettable and costly to change. Each author's treatment of path dependency is subtly different with many of the perspectives offering important insights for MUTPs, as will be outlined below.

Stone (2008) describes path dependence in the Military Profession as taking the form of best-practice 'blueprints'. Military Theorists believed the conduct of war "subject to a set of principles which, once they had been clearly identified, would provide a 'blueprint' for the optimum conduct of warfare, thereby removing it from the reach of uncertainty." Fortunately, this thesis was rejected by Clausewitz, who in 1832 saw his contemporaries' generalisations from observations of Military Practice to constitute no more than mere surface manifestations of more fundamental forces at play. However, despite the early and groundbreaking work of Clausewitz (1993), the recent rapid shifts in contexts facing the US army whilst undertaking operations in Iraq have seen the transfer of tactics from open warfare in an attempt to counter Iraqi insurgency, a situation with a fundamentally different context from open warfare. The results of this context-tactics mis-match have led to prolonged frustration for US military plans. The response by the US Army suggests the path dependency trap is open to those who are taken by surprise, who will fall back to known principles instead of innovation despite the seemingly large mismatch in the underlying context of the situation, perhaps in part due to the fear of trying something new over tried and tested methodologies. The greatest lesson for MUTPs from Stone's observations is that the application of path dependent decision making in MUTPs *can* lead to project vulnerabilities and increased risk due to unexpected and rapid changes in context.

Snowden (2008) highlights the general assumption held by professionals in many areas of management science of the existence of discoverable and repeatable relationships between cause and effect within systems. Such relationships allow the definition of 'best practice' and creation of repeatable recipes for achieving organisation goals. Snowden argues that there is general confusion between correlation and causation. There are, we argue, many exponents of such practices working within MUTP projects with the formation of rules and models which incorrectly represent the underlying principles of a context adding an extra layer of risk to the decision making process. This reasoning strikes a chord with Batty (2008) who considers traditional planning practice incapable of dealing with complex situations which are beyond the ability of their current models – the persistent application of simplistic models, independent of context or poorly tailored to context, on which decisions are based, leads to unrealistic plans and the risk of project failure.

Gibson (2008) explains that the work of underwriters and actuaries seek to determine an appropriate price for each insurance contract by considering, amongst other things, the expected cost of future claims. One of the components of this process is an analysis of the *frequency and severity* of the claims history of the individual risk in isolation. The greater the historical data available for any given risk event, the more certainty presumed when calculating the return period of such an

event. However, the warnings of Snowden, Stone and Clausewitz all apply here: without knowledge of the underlying principles driving the risk events, and their interdependencies, historical data is subject to large uncertainty.

Mumford (2008) describes how, in the agricultural sector during the risk analysis stage before the proposed import of new species, knowledge derived from past case studies is used to identify pests which are known risks in the exporting country. This kind of analysis does not, however, provide any assessment of potential new pests which do *not* cause problems in their native area and may only manifest themselves as a problem in the context of new terrain. Such path dependent practices for risk assessment are likely to be of little value in terms of accurately defining MUTP risks, due to the complexity and uniqueness of their individual contexts.

From the corporate world Sparrow (2008) describes where path dependent best practice is leading to a situation where "each company in a given sector becomes more and more like it's peers ….. each has similar capabilities, costs, market identity and customers are indifferent as to which of their good they buy." Sparrow attributes this observation partially to a host of new tools by which these firms measure the performance of their business processes and "allow their comparison to best practice". Sparrow claims such firms are undergoing 'Commoditisation' where firms compete on price. This behaviour typically leads to shrinking margins and poor performance for investors and stakeholders, and as each enterprise within a sector becomes more similar to all others, so does the entire sectors vulnerability to risks increase. Consumers tend to benefit on price in the short term, but miss out on innovative new products and associated gains in efficiency. Such effects of path dependence may be to some extent dependent upon which stage of the project cycle the MUTP is in. Path dependence in the planning stage may be only a partial problem, as innovation in finance, collaboration and planning is often seen, but as with Sparrow's example, path dependency in the delivery stage stifles innovation which is a detriment to the MUTP project (Ward and Wright, 2008).

From the work of Dora et al (2008) we see that physicians have relied on case histories drawn from their own practices, the experience of their colleagues and from medical literature from the outset of their profession. This process is today being significantly strengthened through the innovative use of the internet. Dora et al do *not* warn against the use of decisions based on path dependent data for diagnostics of human conditions, although the situation must occur that previously unknown diseases and related contexts could be miss-diagnosed using such a system. The system is structured in such a way to minimise the time taken for new lessons to be learnt. Medicine uses case histories as the basis for decisions and their procedures of case examination, categorisation with regard to context, and the use of this data to inform diagnostics. Notwithstanding the misdiagnoses this process might spawn, there is much we can learn and transfer to the MUTP paradigm.

Lemmon (2008) describes the existence of a more or less common *language* of project finance with numerous shared approaches amongst banks and financial institutions as practitioners move from organisation to organisation. This sharing of common language is also evident in the MUTP industry where practitioners move from project to project, often advocating the same tools and techniques and employed on previous projects. According to Lemmon, however, each financial institution has tended to develop its own individual model for analysing, assessing and quantifying risk within transactions. The tools have thus apparently been tailored by the financial industry to suit a particular context much more than perhaps in the planning and engineering practices of MUTPs. The banking analysis described is therefore

necessarily generic, but demonstrates the caveat of the vital importance of specific context to an adequate estimation of risk.

4.4.2 *Innovation*

A second theme running through the papers is innovation. Innovation can be defined simply as the act of introducing something new. It is a process which involves an enormous amount of uncertainty, human creativity, and chance (Utterback, 1994). Innovation may involve radical or incremental changes in thinking, processes and services. The goal of innovation is positive change, i.e., to make someone or something better. Innovation leading to increased productivity is the fundamental source of increasing wealth in an economy. The Working Paper contributions contain a number of transferable lessons for MUTPs - both positive and negative - from the perspective of innovation in both technology and process.

Sparrow (2008) and Kelsey (2008) perceive innovation as important for the very success of a project. The adoption, however, of decision-making based on path dependent processes, as outlined above, is likely to stifle innovation within an organisation, to the detriment of both the organisation itself and its stakeholders. Such organisations will become less responsive and adaptable to new risks (Dimitriou and Thompson, 2008). Innovation also requires some excess capacity, a view shared by Sparrow, Kelsey *and* Flyvbjerg et al (2003) – such resources are not always available in companies which are competing in the open market to the bottom line.

Snowden (2008) refers to innovation as the method by which new techniques are developed which can give rise to insights into and improvement of decision making. Stone (2008) also identifies innovation as important for success, through the introduction of innovative technology as a potential remedy for the delays which are caused by complexity and uncertainty during a military operation, although he adds the effects are not always decisive.

The key focus of Mumford's paper is innovation within the agricultural world, and the techniques for quantifying risks when an entity is introduced into a new environment and the consequences of the introduction are uncertain but potentially highly damaging. This paper takes a more measured view of innovation than other contributions and the lesson here is one of balance. The introduction of new technology to a MUTP may be seen to bring major benefits, it is however very important to analyse the context in which the innovation was *first* developed, and assess the possible effects of introducing the innovation into a new context. Are the risks of the new technology outweighed by its potential benefits or do they merely add unbearably to an already high risk venture?

Dimitriou and Thompson (2008) explain that one of the consequences of innovation and change is to bring about conflicts. Many organisations, furthermore, they point out are inherently resistance to change. Few embrace change as a learning experience which improves capabilities. This view is also held by Kelsey (2008): "innovation must not only develop a new capability, but must *also* organise horizontal communications across departments and overcome opposition". More subtly, Dimitriou and Thompson also warn that technological innovations and the interaction of such forces *can* produce complex reactive forces liable to generate even more contextual change. This may be particularity important for MUTPs where practitioners apply their own tried-and-tested technology to the project, and where decision making can develop into a series of contradicting analyses and insights that ultimately may destabilise the project if not addressed.

