

2.11 TREATMENT OF RISK, UNCERTAINTY AND COMPLEXITY IN DECISION-MAKING IN VARIOUS DISCIPLINES AND PROFESSIONS: A SYNTHESIS

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Introduction

This set of collected papers reflects the outputs of the second stage of the project. As explained in Section 2.1 of this Working Paper, it brings together a number of contributions from leading academics and practitioners in disciplines, sectors and professions that routinely deal with issues of risk, uncertainty, and complexity (RUC) at the core of their endeavours in decision-making and planning¹. In so doing, the document offers a unique opportunity to explore the different perceptions of RUC, and their ways of handling them in their decision making. Our underlying premise is that there are lessons we can learn from the treatment of RUC by other decision makers that can potentially be applied to the planning MUTPs.

As indicated in the Table of Contents, contributions are drawn from war studies, earthquake engineering, banking, insurance, agriculture, medicine and public health, knowledge management, supplemented by two more orthogonal topics: trust and organisational competence. This is a deliberately eclectic mix. There is no practical way this can be deemed to be fully representative of the fields covered, it simply dips into a vast set of fields in order to taste the variety of approaches and experience that is out there. This is therefore a consciously speculative and exploratory exercise. In this paper we synthesise the content of this group of papers to inform the review of the next set of commissioned papers – those relating more specifically to planning, transport and development and the research programme currently underway by the OMEGA Centre and its international partners.

In the synthesis we offer here, we examine the interpretations and operational meanings of RUC in different fields. Despite the variations of interpretations offered, not surprisingly, all papers reveal the importance of context. We explore the parameters of context, and the characteristics of the contexts described to better appreciate what may be generic (and therefore transferable), and what is not. If, as we maintain, context is all important then we might expect to see both similarities and differences across the board, depending on the characteristics of each context. This premise is tested. The paper closes with a description of some lessons and conclusions that we can take forward to the next stage in the project as discussed on Working Paper #4.

¹ We should add here that we feel highly privileged that such renowned, experienced and obviously very busy contributors put in both the time and effort they did to write the papers received in the interest of advancing inter-disciplinary research in the field of study pursued.

Interpretations of risk, uncertainty, and complexity

One early observation we can make is that RUC are used in different ways reflecting different contexts, priorities and desired outcomes. What we can say is that uncertainty is a state of mind denoting imperfect knowledge. It is a wholly human construct, as indeed is 'risk', which itself implies the actual, or contemplation of, commitment of resources in the widest sense (finance, manpower, life and limb) to the achievement of a desirable outcome in a circumstance of uncertainty. 'Complexity' evokes a wider spectrum of interpretation from that of 'very complicated', to a more precise academic invocation of Complexity Theory and all that that implies.

Dora *et al* (Section 2.7) recognise the importance of semantics. They maintain that to understand the strategies that decision-makers have developed to deal with RUC it is first important to define and understand each term. Here there is an implicit but *critically important* acknowledgement (reflected in most of the other contributions) that the possession of a 'strategy' is a prerequisite to effective decision-making and planning. More attention to this is given on Section 1.3 of Working Paper #1)².

In approaching the topic from the perspectives of medicine and public health, Dora *et al* point out that each of these two fields confronts uncertainty, complexity, and risk on two fundamental levels:

- **the scientific level** - where uncertainty may result from lack of knowledge or understanding of complex processes; and
- **the systemic** - where uncertainty about the interaction or influence on complex social systems need to be addressed where other objectives, risks, and perceptions must be considered and weighed.

This is a highly significant generic distinction that is not widely made or appreciated, and yet it has universal applicability in understanding the context of any strategic decision. It nevertheless, accords with the distinctions drawn by Snowden (in Section 2.10) between the 'ordered' and ordered systems and the need to treat each very differently in the decision making context.

