1.4 CONCLUSIONS

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As already indicated earlier in the text of this Working Paper, risk is widely regarded as a special sub-set of uncertainty in which the probabilities and magnitude of outcomes of an event are quantifiable. Our research and that of many of the commentators in applications outside the physical sciences reported upon here suggests, however, that such quantification of risk despite all efforts is rarely practicable, particularly of a comprehensive character. As researchers of risk will testify, this has not inhibited the application of techniques of risk analysis from relying on quantification. It simply means that in such instances assumptions have been made, some realistic and some unrealistic. The temptation may be to assume there is no risk, when it patently exists, in order to portray to a third party stakeholder an air of confidence that is inherently bogus.

Away from the physical sciences, we have noted that classic models of rationality are being abandoned in favour of more sophisticated models which embody a multifaceted perspective of decision-making behaviour in which context is now seen as a key factor influencing outcomes. Furthermore, while our modest literature review reveals that uncertainty and risk have primarily been studied with regard to future events it is now increasingly being recognised that the importance of their study equally applies to the present.

We also found that as we move into the realms of natural science so theories of risk based on mechanistic closed systems cease to have applicability and relevance. We observe and concur with the view that uncertainty relating to the future within the behavioural domain is, and will continue to be, largely intractable. This we argue is the territory of Complex Adaptive Systems (CAS), that are unbounded and inherently unpredictable in outcomes largely because they continuously change and are as a result incredibly complex in any point in time.. Notwithstanding this, we recognize than even from positions of ignorance of outcomes and likelihoods, decisions still have to be made both about the present and for the future and that in both instances understanding better (sense-making) contextual factors – culture, experience, beliefs, and heuristics – offer much guidance in understanding both individual and institutional decision-making in planning..

We conclude that an appreciation of the characteristics of CAS is essential for any interventionist – particularly strategic interventions - in order to understand the limits of influence and control over outcomes. We also argue that recognition of an ‘emerging order’ over time can transform outcomes in positive or negative directions depending on the yardsticks of measure and visions employed to assess ‘progress’. Complexity and Chaos Theories tell us that impacts are not static phenomena and that changes in a system(s) continue to reverberate around it(them) in unpredictable ways, and that the measurement of outcomes and consequences are ultimately only valid for the time in which they are measured. Emergent properties of complex systems therefore mean that subsequent changes are unpredictable and that this so a fact of life which if ignored can be very risky in itself.

It is clear from the preceding discussion that complexity generates uncertainties both within the project and in the decision environment of the project (two closely

related but very different contexts). Each of these may impose risks of their own in the form of threats or opportunities upon the achievement of objectives, and which through on-going interaction can spawn new complexities not previously identified and/or understood. In the context of infrastructure planning, the introduction of new projects may be seen as 'intervention' in an already complex system of infrastructure networks that can acts as a 'disturbance' which triggers myriad responses as elements seek to adjust to new circumstances generated by feedback. These circumstances beckon the question whether it would be better to perceive infrastructure projects more as organic phenomena rather than mechanistic ones, and whether as a result decision-makers need to better appreciate that actions designed to achieve 'directed order' (associated with mechanical notions of organized structure) will inevitably lead to a new unanticipated 'emergent order' given the organic dynamic context of the project, as the new infrastructure system seeks over time to adapt to its new environment.

From our examination of the nature of risk, uncertainty and complexity, and the critical importance of context, together with our reading about methods, tools and techniques deployed to handle them, we conclude that strategic thinking (which includes the use of scenario planning) is a pre-requisite to the effective handling of these concepts in any context. This is a conclusion not only found to be pertinent to public and private sector decision-making for infrastructure and territorial planning (see Working Paper #3) but also verified by other disciplines, sectors and professions well acquainted to these challenges as we may read in Working Paper #2.

Each approach to risk-taking explicitly acknowledges uncertainty as an obstacle in achieving desired outcomes of concerted action. We can see that these methods operate with varying degrees of success, none however is universally applicable, and there is certainly no panacea. We have a sense instead that each method is, at best, only appropriate to particular circumstances (contexts), and yet it is by no means clear what these circumstances are. We conclude, therefore, that what we need is a way of recognising and categorising different contexts, and signposting appropriate ways of handling uncertainty for each. Different types of situations will, in other words, require different treatment and analytical tools to aid decision making, even though certain generic qualities may apply..

Planners have persisted with the use of the rational/deductive decision model for planning for decades in the face of mounting evidence of its inappropriateness for complex, open, uncertain and adaptive environments. It is thus becoming increasingly recognised that a new strategic planning paradigm is urgently needed to fully embrace complexity, uncertainty, and risk. No such models that we are aware currently exist. There are several 'stand-alone' and largely complementary approaches that exhibit a degree of promise. Among these are Scenario Planning, Soft Systems Methodology (SSM), and the Strategic Choice Approach (SCA). Each has its origins over thirty years, and yet still has not been widely appreciated and/or adopted.

What also has been lacking is an overall framework into which each method will fit and perform a distinct and valuable function. We see the *Cynefin* Framework as perhaps the most powerful of these possible overarching constructs to date. It is deceptively simple, it embodies concepts of degrees of uncertainty, distinguishes between chaotic, complex, complicated and simple systems, and differentiates between 'emergent' and 'directed' orders, which in turn indicates response models more appropriate to specific decision domains. Any major infrastructure project will require engagement with each of the *Cynefin* decision domains: the known, knowable, complex

and chaotic, as for example one ranges from the civil engineering of infrastructure through to the social consequences of the subsequent new facility or service. The skill is in recognising the domain of operation and adopting the response model appropriate to that decision domain.

Finally, four key consequences stemming from characteristics of complex systems need to be appreciated. These include: the inability to predict, the inability to control, self-organisation and emergence. All potentially have a radical impact on the nature of strategic planning if the processes themselves adapt in their recognition. Planners will do better to understand the limits of their capabilities (rather than exaggerate them as they currently often do), be more realistic about what they can predict and achieve, better manage stakeholder expectations, and concentrate on the most effective use of their instruments and influence. If infrastructure plans and programmes are highly prescriptive in a complex environment they will almost certainly 'fail' because the forces of change *cannot* be directed with any degree of certainty. These conclusions, we contend, have major implications for the infrastructure planning process for mega transport projects, its practitioners and analysts. They shift attention from end-state plans, towards day-to-day operational decisions; from defining a blueprint to be pursued to understanding the consequences of actions; and from reliance on experts to dialogues with stakeholders.