Hall (1980/2008) calls directly for innovation in support of decision making in MUTPs – the analysis of which currently tends to lead to knowledge of the patterns of decision making, but the creation of improved contextually aware rules is less common, more difficult but more valuable.

Innovation is not the focus of the Dora et al contribution or of Lemmon's contribution. In the latter case this is perhaps surprising as recent financial innovations to package and trade debts have generated large amounts of risk and uncertainty. In the former case, health is one of the most innovative industries and there therefore may be many insights into managing innovation which could be fed into decision making for MUTPs.

4.4.3 *Strategy*

The recommendation of strategy formulation is seen by many of the authors as essential to the quest to reduce the effects of RUC in decision-making. For our purposes a Strategy is here defined as a "plan that 'joins-up' major goals, policies and actions into a cohesive entity" (Dimitriou and Thompson, 2008). 'A well-formulated strategy helps to marshal and allocate an organisation's resources into a unique and viable posture based on its relative internal competencies and shortcomings, anticipated changes in the environment (context) and contingent moves by intelligent opponents' (Quinn, 1995).

Sparrow (2008) sees formation of a strategy as key in allowing informed decisions which lead to innovation and to help overcome the effects of uncertainty and complexity. Those that possess an informed narrative about "who we are and what we are about" have generated something which is truly valuable. It allows them to innovate, to define the concrete steps forward that we often call 'strategy'.

Stone (2008) treats strategy as the instrumental link between political goals and the planning process. He stresses an important defining feature of a strategy is it's consideration of an adversary and the subsequent interdependence of choice. The requirement of an adversary may be relevant for MUTPs as, for example, a politician who is strongly in favour of a particular infrastructure project may well need to build adversarial responses to those of his colleagues who favour alternative approaches. . Such strategies need to be extremely flexible and adaptable as adversary positions can change very quickly in the political arena of MUTP planning.

Dimitriou and Thompson (2008) highlight the importance of the link between strategy and Government. Solutions to complex problems (they argue) depend upon the ability to combine the creation of strategic long term visions with short term actions. This presumes government to successfully 'identify, design and deliver 'shared futures' that are capable of expression in spatial forms and agreed by major stakeholders'. Dimitriou and Thompson point out that this situation is in fact rarely present in spatial planning. Government strategies for MUTP developments in the UK could be further expanded to ensure they are broken up into 'bite-sized' pieces for straightforward and cost effective implementation while still demonstrably contributing to the strategic long term vision.

There is evidence from past MUTPs that visions, which usually precede strategy (either explicitly or implicitly), can be an anathema to politicians because visions require relatively long term (in politics) buy-in and may not give the room for manoeuvre that politicians like. Evidence from the work of the OMEGA Centre at UCL suggests that currently MUTPs do not typically possess a built-in response to a

coherent pre-determined 'strategy' per se but instead respond in a rather *ad-hoc* manner to different contextual forces (Ward and Wright, 2008).

4.4.4 *Governance, regulation and enforcement*

Governance, regulation and enforcement are concurrent themes which are linked to RUC by a number of the authors in the preceding Working Papers. Discussion here focuses on two areas: the beneficial use of regulation to help manage risk and the possible detrimental effects of regulation upon projects.

In agriculture we see from Mumford (2008) that international bodies provide standards to assess and reduce risks during the implementation of cross-border projects. National bodies are, for example, responsible for implementing systems to meet these international standards at the local contexts. This is similar in the medical field, where "many countries have seen the development of one or more national agencies to provide guidance and quality control over medical research, the evaluation of the effectiveness of medical treatment, the safety quality and safety of proposed treatments, and the process for considering and balancing differing views or competing interests of the various stakeholders" (Dora et al, 2008). There are few if any such agencies in the MUTP field in the UK with the exception perhaps of National Audit Office. This, however, has an accountancy scope of concern that is far too narrow to be able to offer a balanced overview of what is/ is not a successful MUTP. Perhaps the relative infrequency of Mega Projects within any one country is a contributing factor to the lack of such agencies. A more international standpoint may therefore be required. Rosetto (2008) highlights that even when international agencies exist with regulatory frameworks and accompanying codes of practice, such as the EU Eurocodes, their non-enforcement, combined with poor inspection procedures is, in reality, lethal. Any regulations *must* they argue, be backed up with competent enforcement bodies with sufficient powers. Kelsey (2008) states it is common for environmental risks caused by MUTPs to trigger pressure from concerned stakeholder groups which lead to further legislation.

Concerns regarding possible negative effects regulation *can* have on an MUTP can be seen in regulations mandated by the State which seeks to produce or prevent outcomes (in given timescales, and locations) that might not otherwise occur. The outcomes of some such regulations are not necessarily advantageous for various aspects of MUTP developments and can impact upon the success of a project in an adverse manner in a number of ways. Sparrow (2008), in a different context, explains that: "Governments, in the shape of regulators and anti-trust lawyers, seek to increase competition, thereby directly or indirectly further reducing these barriers (to competition). This throws companies into ever-more heated pursuit of best practice, to the clear benefit of customers *but* to the probable detriment of employees and shareholders." Furthermore, he goes onto argue, "many industries which rely heavily on innovation – such as the pharmaceutical industry – are also heavily regulated. They are always faced with litigation around new products and in other ways deterred from innovation with the result that "the output of new compounds per unit of investment has fallen steadily, despite enormous advances in the underlying science". These observations could well apply to aspects of MUTP developments.

Snowden (2008) also stresses how regulation can lead to unwanted situations due to emergence as "constraints in an ordered system can easily produce the conditions under which that system shifts to being complex, or even collapses into chaos. For example, attempting to exert excessive control through bureaucracy may

result in a slow build up of tension through frustration which leads to a collapse of control and increased levels" of unintended, and sometimes negative effects. The view that underlying forces of complexity prevail is also held by Dimitriou and Thompson (2008) and Batty (2008) who explain that the introduction of new regulations can change an MUTP's context in unexpected and even sudden ways. These changes can lead to detrimental effects if the MUTP practitioners are not poised for rapid action through effective analysis of and response to the changed environment.

4.4.5 *Stakeholders, relationships, trust and transparency*

The interaction of stakeholders, their relationships among themselves and the role of trust and transparency have all been identified as themes with some commonality amongst many of the contributions. Relationships among stakeholders *can* be considered a critical factor in reducing some aspects of RUC attributed to various stages of an MUTP's development. Trust, credibility and transparency are necessary factors towards building stakeholder relationships and facilitate consensus building and risk sharing. These themes are expanded below using insights gained from various contributors to Working Papers #2 and 3.

Mumford (2008) highlights trust as an *essential* factor in any risk assessment that is strongly connected to transparency. There is an implicit trust within all formal risk assessment processes that stakeholders are transparent with information. However, in the context of MUTPs, only stakeholders involved in the promotion of such projects have a strong incentive to disclose information; other competing stakeholders may *not* be so forthcoming. Mumford (2008) and Perry (2008) believe organisations tend to hold onto the notion that 'knowledge is power' and see collaboration as a potential threat or weakness. This is damaging to the build up of trust amongst MUTP stakeholders. Dimitriou and Thompson (2008) also discuss this weakness, and the importance of transparency amongst stakeholders as the prerequisite to developing 'change responsiveness', vital for success.

Currall and Inkpen (2006/2008) offer the deepest theoretical understanding of trust as a concept and the critical relationship between trust and risk. The more risk associated with a relationship, the more trust required for the functioning of the relationship. They also point out that trust within an organisation tends to change over time, and with organisational context; trust between parties can build up or diminish over time, and the culture of an organisation may by default encourage or extinguish rust. The link between trust and time also feeds into path dependency. In the situation where old methods and past failed initiatives have subsequently been made good in a viable new project such as Eurostar, the distrust generated with the original project can attach itself to the new project, and subsequently needs to be overcome by a new approach, persuasion or political commitment.