Dora *et al* point out that in common parlance 'uncertainty' is often used loosely to describe all kinds of variation. Theoreticians, on the other hand describe uncertainty more precisely as falling into two categories: *aleatory* uncertainty and *epistemic* uncertainty. They distinguish the two by adopting the terminology whereby *variability* is used for *aleatory* uncertainty and uncertainty is used to describe epistemic uncertainty. They define each of these as follows:

- **variability** - is the heterogeneity of values over time and space of different members of a population. It is generally a property of a system itself. It can arise from stochastic or random processes or from processes that are controllable in various ways. They cite the example of the distribution of heights of a human population.
- **uncertainty** – (in the epistemic sense) is "incomplete, imperfect knowledge concerning the present or future state of a system under consideration. It arises from

² Here a 'strategy' may be seen as a plan that joins-up' major goals, policies and actions into a cohesive entity. It '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 and contingent moves by intelligent opponents' (Quinn, 1995: 5).

data that is limited (e.g. sparse, of questionable quality or relevance), and processes that are as a result not fully understood and predictable.

Dora *et al* assert that these distinctions matter because they dictate what measures are appropriate for dealing with the variation in systems. ‘Variability’ as defined here cannot be reduced. Uncertainty can theoretically be reduced by conducting research, collecting data, and in essence adding to the knowledge base.

Rossetto (see Section 2.3) adds to these two categories of uncertainty: *modelling uncertainty*, described as the inability accurately to represent what we know, and *parametric uncertainty*, defined as differences between assumed and actual values. These two refinements may be useful in a wider generic context where quantification is legitimate.

Dora *et al* go on to consider ‘complexity’ in the sphere of public health assessment and management. It arises they explain when more variables are increasingly introduced and or where systems are characterised by more than one causal or cause-and-effect relationship. Complexity can exist on multiple levels so that it affects the ability to understand and characterise systems. Snowden, on the other hand, argues that in Complex Adaptive Systems, causality can *only* be shown retrospectively in any event. According to Dora *et al*, complexity can also describe the multiplicity of stakeholders, actors, actions and consequences that describe a particular decision context. It can operate at many scales from the level of an individual making a decision, to that of a national government making policy decisions about complex problems with far reaching implications for society, the environment and the economy. Snowden would not take issue with complexity used in that latter sense.

They make an important distinction between ‘complexity’ and the conflicts that arise because of fundamental differences in underlying values, ethics or motivation, a situation which in the literature is termed ‘*ambiguity*’. Ambiguity in a decision context arises when individual stakeholders or actors value the consequences, whether risks or benefits, differently. They assert that it is important to distinguish ambiguity from uncertainty and complexity as it calls for different strategies for dealing with these key differences in the overall policy-making process. These authors are alone amongst our contributors in emphasising this concept. In the arena of public policy and planning this has to be an important concept by virtue of the wide range of stakeholders, plurality of opinions, and the exercise of choices that determine ‘winners’ and ‘losers’.

The military field offers the oldest accounts of strategic thinking. Here planning is conducted with the aim of defeating a sentient adversary, who is equally intent on avoiding defeat, or gaining victory. Because opposing parties in the military context exhibit *interdependence of choice* strategies they are subject to *acute* levels of uncertainty and complexity. Stone (in Section 2.2) focuses on uncertainty as to enemy motivations and intentions, and the complexity associated with military organisations and their operations. In combination military decision-making at a strategic level embodies an acute degree of risk, with stakes that are very often of the highest order. Stone recognises that the existence of a sentient adversary introduces an extra order of magnitude of uncertainty to any planning exercise compared to say a complicated civil engineering project, or indeed sending astronauts to the moon. The military must contend with the ‘unknowable’, the others are dealing largely with the latter if not the ‘known’ or at worst the ‘knowable’.

Stone claims that an effective military strategy is one that generates desirable military outcomes *without* incurring disproportionate costs in terms of damage suffered by the military and military effort expended. He goes on to clarify that desirable military outcomes are not always, indeed are frequently not, consistent with politically desired outcomes. The best military outcome can be seen as disproportional to the overall aims of international diplomacy in which the military action is seen by the politician to be only a part of the strategy for problem solution. This intervention by the politician can be a source of resentment by the military. It is akin to the reservations that many technocrats have with the interventions of politicians in the planning and approval of major projects where optimum technical solutions are not deemed politically acceptable by the powers that be - leading to the implementation of technical sub-optimum solutions instead. These circumstances highlight the significance of 'context' and the political hierarchies of different decision-making contexts in terms of which carries most political clout.

