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Cont.

UPENET (UPGRADE European NETwork)

CEPIS NEWS

The application of the 'New Sciences' to Risk and Project Management[1]

David Hancock

The type of problems that need to be solved in organizations are very variable in terms of their complexity ranging from 'tame' problems to 'wicked messes'. We state that projects tend to have the characteristics of wicked messes where decision making gets confused by behavioural and dynamic complexities which coexist and interact. To address the situation we cannot continue to rely on sequential resolution processes, quantitative assessments and simple qualitative estimates. We propose instead to develop the concept of risk leadership which is intended to capture the activities and knowledge necessary for project managers to accommodate the disorder and unpredictability inherent in project environments through flexible practices leading to negotiated solutions.

Keywords: Behavioural Complexities, Chaotic Systems, Dynamic Complexities, Quantitative Assessments, Qualitative Estimates, Risk Leadership, Risk Management, Scientific Management, Tame Problems, Wicked Problems.

"We're better at predicting events at the edge of the galaxy or inside the nucleus of an atom than whether it'll rain on auntie's garden party three Sundays from now. Because the problem turns out to be different. We can't even predict the next drip from a dripping tap when it gets irregular. It's the best possible time to be alive, when almost everything you thought you knew is wrong."

"Arcadia" by Tom Stoppard

Introduction

There is a feeling amongst some risk practitioners, myself included, that theoretical risk management has strayed from our intuition of the world of project management. Historically, project risk management has developed from the numerical disciplines dominated by a preoccupation with statistics (Insurance, accountancy, engineering etc.) This has led to a bias towards the numerical in the world of project management.

In the 1950's a new type of scientific management was emerging, that of project management. This consisted of the development of formal tools and techniques to help manage large complex projects that were considered uncertain or risky. It was dominated by the construction and engineering industries with companies such as Du Pont developing Critical Path Analysis (CPA) and RAND Corp developing Programme Evaluation and Review Technique (PERT) techniques. Following on the heels of these early project management techniques, institutions began to be formed in the 1970's as repositories for these developing methodologies. In 1969 the American Project Management Institute (PMI) was founded; in 2009 the organization has more than 420,000 members, with 250 chapters in more than 171 countries. It was followed in 1975 by the UK Association of Project Managers (changed to Association for Project Management in 1999) with its own set of methodologies. In order to explicitly capture and codify the processes by which they believed projects should be managed, they developed qualifications and guidelines to support them. However, whilst the worlds of physics, mathematics, economics and science have moved on beyond Newtonian methods to a more behavioural understanding, the so called ***new sciences***, led by eminent scholars in the field such as Einstein, Lorenz and Feynman. Project and risk management appears largely to have remained stuck to the principles of the 1950's.

Author

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Box 1: The Butterfly Effect

In 1961 whilst working on long range weather prediction, Edward Lorenz made a startling discovery. Whilst working on a particular weather run rather than starting the second run from the beginning he started it part way through using the figures from the first run. This should have produced an identical run but he found that it started to diverge rapidly until after a few months it bore no resemblance to the first run. At first he thought he had entered the numbers in error. However this turned out to be far from the case, what he had actually done was round the figures and instead of using the output of 6 decimal places had used only three (.506 instead of .506127). The difference one part in a thousand he had considered inconsequential especially as a weather satellite being able to read to this level of accuracy is considered quite unusual. This slight difference had caused a massive difference in the resulting end point. This gave rise to the idea that a butterfly could produce small undetectable changes in pressure which would considered in the model and this difference could result in altering the path, delaying or stopping of a tornado over time.

Edward N Lorenz . 1972 Predictability: Does the Flap of a Butterfly's Wings in Brazil Set Off a Tornado in Texas?