Interestingly Sparrow (2008) bundles the characteristic of trust together with legitimacy, capability and confidence - to create the term competence, which illustrates that although trust is an important factor in a relationship, it does not need to be based on being 'correct'. He goes on to state: "competence "is a fine state of mind, and one that can be held by people who are, under an informed eye, either correct or completely wrong in their view of the world. It is *no* guarantee of a sensible stance towards events, only an assurance of confidence."

Snowden (2008) highlights trust as a mechanism for forming self regulating lending groups. Members of a group each agree to take out a similar size loan and to

guarantee each other's debts. The results are very low levels of payment defaults. The lending risk to the bank has been massively improved by using self regulation based on trust. This may be a valuable lesson for MUTPs that may help to circumnavigate the adversarial culture, outlined by Kelsey (2008), where relationships are defined more by legal contracts and subsequent threats of legal action than principles of collaboration and cooperation.

Although trust can be built or reduced from the interdependent actions of companies, Lemmon (2008) reminds us that trust is also related to rhetoric. "With an eye on all stakeholders, a large banking group also needs to nurture a reputation for conducting business to the highest possible standards of honesty and integrity, and with due care for the environmental and social impact of its own direct operations and the impact of the operations of the clients which it supports.". This statement contains an important lesson for companies involved in MUTP projects, but given the credit crunch of 2008 and its underlying cause, it also highlights the questionable use of rhetoric. Overall, as Currall and Inkpen (2006/2008) outline, trust is an under-theorised, under researched field. This is an important statement as trust remains a highly important factor of MUTP developments given their heavy reliance on joint venture agreements, the use and abuse of rhetoric surrounding many such projects, the importance of reputation building, and the search for transparent decision-making.

Important to business relationships and ultimately success in dealing with RUC is consensus-building. Ideally, Sparrow (2008) argues: "all parts of (one) organisation should have adopted the *same* set of values. If different parts of an organisation inhabit different parts of the value space, then they may have difficulty in finding common ground, insofar as they cannot agree on what an acceptable outcome will look like". This is reiterated by Snowden (2008) who believes shared contexts are critical for decision-making. Mumford (2008) reports that risk assessments in the agricultural sector are open to consultation with stakeholders and that 'acceptable' risk are defined *after* reaching an agreement with the stakeholders. This is in contrast to the medical profession where acceptable risk is dictated by experts. Rossetto (2008) discusses the cost benefit balancing act required to decide the level of seismic protection to be afforded to a building. In order to set the level of protection, she explains that the level or risk which is socially acceptable must be identified by discussion with stakeholders to reach consensus. Ideally she goes onto explain "socially acceptable risk is the probability of failure (damage) of infrastructure that is acceptable to governments and the general population in view of the frequency and size of natural hazards, and the infrastructure use, importance and potential consequences of its damage ... In most cases constructing buildings and infrastructure that can *fully* resist the largest earthquake is uneconomical (and often unjustified due to the rare nature of some natural hazards). Hence a limited risk is accepted" (Rossetto, 2007). The critical question here is who determines this acceptance? Deciding what an acceptable risk is involves the use of an acceptable decision process. Paté-Cornell (2002) lists the elements of an acceptable decision process, which amongst other things include a sound legal basis with clear understanding of individual and societal risks and treatment of economic effects, a communication system, a public review process, a conflict resolution, monitoring and feedback system. Many of these points resonate with the concerns of the major players within the MUTP industry.

Finally, Dora et al (2008) highlight the importance of ambiguity, where differences in the interpretations of risks due to stakeholder values can contribute towards project complexity. Stakeholder dialogues must be founded on a common

vocabulary, and the effects of different perceptions of risk must be fed into all stages of a risk analysis. Overcoming ambiguity and promoting dialogue, is also important in MUTP planning and delivery, particularly in efforts at resolving conflicts.

4.4.6 *Information, tools, techniques and experts*

The problem of basing decisions on partial information is a common theme in almost all the papers featured in the two Working Papers. Sparrow (2008) suggests that gaining insight into the operations of a project (be it a MUTP or whatever) will help reduce risk. Dimitriou and Thompson (2008) highlight the effective analysis of changing contexts is critical to project success. Stone (2008) attributes decisions made under partial information as an important factor in exposing a project to the influence of uncertainty. The more knowledge available, the less uncertainty and hence the less risk. However, gaining this knowledge over a complex system such as an MUTP is a daunting challenge, as each project has its own very unique context(s), so the ability to gain knowledge about it/ them and to pass on lessons from one project to another has to be carefully managed/ controlled to ensure 'false lessons' are not transmitted and accepted without challenge (Ward and Wright, 2008). Sparrow (2008) points to the tendency for corporations, when put under pressure by forces such as competition, to focus on reducing and streamlining the tangibles. He suggests that for large projects, such as MUTPs, decision makers would do well to consider and tackle the intangibles and their associated uncertainties and risks head-on. Gaining insights into these intangibles and finding innovative solutions to them are critical to gaining awareness to and possible reduction of risk.

Cost Benefit Analysis (CBA) as part of the project appraisal process is a typical procedure undertaken by the MUTP planning process to aid decision-making. It can in the planning and transportation field become the principal/sole determinant in deciding whether a project goes ahead. Certainly, politicians who wish a project to be promoted/ implemented will grasp at the first opportunity to cite a positive outcome of such an appraisal to back-up his/her promotion for such a project. Sparrow (2008) relates cost-cutting to a number of negative factors within a business linked to destroying innovation, reducing competence and increasing path dependency. This suggests the positive and negative effects of these characteristics are not currently factored into a CBA, but might be to the detriment of an otherwise promising project. Stone (2008) acknowledges CBA should be part of the process of strategy in that he argues that "an effective strategy is one that generates the desirable political effects without occurring disproportionate costs". However, he goes on, "deciding on the minimum cost requires knowledge of our adversaries' commitment, and what they are most likely to do, rather than the most dangerous thing they could do." There is then a large amount of uncertainty attached to this process. Clearly, the military perspective - premised as it is on potential conflict - has much to offer MUTP planning where major conflicts are anticipated and where knowledge of the adversaries' ideals and beliefs can help reduce uncertainties.

The quest for information, new knowledge and the practice of expert validation raises the question of the real value of the role of experts in critical areas of development that affects the public domain. Many of the contributors offer a variety of views here; Gibson (2008), Rossetto (2008) and Hall (1980/2008) all highlight the important role of experts. There seems to be a general realisation that mathematical models and formulations can *only* provide data to aid a decision-maker rather than make the decision for the decision-maker, and that as a result there is still a heavy

reliance on the role of experts and expert opinion based to help finalise choices. The vulnerability of buildings to earthquakes, for example, relies both on mathematically based models and on expert opinion to derive parameters which are incorporated into a mathematical risk analysis (Rossetto, 2008). Gibson (2008) similarly explains that scientific models *cannot* account for every actuary situation. Judgment she goes on to explain can be important for assessing future risks and contexts with greater accuracy than statistical methods. An important function of the expert must therefore be to both comprehend and communicate 'drivers' of RUC in a transparent way to the information consumers. A balance must also be found for MUTP decision-making to similarly view the insights gained from mathematical models and simulations to be complimented by the views and experiences of the experts with the possible addition that the 'wisdom of crowds' as advocated by Surowiecki (2004) also be factored into the equation in consultation and participation exercises.

5. Conclusions

5.1 *Risk management responses*

A total of 15 individually commissioned papers on the treatment of risk, uncertainty and complexity in decision-making for planning with a very broad span of disciplines and professions *cannot* claim to be representative in any way. However, within those limitations the papers do indicate, as one might expect, an awareness and treatment of RUC in some quarters that is prominent with potential lessons for MUTPs.