The second great source of uncertainty in the practice of war is that military operations can *never* be perfectly controlled. (This resonates with experiences of major project planning and delivery). This is because in the direction and conduct of war decisions must be made on the basis of partial information, and by individuals and conditions of tiredness and fear (the "fog of war"). Stone cites Clausewitz (2004) who coined the term *friction* to cover the collection of influences that conspire to reduce the efficiency of Armed Forces where they are continuously bringing them into contact with the influence of 'chance', i.e., incidents that occur that could not be anticipated. The term chance is frequently associated with probability (as in - a one in six chance), and yet in this environment it is clear that quantification plays *no* part in strategy judgements. The variables associated with Clausewitz's concept of friction are myriad, interacting, behavioural and dynamic - to the extent that they defy calculation. In this sense, the war context is truly complex in that Complexity Theory has distinct relevance.

On returning to consider seismic risk (see Rossetto's contribution in Section 2.3 of this Working Paper) and risks in many other of the sectors we reviewed the situation is very different. There is no sentient adversary seeking to frustrate the efforts of the seismic engineer to mitigate the impact of earthquake activity. The resources are put at risk through death, injury, and damage to buildings and infrastructure caused by earthquakes not by opposing parties.

In the field of agriculture, Mumford (in Section 2.6 of this Working Paper) tells us that uncertainty of weather, climate, pests, diseases and weeds impact on crop yield and quality, and price fluctuations - putting at risk agricultural production and income. Risks here are a product of natural events and human intervention(s). Mumford focuses on the risks caused by agricultural pests as influenced by human activity such as trade and travel arising from the deliberate movement of organisms around the globe. The very activity of trading agricultural produce, he argues, embodies the risk of transmuting pests into their territories and the consequent threat to the local agricultural economy. The imperative is that trade needs to continue to distribute food supplies around the world and support the international economy notwithstanding the risks that this entails.

The objective of a large international bank such as the Hong Kong Shanghai Banking Corporation (HSBC) is to make profits for its shareholders, more specifically to optimise returns on the amount of capital it has available to deploy given the risks it

undertakes in doing so. As one may readily appreciate from Lemmon's contribution in Section 2.4 of this Working Paper, risk is a central theme in *any* banking business. There are generic motives for assessing risk in any investment. It will seek to achieve or exceed the target return on capital, based around the amount of bank capital required and the limits of risk it is prepared to undertake.

The language of the banker, in project finance in particular, is almost exclusively on talk of risk, as opposed to uncertainty and complexity: construction risk, revenue risk, operating and a life cycle risk, macro economic risk, and force *majeure* risk. Interestingly, uncertainties of *outcome* are among the main aspects of risks analysed. The uncertainties that command attention are those relating to the future *not* those relating to the state of knowledge about the present. Lemmon remarks that each new case is significantly different from any previous case, despite the very large number of project finance deals across the globe. While the process of appraising investment options is generic, the differences of context dictate that there are no generic solutions.

Gibson (in Section 2.5 of this Working Paper) informs us that the insurance industry is founded on the very existence of uncertainty and risk. General insurance is the means by which the insured can 'buy out' their risk. They reduce their remaining uncertainty at a price: a premium. An insurance company offers insurance to others, by considering the risk spread across a wide group of insured parties, their own resources and attitude to risk taking account of the characteristics of the insured party.

Overall risk in the insurance industry is seen as a function of the probability of a claim, and the potential sizes of claims. However, in almost all insurance the frequency and severity of claims are not known. Furthermore 'insurance policies are not independent of each other and so sometimes can all go wrong together'. Past data are employed to analyse prospects of claims even though older data is less relevant (because things keep changing) while more recent data is unreliable because claims have not all been settled. Gibson points out that writing an insurance policy is risky because we 'don't really know what claims we can reasonably expect, and, because of reserving uncertainty, we don't know how much money we made last year or the year before from similar policies. And we don't really know how volatile the claims experience might be or how much business we might be able to write, so we don't really know how much capital we need'.