The most explicit treatment of the fields of RUC were the contributions from the property developer, the banker, the insurance broker/ actuary, the earthquake engineer and the civil engineer/ project manager. In other quarters, the treatment of RUC is much less apparent. The review of strategic and regional planning, city planning and transportation policy represented more critiques of how RUC *ought* to be treated, suggesting that these professions/disciplines have a history of adopting a more naïve and piecemeal approach to RUC; in some cases displaying even a strong resistance to the more explicit systematic factoring in of RUC to decision-making. This is despite early attempts in the late 1960s through to the late 1980s by Friend and Jessop (1969) and Friend and Hickling (1987) to introduce a far more explicit treatment of these fields in planning. While Hall (in Working Paper #3) speculates on the reasons for this, there is no single obvious explanation for such neglect.

Complexity as a driver of uncertainty

We found in our research that the properties of complex systems include: 'emergent' rather than directed outcomes and relationships that contain: feedback loops, 'open' systems, retrospective coherence, an acknowledgement that the whole is more than the sum of the parts and holonic (hierarchical) characteristics. We also noted a difficulty to determine boundaries, relationships that are non-linear, a frequent inability to predict due to the absence of knowledge of probable behaviour over the long term, relationships that are non-linear with transitions occurring abruptly when thresholds are breached (*tipping points*).

In the case of complex systems that reflect characteristics of 'emergent order', we concur with Batty (2008) that "there are too many variables and too many interactions to be handled by traditional methods of management, planning and modelling". We conclude that MUTP specialists, for all the expertise they possess,

have an inability to predict outcomes accurately *on a consistent basis*, and possess an inability to control outcomes within what we have come to know as complex adaptive systems (CAS). We see cities and regions (the context of MUTPs) as CASs – possessing change dynamics more akin to organic rather than mechanistic phenomena; a perspective which we believe has profound implications for planning in general and MUTP planning in particular.

From a comparative analysis of the treatment of RUC by the authors of contributions to Working Paper #2 and Working Paper #3 we note that both sets of contributors rely heavily on specific tools and modelling techniques in their management of RUC. Taking Batty's observation into account, along with the work of Ormerod (2005), it seems that the adoption of traditional modelling techniques, based upon assumptions of equilibrium borrowed from the Natural Sciences, leads to a modelling paradigm which breaks-down under many conditions. We are in fact of the view (increasingly shared by others in the light of revelations emerging from the Credit Crunch) that many such tools that employ these assumptions have in fact become the cause of much risk in themselves, and that this conclusion has major ramifications for MUTP planning.

To understand CAS - whether they are systems of city and regional growth or infrastructure development – we see the need to employ a holistic perspective. Here an appreciation of the concept of a *holon* (Greek *holos*, "whole") is essential. A *holon* is something that is simultaneously a whole *and* a part (Koestler, 1967: 48). It is an open system that is nested within another system. Being embedded in larger wholes, a *holon* is influenced by and influences these larger wholes. By virtue of its openness, a *holon* must be able to be a member of more than one supra-system. The supra-system is always part of the 'context' of the system.

In an *holarchic* system (holarchy) levels are sub-systems or supra-systems of each other. When the sub-systems join in a supra-system, new characteristics *emerge* that cannot be deduced from the qualities of the sub-systems. They are in other words different objects with some characteristics that *cannot* be derived from the characteristics of the sub-systems. MUTPs can be seen as *holonic* in that they are comprised of sub-systems and are part of one or more levels of supra-systems; to illustrate in terms of transport infrastructure in one dimension the UK Channel Tunnel Rail Link (CTRL) comprises line-haul and hub sub-sub systems, and the CTRL is a member of a UK rail network supra-system.

The management of risk

From the commissioned papers, particularly in Working Paper #1, we note that there are five principal strategies for managing risk. These include the strategies for risk: avoidance, reduction, sharing, transfer, retention, and hybrids of these.

The commissioned papers in Working Paper #2 offer a rich source of information on the treatment of RUC in a variety of disciplines, sectors and professions. Those professions, disciplines and sectors that deal with decisions on a day-to-day basis within a context that incorporate significant levels of uncertainty, talk primarily of risk since they are very much aware of the possibility that their decisions and subsequent actions may *not* yield the results that were intended. Uncertainty is notionally represented in all risk models – this being the probability of an unfavourable event in relation to the magnitude of its consequences. This construct remains the case whether or not each of these dimensions is actually quantifiable;

which in many cases they are not, as uncertainty is unresolved for a variety of reasons. This is the decision space occupied by judgement.

From a comparative analysis of the treatment of RUC risk by the authors of Working Paper #2 and Working Paper #3 it seems that the principle strategies for the management of risk which feature heavily in Working Paper #2 are *not* supported by the discussions from Working Paper #3. This suggests that there may be scope to transfer risk management strategies more widely into the fields of strategic urban and regional planning, and transport policy and planning, including for mega projects.

Context of risk

We have already referred to the multi-dimensional characteristics of 'context' of which the following categories of properties are the most apparent: temporal, spatial, political, institutional, economic, social, attitudinal, and environmental.

What needs to be emphasised here is that the context of any individual decision is unique, if only because of its temporal context, despite common threads and similarities (particularly in standardised decision-making processes, packages and models). Context is, in other words, *never* repeated in time, even though decisions may take place on a regular basis in the same place and institution. Technological outcomes of these decisions (such as transport hardware investments and infrastructures) may be replicated in different time and geographical contexts. They are, however, unlikely to be successful without particular sensitivity and attention to the unique set of local conditions. Categorically, 'one size does not fit all'.

Generic attitudinal context

From the papers commissioned for Working Paper #2 and 3, we identified four principal categories of attitudinal contexts. These include: adversarial, competitive, collaborative and mitigative

The military clearly operate in an adversarial arena, while the seismic engineers' practices are almost always mitigative in character. Each of these categories of contexts can be set against our typology of risk responses. We have tabulated the specific measures, tools and techniques associated with each of these combinations in Figure 22 below. This table illustrates the variety and pervasiveness of the treatment of risk across sectors. It does not, however, reveal 'trust' as a widely represented theme. Notwithstanding the fact that we have a limited selection of disciplines, professions and sectors represented in our contributing papers, and that we have papers that principally refer to the UK context, only a very few of the contributors highlighted the feature of 'collaboration' amongst companies as being important. This was in the delivery of large projects in the construction industry. Even here, though, it was indicated that in the face of delays or cost overruns consortia members quickly degenerated into a blame culture and adversarial relationships. This in part is attributed to the overall adversarial (legal, governmental and commercial environment) that prevail in the UK which has been widely criticised both within and outside the industry as representing an ineffective model.

Figure 22: Risk management responses

Generic Risk Management

Generic Attitudinal Risk	Avoid	Reduce	Share	Transfer	Retain
Adversarial	• Retreat	• Reinforcements • Recruit • Technology advance • Win battle • Strategy	• Alliance	• Mercenaries	• Stand-off
Competitive	• Sell-out • Cartel	• Take-over • Specialisation • Lobbying • Strategy	• Joint-venture • Diversification	• Franchise • Insurance • Sub-contract	• Market
Collaborative	• Cartel	• Trust • Consortia • Alignment • Strategy	• Contract • Consortia • Trust	• PPP/PFI • Trust	• Trust
Mitigative	• Relocate • Reroute • Abandon	• Protective works • Resiliant structures • Strategy • Contingency	• Co-operate	• Insurance	• Gamble

5.2 *Lessons for MUTPs*

Project lifecycles

Here we highlight some of the key insights that can be drawn from the different disciplines reviewed (both within and outside the 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.

It is hardly surprising, given the nature and scale of MUTPs, that many of the observations made earlier about 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:

- **Phase 1: Project conception**. 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 final sections provide important insights into the nature of MUTPs and the RUC associated with decision-making in their planning and delivery gleaned from the preceding analyses 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 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 (we repeat) *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:
    - as all embracing and contextually sensitive as possible, able to anticipate contextual change wherever possible;
    - based on the concept of risk hierarchies;
    - accompanied by constant monitoring and iteration; and
    - 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.

The ardent reader of this document who has taken the trouble to read the extensive detailed review of the individual contributions to the various Working Papers of this study will readily appreciate that our focus above on a few selected concluding themes/lessons for MUTPs does *not* do justice to the fact that others could also have legitimately been included. All we can present here in our defence is the excuse that we were ultimately defeated by the constraints of time, space and our capability of articulating the various complexities identified in (essentially) the written word. We, nevertheless, remain hopeful that what we have discussed and shed light on in our conclusions are of sufficient value to offer new insights into future MUTP developments and some modest advancements in the field that will encourage further fruitful research and enhanced MUTP practice in the fullness of time.

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Appendix 1: Table of contents of preceding Working Papers

Working Paper #1: Concept clarification: Literature review of risk, uncertainty and complexity in decision-making and planning
Edited by Harry T. Dimitriou and Richard S. Oades, University College London

1. **Introduction**
   Richard S. Oades and Harry T. Dimitriou, University College London

2. **The Significance of Concepts of Uncertainty, Risk and Complexity in Decision-making and Planning**
   Richard S. Oades, University College London

3. **Strategic Planning Thought: Lessons from elsewhere**
   Harry T. Dimitriou, University College London

4. **Conclusions**
   Richard S. Oades and Harry T. Dimitriou, University College London

Working Paper #2: The Contemporary Treatment of Risk, Uncertainty and Complexity in Decision-making in Selected Disciplines
Edited by Harry T. Dimitriou and Richard S. Oades, University College London

1. **Introduction**
   Richard S. Oades and Harry T. Dimitriou, University College London

2. **Strategy: Military planning under conditions of uncertainty, complexity and Risk**
   John Stone, Kings College London

3. **Earthquake Engineering and Seismic risk**
   Tiziana Rossetto, University College London

4. **The Treatment of Risk, Uncertainty and Complexity in Project Finance: A banker's perspective**
   Mark Lemmon, Hong Kong Shanghai Banking Corporation HSBC

5. **Complexity, Uncertainty and Risk-Taking in General Insurance and the Role of the Actuary**
   Lis Gibson, Deloitte and Touche LLP

6. **Agricultural Pests and Diseases: Complexity, uncertainty and risk**
   John Mumford, Imperial College London

7. **Scientific Uncertainty and Complexity in Public Health**
   Carlos Dora, Carolyn Vickers and Katherine Walker, World Health Organisation

8. **On the Complexity of Organizational Trust: A multi-level co-evolutionary perspective and guidelines for future research**
   Steven C. Currall, University College London and Andrew C. Inkpen, Thunderbird School of Global Management

9. **A New Kind of Competence: On avoiding mistakes in large organisations**
   Oliver Sparrow, The Challenge Network

10. **Naturalising Knowledge Management**
    David Snowden, Cognitive Edge Pty

11. **Treatment of Risk, Uncertainty and Complexity in Decision-making in Various Disciplines and Professions: A summary and synthesis**
    Richard S. Oades and Harry T. Dimitriou, University College London

Working Paper #3: The Treatment of Risk, Uncertainty and Complexity in Transport, Regional and City Planning and Urban Development
Edited by Harry T. Dimitriou and Richard S. Oades, University College London

1. **Introduction**
   Richard S. Oades and Harry T. Dimitriou, University College London

2. **Complexity and Emergence in City Systems: Implications for urban planning**
   Michael Batty, University College London

3. **Strategic Thought and Regional Planning: The importance of context**
   Harry T. Dimitriou and Robin Thompson, University College London

4. **Managing Risk on a Hypermobile World**
   John.Adams, University College London

5. **Great Planning Disasters: What lessons do they hold?**
   Peter Hall, University College London

6. **Risk, Uncertainty and Complexity in Construction and Civil Engineering Projects**
   John M. Kelsey, University College London

7. **The Property Sector Approach to Major Projects: Risk, uncertainty and complexity**
   Keith Perry, Asset Factor Ltd.

8. **Past and Contemporary Treatment of Risk, Uncertainty and Complexity in Transport, Regional and City Planning and Urban Development: A summary and synthesis**
   Harry T. Dimitriou and Richard S. Oades, University College London

Appendix 2: Comparative analysis and relevance of contributions in Working Papers #2 and #3

Prepared by John Ward, University College London

Assumptions for the following analysis

- Each author has given a wide-ranging account of risk, uncertainty and complexity which is representative of their field
- WP2 – Represents actors who are *not* professionals within the field of "*urban transport infrastructure investment and planning,* and city and regional policy-making and planning"
- WP3 – Represent actors who are professionals working within the field of "*urban transport infrastructure investment and planning,* and city and regional policy-making and planning"
- Any effects due to an uneven distribution of papers within WP #2 (9) and WP #3 (6) can be disregarded
- Data collected from a non statistically significant sample can provide useful insights as part of a qualitative analysis
- The sense-making indexing (SMIs) of the data by only two research staff has not introduced bias into the indexes.

Summary of Key findings from Comparative Analysis of WP2 and WP3:

Below is a summary of the key analysis findings from the analysis.

- Significant differences were observed between the distributions of indexes for WP2 and WP3.
- There is a more widespread reference to uncertainty and complexity within WP #2s than in WP #3s (See figures 1.1 and 1.2 below).
- There are more RUC management techniques applied in WP2s than WP3s (see figures 2.1 and 2.2 below).
- Collaboration is the most dominant attitudinal type for both WP2s and WP3s. However the second most important attitudinal type for WP2 is mitigation, whilst for WP3 it is competition (see figures 3.1 and 3.2 below).

- There are many more role types/stakeholders featured in WP3s than in WP2 even though there are more professions represented in WP2 than by WP3 (see figures 1.1 and 1.2 below).

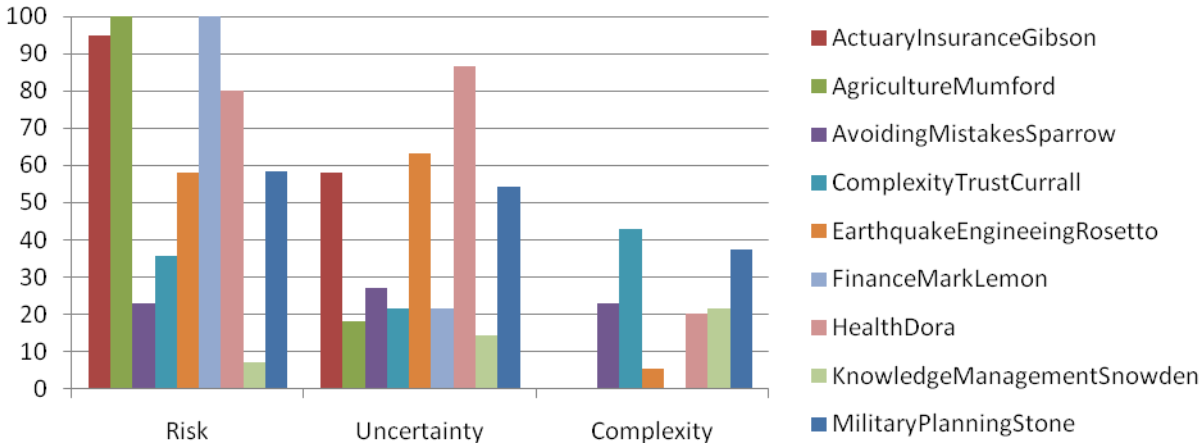
- There are distinctly different trends visible in the distribution of risk, complexity and uncertainty throughout the project life cycle for WP2s and WP3s. The consideration of risk, uncertainty and complexity tends to increase through the Planning, Implementation and Operation stages of WP #2s whilst decreasing through these three stages in WP #3s (See figures 5.1 and 5.2 below)

- There are distinctly different trends visible in the distribution of RUC management techniques and RUC sub-categories (Figures 6.1 and 6.2). WP #2 shows an even distribution of RUC management techniques through all the RUC sub-categories, whilst for WP #3 there are only sporadic links between the management techniques and RUC sub-categories.