Despite this apparently overwhelming array of unknowns and unknowables, a major component of the financial services sector operates and prospers. The insurance business in fact flourishes on this risk. There are, however, no universally accepted definitive methods by which actuaries quantify uncertainty in outcomes. They do though bring a combination of statistical and analytical skills together with a significant degree of judgement.

Currall (see Section 2.8 of this Working Paper) adds a further dimension to the consideration of risk through the very important topic of 'trust'. Currall and Inkpen, (2006) define trust as 'the decision to rely on another party (i.e. person, group, or organisation) under a condition of risk'. They explain the significance of the related concept of 'reliance' – this being the 'action through which one party permits its fate to be determined by another'. Reliance is based on positive expectations of or confidence in, the trustworthiness of another party.

On this basis, risk is the potential that the trusting party will experience negative outcomes ('injury or loss) if the other party proves untrustworthy. Thus, risk creates the opportunity for trust. Risk is also a precondition of trust. If there is no perceived risk,

trust is irrelevant. We see from this then that trust involves the twin principal concepts of reliance and risk. The logic here is that increased complexity leads to increased uncertainty and that this increased uncertainty in turn requires greater trust. Trust in turn calls for transparency in decision-making or put another way, opaque decision-making places strains on trust, particularly when unexplained and unexpected negative outcomes arise from non-transparent decision-making.

Uncertainty exists about the level of risk where risk refers to the magnitude of potential negative consequences. Risk also, by implication, refers to the damage that one would experience if another party is untrustworthy. The issue of risk then has to do with the magnitude of the downside as well as the magnitude of the loss, while uncertainty is about the *likelihood* of the negative consequence. Uncertainty also relates to the forecasting of the counterpart's behaviour and whether that party is going to fulfil their commitment or not in any agreement that involves trust. It is here where uncertainty comes in and where the issue of reputation emerges as highly important. Indeed the very survival of businesses and professions is dependent upon reputation, particularly in the service industries.

Currall introduces the very important concept of the 'certainty threshold'. Here the greater the risk the more certainty a party must have about the behaviour of the other. As risk goes up so the tolerance of uncertainty goes down, and the certainty threshold goes up. The larger the project, the more significant trust becomes. Currall points out that trust is a lubricant that helps the parts of the big project move together smoothly. While trust refers to the potential downside, the risk side of the equation, there may be a massive upside as well, especially in large undertakings with multiple parties (consortia and joint ventures), where the joint vision and the potential benefits derived from the collaboration are what is driving the group's behaviour. Given the increasing role of public private partnerships (PPPs) in the financing of major projects world-wide, this understanding of trust, reliance and certainty thresholds is extremely important, especially in cases that involve privatisation and increased dependency on the private sector for services previously delivered by the public sector.

Parameters of context

It is our assertion that the treatment of RUC should greatly depend on the context of the operation(s). In other words, we need to understand not only the treatment of RUC but also the characteristics of the context in which it takes place. In order to do this we need to be able to describe and compare different contexts. It is insufficient to make reference to the contexts of specific disciplines, sectors or professions alone, and from this draw out what might be considered to be generic and what might be specific to their particular field, as useful as this may be. For this does not take us further forward in understanding the critical properties of 'context' (time, place, organisation, government, ideology, society, culture etc.). It tells us nothing about the similarities and differences between them with the result that we recognise the need to delve deeper into the definition, key characteristics and properties of context as the frame for RUC studies in decision-making and planning.

Currall offers some pointers here. He quotes Johns (2001: 32) who has explained that 'organisational context' 'can be characterised as cross level effects in which a stimulus of phenomena in/at one level unit of analysis has an impact on/at another level of unit of analysis. Currall goes on to cite Mowday and Sutton (1993: 198) who define

context as ‘stimuli and phenomena that surround and thus exist in the environment external to the individual, most often at a different level of analysis.’

Snowdon (in Section 2.10 of this Working Paper) offers us a high-level perspective in the differentiation between ‘ordered’ complexity and chaotic systems. In ordered systems - be they simple or complicated - there are repeating relationships between cause and effect that can be discovered by empirical observation and analysis. We can use the understanding of those relationships to predict the future behaviour of the system and to move towards desired end states. In a complex adaptive system (CAS) the system and its constituent agents interact one with another. As a result of this double interaction the system is inherently unpredictable and, most importantly, will *not* return to an equilibrium state after it is disturbed. According to Snowden, any order is emergent and *only* repeats itself, if at all, by accident *not* by design. This is a perspective also offered by Batty (in Section 3.2 of this Working Paper) and potentially is highly significant in how to perceive the development (evolution) of major projects over time in cities and regions as will be alluded to in Working Paper #4.

Snowdon reminds us that ‘most human systems are complex’ and respond and adapt to local interactions where we are constrained by such systems. He also points out that we are also capable of constraining the systems and changing them. He goes on to emphasize small things can lead to unintended and unforeseeable consequences and that once disturbed, any human system is altered irretrievably. Perhaps most significantly of all he argues that if we understand that the system is complex then our expectations of its decisions are different. There is an implicit acceptance that we cannot in these circumstances make decisions merely based on forecast double outcomes and best practice.

As the first parameter of context analysis we can examine whether we are dealing with an ordered or complex system. From the papers we have presented and reviewed in this Working Paper we can identify distinctly different motivations behind decision-making. This leads us to suggest a four-part typology of ‘motivational contexts’:

- ***combative*** - the aim is to destroy or eliminate any threat from a sentient opponent;
- ***competitive*** - the aim is to be more successful than a sentient rival;
- ***collaborative***: the aim is to co-operate with another stakeholder to gain mutual benefit; and
- ***mitigative*** - the aim is to prevent hazards from developing into disasters or to reduce the effects of disasters when they occur by focusing on long-term measures for reducing or eliminating risk.

We can place each of our disciplinary, professional or sector contributions within a notional space defined by these four categories (see Figure 1). None is to be found exclusively within one category but, for example, the military is predominantly geared to the combative, whilst seismic engineering, agricultural pest control and medicine and public health planning are largely driven by mitigative objectives. Insurance and banking project finance combine substantial elements of both the competitive and the collaborative.

Framework for comparative treatment of risk, uncertainty and complexity

On the basis of the commissioned papers reviewed so far it is very apparent that the treatment of RUC varies to a significant degree in detail. This calls for a systematic framework by which to compare the treatment of RUC. Dora *et al* offer us one starting point for this. They cite a basic paradigm for the risk assessment process devised by the US National Academy of Sciences which incorporates four basic components, namely:

- hazard identification,
- response assessment,
- exposure assessment, and
- risk characterisation.

In the assessment of seismic risk by Rossetto, here we see risk is a function and has of three elements:

- ***hazard assessment*** – the annual probability of different levels of earthquake, seismic hazard cannot be reduced as it is determined by nature;
- ***vulnerability assessment*** – identification and categorisation of buildings into groups and their susceptibility to damage through earthquake activity;
- ***exposure evaluation*** – interpolation of human and economic losses from the predicted damage scenario using occupancy and value data.

There are as we can see commonalities here between the two sets.

There are also well-developed systems of risk analysis to address the threats and exposures and interests involved. Mumford describes one such system advocated by the IPPC (1995) which is widely adopted for pest risk analysis. It incorporates four stages:

- risk awareness,
- risk assessment,
- risk management, and
- risk communications.

These are of generic importance and could be applied across a wide range of disciplines, professions and sectors. This could be the basis of a generic and comparative framework for the analysis of the treatment of RUC. We see here a pattern across the board: risk assessment generally plots the likelihood of frequency of an event or situation on one axis against the severity of the impact of that event on the other axis. Mumford describes the principle of *acceptability of risk* in this context by making reference to a graph that represents these properties (see Section 2.3 in this Working Paper) which is divided into areas of ‘negligible’, ‘justifiable’, and ‘acceptable’ risk, judged against the benefits or costs of prevention or mitigation.