1. Distribution of SMIs linked to RUC

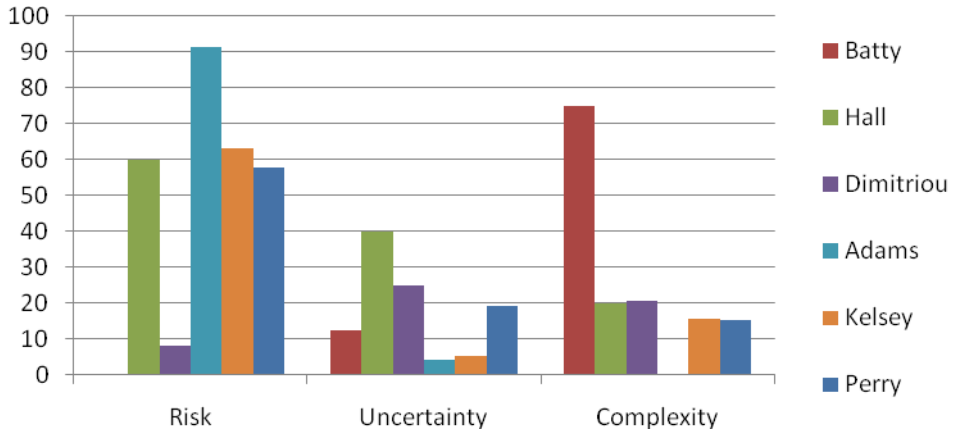
From figure 1.1 below (showing the number of SMIs from working paper 2 related to Risk, Uncertainty and Complexity) risk is the most widespread concept, followed by uncertainty, and then complexity. The dominance of risk in the distributions of the three concepts could be genuinely attributed to its higher prevalence in reality, or could be due to ambiguity surrounding the meanings of risk, uncertainty and complexity.

Figure 1.1: Distribution of SMIs linked to Risk, Uncertainty and Complexity for WP2



From figure 1.2 below (showing the number of SMIs from working paper 3 related to risk, uncertainty and complexity) there are similarities with the distribution seen in WP2 in that risk is the most commonly featured of the three concepts, and there is a generally low number of SMIs related to complexity (with the exception of Batty, much of who's research focuses on agent based models of complexity). However, there is a definite lack of dealing with uncertainty in WP3s - it could be that planners either do not understand the concept of uncertainty, or that it simply does not occur in their profession.

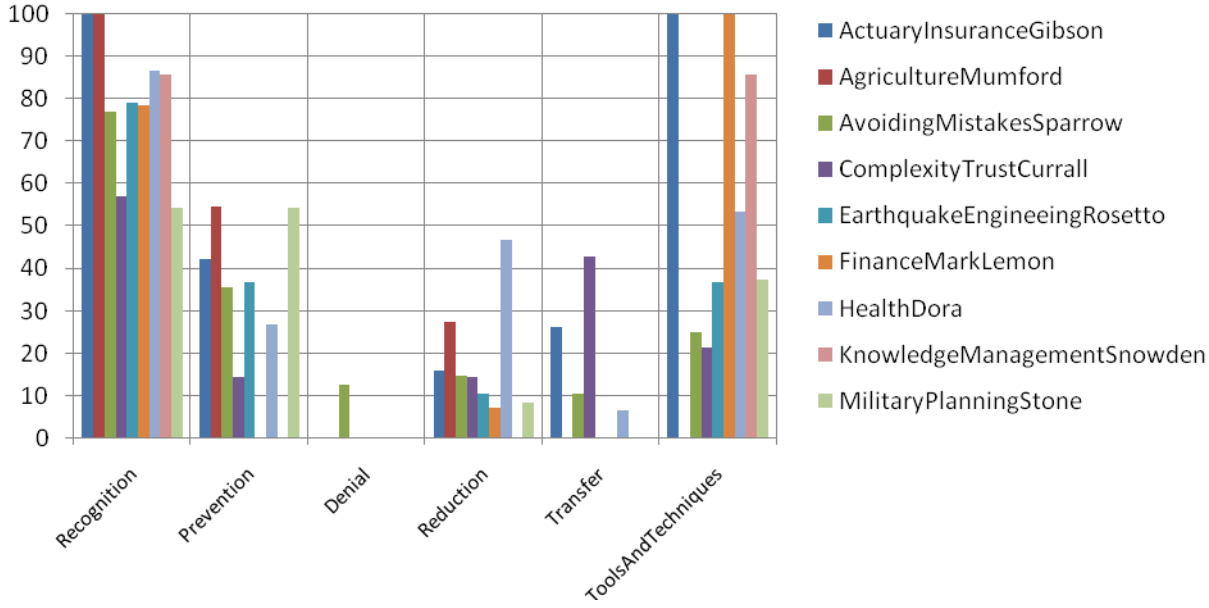
Figure 1.2: Distribution of SMIs linked to Risk, Uncertainty and Complexity for WP3



2. WP2 Greater range of RCU management

Figure 2.1 below shows a range of RUC Management Tools and how they are related to the WP2s. There is adoption of all six management techniques within the WP2s. The highest number of SMIs are related to the recognition and tools/techniques management types. There is a definite preference in WP2s for tools/technical solutions to RUC, which in turn exposes the users to a new set of RUCs inherent in all software (and a contributor to the current Credit Crunch). Denial is the least featured of the management techniques (underreporting of the use of denial may be common amongst practitioners).

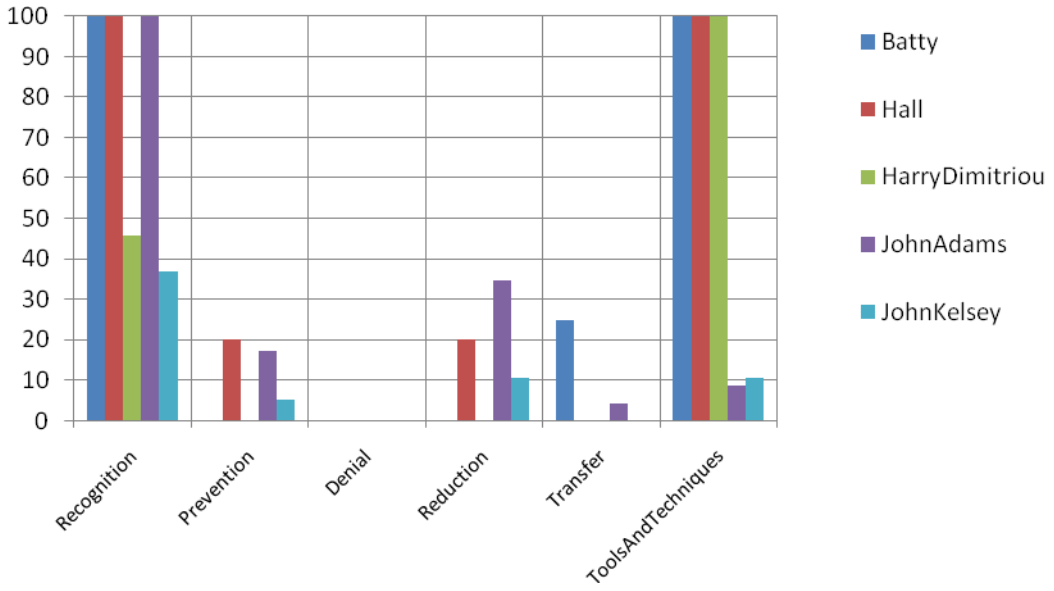
Figure 2.1: Distribution of SMIs linked to Risk, Uncertainty and Complexity Management for WP2



WP3 (see figure 2.2 below) shows a generally lower adoption of all but the recognition and tools/techniques management types. Given the complexity of

associated with most decisions, the avocation of models to deal with RUC could be a dangerous reliance –the adoption of tools could be seen as consistent with a unwillingness to allow for uncertainty and complexity as models are generally poor at accommodating changes which arise due to complexity.