Mumford also introduces us to another aspect of risk reduction. This essentially concerns mechanisms for communicating the codified and verified results of efforts to reduce uncertainty and risk in particular fields, especially those operating in the environment of scientific (as opposed to systemic) uncertainty. There are sophisticated international rules, regulations, standards, and enforcement agencies dedicated to minimising impacts in the fields of agricultural pest control, medicine and public health

for example. There are also instances in seismic engineering where risk assessment is used to inform decisions on building strengthening regulations, design codes and disaster management planning. In the paper contributed by Rossetto she sounds a warning note that ‘newly acquired advice, regulation and standards are nothing without application’ and cites examples where these have been ignored with tragic consequences.

Given the options open for the identification and assessment of risk, what avenues are open to deal with uncertainty in risk? Our examination suggests these basically fall into four categories: elimination, reduction, diversification and acceptance. The classic choice faced by the military to reduce risk is to *eliminate* that source of risk – the enemy. In Stone’s description of that choice and the influence of technology on war over the last 200 years he explained that elimination ceased to be an option in the Cold War nuclear age with the prospect of mutually assured destruction. Ironically in today’s context of climate change, inaction (rather than elimination) may lead to the same destiny with changing weather patterns becoming the principal agents of destruction.

The review of the papers contributed to this Working Paper highlights the fact that the possibilities of reducing uncertainty and risk depend *very much* on context and that therefore the effectiveness of strategies and decisions need to be context-sensitive. This poses important questions regarding the transferability of ‘solutions’ from one context to another, be they (the contexts) cultural, geographical or sectoral. Epistemic uncertainty can in theory be reduced by the application of resources to further investigations in the anticipation that this will add to the body of knowledge as a basis for taking more effective action. This is particularly revealed in the papers from Dora et al, Mumford, and Rossetto. Each of the fields they work in relies to a large extent on scientific evidence and place great emphasis on research and the communication of those results. In the realms of complexity, adherents to Complexity Theory refute the value of an evidence-based response to problems. They argue that the results obtained from these exercises are largely *not* repeatable. This same observation, in the context of war, was made by Clausewitz two centuries ago long before the formalisation of Complexity Theory. Where do these conflicting conclusions take us? Is context everything, and generic practice in the treatment of RUC ill advised? Or (more likely) are we insufficiently informed as to which contexts apply to these very different conclusions?

One of the fundamental principles of insurance is that of spreading risk, known in the industry as ‘diversification’ (see Section 2.4 of this Working Paper). According to Gibson it is the principle of diversification which allows insurance to exist – and that this is informed through the gathering together of large numbers of disparate risks to become an attractive investment proposition to both insurer and the insured who wish to transfer risk at a price. We also see this to in the field of project finance in banking where the risk is spread amongst different stakeholders and limits are set on the proportion of any individual financial stake in a project. This tactic limits the liability in the event of a disaster, so constraining the benefit from any runaway success, though the latter is invariably less likely (see Sparrow’s contribution in Section 2.9 of this Working Paper). Ironically the tactic of diversification has been so widely applied in the banking sector with hugely complicated global networks of deals that it now threatens the very stability of the world’s economy as we write. The crises triggered by sub-prime mortgages (originating from the USA) has revealed a complexity in the system with

dynamics that no single person or organisation is able to map, such that the vital attribute of trust between many financial institutions has been eroded if not destroyed. The knock-on effects – reverberating globally – have virus-like features more akin to contagious diseases than anything else. This is reinforced by the work of Snowden, Batty and Sparrow who see complex adaptive systems with features akin to organisms and ecological systems as a better basis for understanding organisations, cities and regions, and their infrastructure than the mechanistic perceptions more typically employed. This returns us to the question of the value of analogies experiences, models and phenomena, and their transferability, from one discipline, profession and sector (context) to another.

A legitimate response illustrated by Mumford in the treatment of risk in the agricultural domain (see Section 2.6 in this Working Paper) is the *acceptance of risk* where its nature and scale is well understood and where the benefits of accepting that risk significantly outweigh any costs that might be incurred in safeguarding society against it. This principle and its representation we contend is generically useful.

Sparrow (see Section 2.9 of this Working Paper) does not engage in explicit discussions of risk and uncertainty, and only obliquely refers to complexity. Yet, the whole of his intriguing discussion is implicitly either about the treatment of RUC (albeit in large organisations) by different personality types or has ramifications on the treatment of RUC by these categories of persons.

Sparrow explains that there has been considerable research into the cognitive styles of people who rise in large organisations, and the types which thrive. For purposes of discussion, he argues that the many types that are found can be collapsed into the *Hedgehog* and *Fox* personality types. The former are happiest in a closed problem domain, in which standard tools and focused effort allow them to compete with their peers. The latter, 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. They tend to be the greater risk-takers. Groups of Hedgehogs, Sparrow claims ‘constitute wonderful engines by which to deliver against unambiguous tasks and tight deadlines’. Groups of Foxes, on the other hand, ‘neither enjoy such tasks nor perform well at them.’ Hedgehogs are often baffled, and perform worse when asked to extend the borders of their current activities, to predict events and to mitigate new sources of risk while Foxes excel at such tasks.

The core concern of Sparrow’s contribution are ways of improving decision-making or as he puts it ‘avoiding mistakes’. He asserts that failure is the norm and that success is rare in any risk-based business activity. His thesis is that business organisations (especially large ones) need to become more like organisms: to develop in-built drives and to create the capacity to generate synoptic use of the current situation in order to avoid mistakes. He argues that the ability to take ‘informed decisions’ requires the three following forms of activity to generate this synoptic view:

- model creation,
- value definition, and
- option identification (abbreviated to MVO).

According to Sparrow, aware organisms handle MVO together as a seamless whole, while organisations can *only* do so with great effort. He maintains that this effort is needed in order to remove sources of error in decisions and decision-making.

Furthermore, he makes a distinction between the concept of 'ideation' and operations, where ideation is the process by which model creation, value definition, and option identification is derived. While Sparrow does not make this explicit, the process and ideation and the generation of MVO is an approach that maximises the coherence and consistency of organisation behaviour and which therefore reduces uncertainty. The aim of the model is to represent the level of understanding of the environment. This suggests that the exercise by which it is developed itself reduces uncertainty; this being done by gathering and interpreting information. Defining a set of shared values then peels away yet another layer of uncertainty relating to internal behaviour. Option identification on the other hand increases the awareness of the organisation to future possibilities, and therefore reduces the level of uncertainty. Collectively they make inroads into the overall reduction of uncertainty and risk.

Sparrow refers to 'the leaf caught in the stream'. This is an analogy where the subject has no control in the face of external environmental forces and finds a parallel in the concept of 'friction' coined by Clausewitz. The buffeting by external disturbances generates uncertainty and risk however, efforts to research and understand those disturbances will reduce their power to deflect strategies.

Currall's analysis of trust in decision-making (also drawn from the corporate world) can be applied to persons, groups and organisations (i.e., different contexts and levels of contexts) because all three make trust decisions and show measurable actions that follow from such decisions. This conceptualisation is scaleable from the inter-personal to the inter-group, to the inter-organisational level. Put in Currall and Inkpen words: 'under a condition of risk, a person's, group's, or organisation's trust is signified by a decision to engage in action that allows its fate to be determined by another person, group or organisation' thereby distinguishing between the 'trustor' (the party that does the trusting), and the 'trustee' (the party that is trusted).