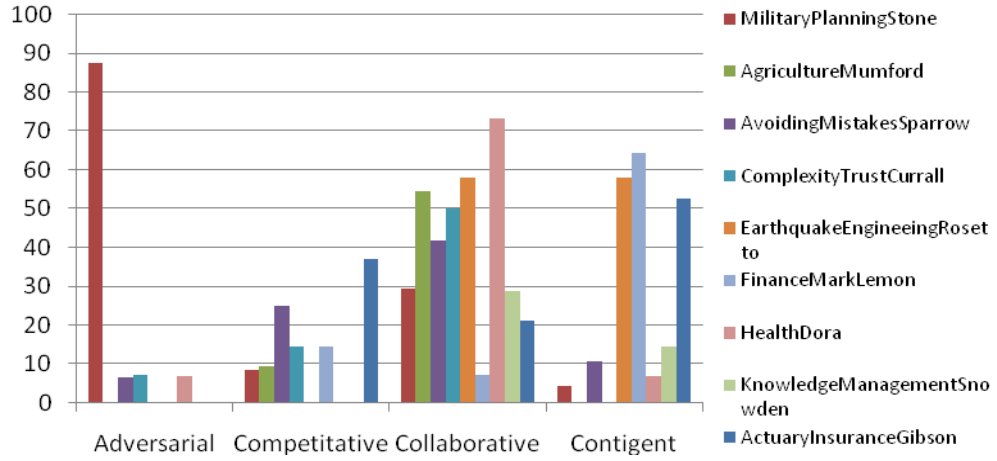
Figure 2.2: Distribution of SMIs linked to Risk, Uncertainty and Complexity Management for WP3



3. Collaboration Dominant for WP2&3

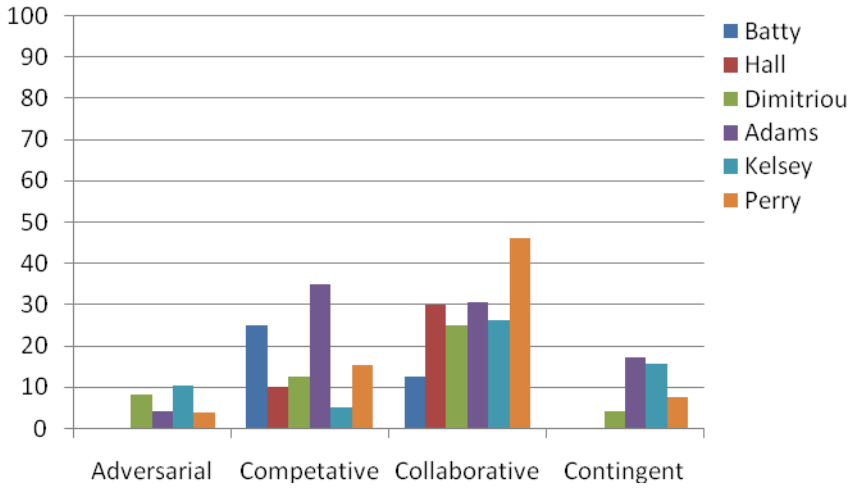
Figures 3.1 and 3.2 below show the attitudinal types associates with the WP #2s and WP3s respectively. Whilst attitudinal types are generally more prevalent in WP #2 than WP #3 – the SMIs of both papers make the greatest reference to Collaboration. It is not clear here if the link between collaboration and RUC is a negative or positive association, but either way, it is surprising for WP2 as six out of the nine Papers are from the commercial setting where one would expect the competitive attitude to prevail. The second most important attitudinal is contingency, where companies try to cover for potential losses.

Figure 3.1: Distribution of SMIs linked to Attitudinal Type for WP2



It is interesting for WP3 (figure 3.2 below) that after collaboration, the second most dominant attitude is the competitive attitudinal type. Again is unclear if competition is a positive or negative relationship, being either the creator or solution to risk, but it is more prevalent than contingency in WP3. Competition is considered a good thing as it sparks innovation, but it depends if this competition has evolved within the industry, or if it imposed through legislation (Ormerod). Either way it is surprising to find it so strongly related to the WP3s.

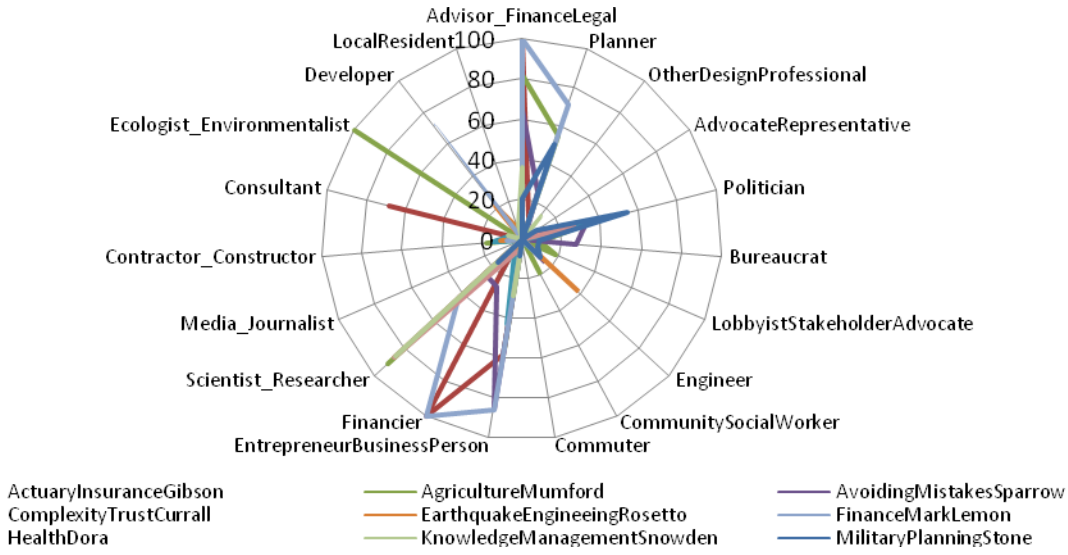
Figure 3.2: Distribution of SMIs linked to Attitudinal Type for WP3



4. Stakeholders and Complexity

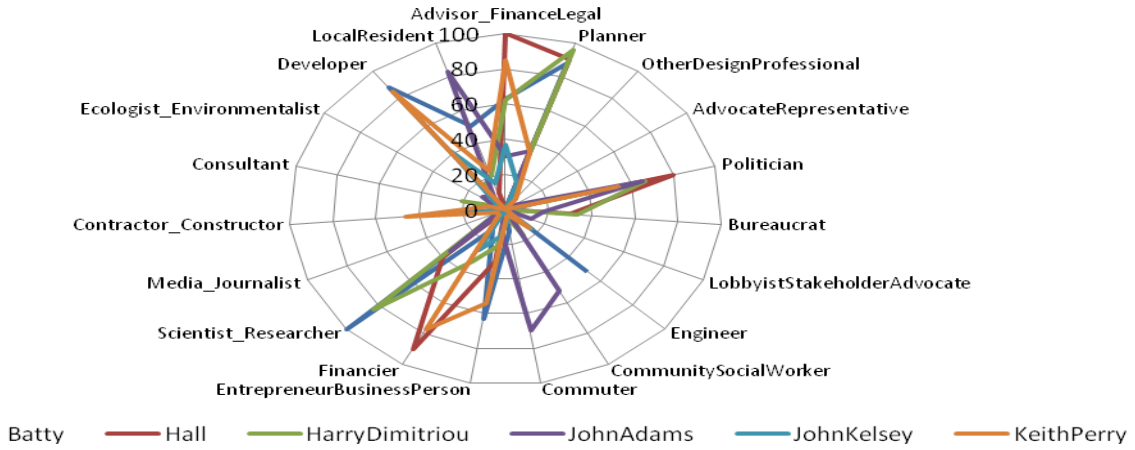
Figure 4.1 and 4.2 show how the SMIs of WP2s and WP3s are related to roles. WP2 shows a limited number of roles associated with the WP2s (from figure 4.1). This is surprising considering the wide diversity of professions of WP2s. The only role type outside the authors direct professions are Politicians.