Currall and Inkpen have developed an interesting model of trust which operates from a baseline of inter-personal dynamics which they claim is valid and scalable to groups, firms, and beyond. As already implied, central to their conceptualisation is the interplay of inter-personal, inter-group and inter-organisational trust, especially during the developing trust phase. Inter-personal trust between leaders from two organisations may serve as the organisational context for the development of trust between groups or trust between organisations. Conversely, a historical context of trust and partnerships between two organisations may foster the emergence of trust between groups of managers representing their respective organisations or inter-personal trust between two managers from the two firms. This reciprocal interplay of trust over time is what they term the 'co-evolution of trust'. Here trust at one level will evolve over time and, in so doing, will serve as the organisational context for trust dynamics at other levels. Fundamental to this is the idea of 'reciprocity' of relations among inter-personal, inter-group and inter-organisational trust. Conversely, discrepancies can exist between inter-personal trust and inter-organisational trust within a collaborative venture because trust between partner organisations' managers may be strong while the trust between partner firms is weak.

Many factors then determine the movement of trust across levels. Currall & Inkpen assert that trust changes with evidence in favour of, or against, further trust. Trust will therefore move, or fail to move, from one level to another based on evidence regarding the trustworthiness of a trustee person, group, or organisation. This is what makes trust a dynamic construct. It is not static because there is a constant flow of trust-

related evidence based on a counterpart's behaviour that leads the opposite number constantly to update and recalibrate their assessment of the trustworthiness of the trustee.

At the outset of the discussion about trust it was explained that it is a means by which the parties involved seek to reduce their individual risks. However, because risk can be one-way, two-way or multi-directional, it hinges on which party or parties stand to lose if the inherent reliance proves ill founded. In practice we can see that although the purpose of trust is to reduce risk through a collaborative exercise it may trade one set of risks for another given the dynamics of trust.

Conclusions and lessons

In this review we have seen that the interpretation of RUC terminology varies. We take forward the distinction that uncertainty can be divided into the scientific and the systemic, with further sub-division into variability and imperfect knowledge.

There is in addition a widespread view that risk is a function of frequency (or probability) of an event and the magnitude of that threat or hazard. Those operating in the domain of scientific invariably and legitimately seek to quantify that risk, while those operating amidst systemic uncertainty may do so but with limited reliability, and veer towards more notional representations. We have encountered the important concept of ambiguity in a decision context where stakeholders value outcomes differently.

The examination has led us to devise and propose a typology of motivational context where we are able to better match examples of the treatment of RUC against those categories, as follows:

- **combative**: eliminate opposing forces, exert overwhelming threat, enhance threat to opponent through alliances;
- **competitive**: acquisition, take-over, market forces, market intelligence, scenarios, ideation; and
- **collaborative**: joint ventures, consortia, diversification, knowledge transfer, trust;
- **mitigative**: increase evidence base, codify knowledge, apply lessons through regulation.

We offer the above as a very provisional framework for the treatment of RUC, recognising that corporate organisations tend not to operate exclusively in one category (competitive), military in another (combative), government agencies in yet another (collaborative) and seismic engineers in another (mitigative). Having said this, there are mixes. Even in the combative realm there are elements of collaboration (through alliances and coalition arrangements); while those with a primarily mitigative orientation will collaborate on the free exchange of information. Clearly these ideas and proposals constitute only a start in the development of a framework of sense-making contexts and their features.

References

- Courtney, H., Kirkland, J. and Viguerie, P. (1999) 'Strategy Under Uncertainty', in Harvard Business Review on 'Managing Uncertainty'. Harvard Business School Press, Cambridge, MA.
- Currall S. and A.C. Inkpen, (2006) 'On the Complexity of Organisational Trust: A multi-level co-evolutionary perspectives and guidelines for future research' in *Handbook of Trust* edited by B. Reinhard and A. Zaheer, Edward Elgar, Cheltenham
- IPPC (1995) ISPM2 International Standards for Phytosanitary Measures. Guidelines for Pest Risk Analysis, FAO, Rome, Italy.
- Johns, G. (2001), 'In praise of context', *Journal of Organizational Behavior*, 22, 31–42
- Quinn, J.B. (1995) 'Strategies for Change: some useful definitions', in *The Strategy Process*, by H. Mintzberg, J.B. Quinn and S. Ghoshal. London: Prentice Hall.
- Von Clausewitz, C. (2004) *On War* (tr. Colonel J.J. Graham). NY: Barnes & Noble, pp. 1–19.