Figure 4.1: Distribution of SMIs linked to Role Type for WP2



WP3 (see figure 4.2 below), despite a more narrow subject field, shows a much wider variety of actors, both from professional and non professional positions. This may be due to this particular set of indexes being developed by planners, and thus showing a better fit to the planning data, or it may be a sign that despite the low significance of complexity with WP3s (from figure 2.1 above), the planning world, with its greater diversity of stakeholder types, may be all the more vulnerable to complexity as a result.

Figure 4.2: Distribution of SMIs linked to Role Type for WP3



5. Project Stage Split by RCU

Figures 5.1 and 5.2 below show RCU as it is linked to different phases of the project cycle within WP2 and WP3 respectively. The most noticeable feature of both graphs is the dominance of risk, complexity and uncertainty is the Vision Goal phase of the project.

From figure 5.1 below a noticeable feature of WP2 is complexity tends to be least associated with the planning phase, but ramps up towards the operation stage, which is the total opposite from WP3s where risk, complexity and uncertainty all diminish with each project stage. It seems that the authors of WP2 link RUC as most critical in both the vision goal stage, and the operations stage, showing a more long term view of RUC, whilst the authors of WP3 are shorter term, focusing mainly on the vision goal stage.

6. RCU Subcategories split by RUC Management

There are distinctly different trends visible in the distribution of RUC management techniques and RUC sub-categories. WP2 (figure 6.1 below) shows an even distribution of RUC management techniques throughout all the RUC sub-categories, whilst for WP3 (figure 6.2 below) there are only sporadic links between the management techniques and RUC subcategories. This second graph shows that not only are there fewer RUC management types being applied to WP3, but they are application within the RUC subcategories, linked to different aspects of a project, is very patchy.

Figure 5.1: Distribution of SMIs linked to Project Stage, Split by RUC for WP2

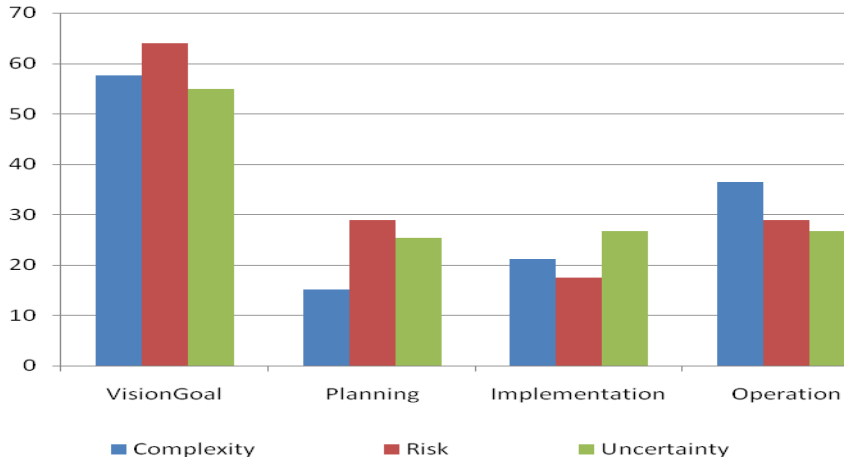


Figure 5.2 - Distribution of SMIs linked to Project Stage, Split by RUC for WP3

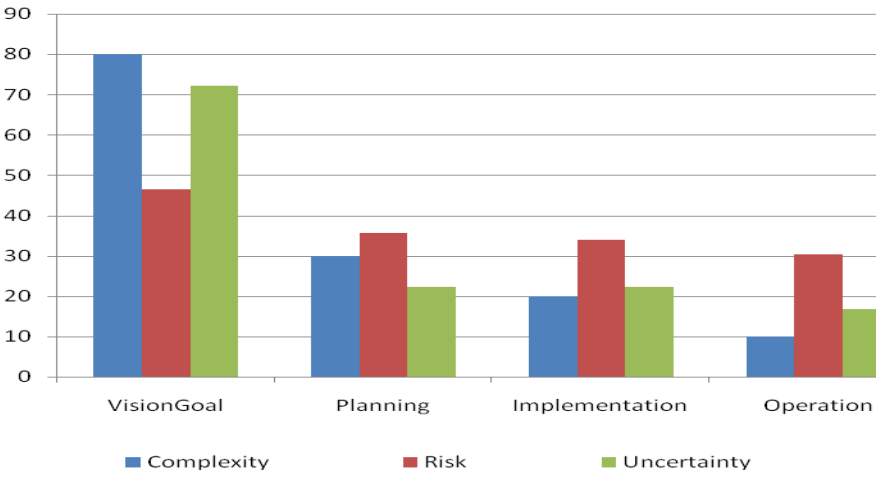


Figure 6.1: Distribution of SMIs linked to RUC Management, Split by RUC subtype for WP2

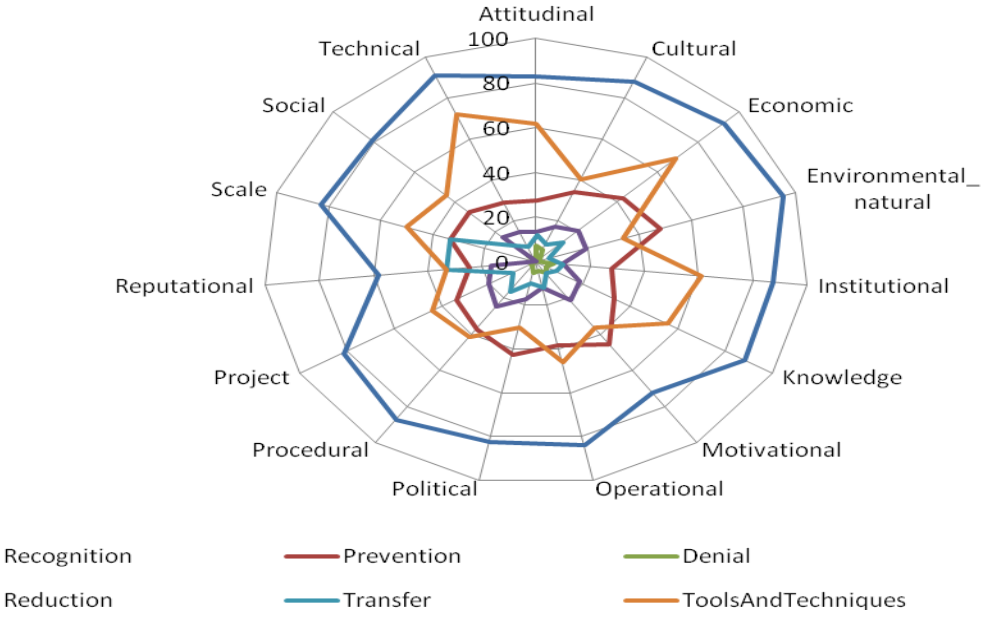


Figure 6.2: Distribution of SMIs linked to RUC Management, Split by RUC subtype for WP3