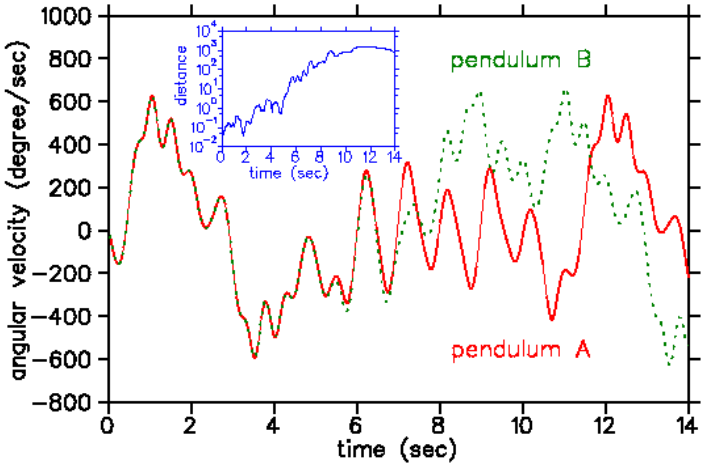

Figure: Two pendulums with an initial starting difference of only 1 arcsec (1/3600 of a degree).

Table 1: The implications of the New Concept of Risk Leadership.

Risk Management

The general perception amongst most project and risk managers that we can somehow control the future is, in my opinion, one of the most ill-conceived in risk management. However, we have made at least two advances in the right direction. Firstly, we now have a better understanding about the likelihood of unpleasant surprises and, more importantly, we are learning how to recognise their occurrence early on and subsequently to manage the consequences when they do occur.

Qualitative and Quantitative Risk

The biggest problem facing us is how to measure all these risks in terms of their potential likelihood, their possible consequences, their correlation and the public's perception of them. Most organisations measure different risks using different tools. They use engineering estimates for property exposures, leading to MFLs (maximum foreseeable loss) and PMLs (probable maximum loss). Actuarial projections are employed for expected loss levels where sufficient loss data is available. Scenario analyses and

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> “To address the situation we cannot continue to rely on sequential resolution processes, quantitative assessments and simple qualitative estimates”

Monte Carlo simulations are used when data is thin, especially to answer how much should I apply questions. Probabilistic and quantitative risk assessments are used for toxicity estimates for drugs and chemicals, and to support public policy decisions. For political risks, managers rely on qualitative analyses of ‘experts’. When it comes to financial risks (credit, currency, interest rate and market), we are inundated with Greek letters (betas, thetas, and so on) and complex econometric models that are comprehensible only to the trained and initiated. The quantitative tools are often too abstract for laymen, whereas the qualitative tools lack mathematical rigour. Organisations need a combination of both tools, so that they can deliver sensible and practical assessments of their risks to their stakeholders. Finally it is important to remember that the result of quantitative risk assessment development should be continuously checked against one’s own intuition about what constitutes reasonable qualitative behaviour. When such a check reveals disagreement, then the following possibilities must be considered:

1. A mistake has been made in the formal mathematical development;
2. The starting assumptions are incorrect and/or constitute too drastic oversimplification;
3. One’s own intuition about the field is inadequately developed;
4. A penetrating new principle has been discovered.

Tame Messes and Wicked Problems

One of the first areas to be investigated is whether our current single classification of projects is a correct assumption. The general view at present appears to treat them as linear, deterministic predictable systems, where a complex system or problem can be reduced into simple forms for the purpose of analysis. It is then believed that the analysis of those individual parts will give an accurate insight into the working of the whole system. The strongly held feeling that science will explain everything. The use of Gant charts with their critical paths and quantitative risk models with their corresponding risk correlations would support this view. However this type of problem which can be termed ***tame*** appears to be the only part of the story when it comes to defining our projects.

Tame problems are problems which have straight-forward simple linear causal relationships and can be solved by analytical methods, sometimes called the cascade or waterfall method. Here lessons can be learnt from past events and behaviours and applied to future problems, so that best practices and procedures can be identified. In contrast **‘messes’** have high levels of system complexity and are clusters of interrelated or interdependent problems. Here the elements of the system are normally simple, where the complexity lies in the nature of the interaction of its elements. The principle characteristic of which is that they cannot be solved in isolation but need to be considered holistically. Here the solutions lie in the realm of systems thinking. Project management has introduced the concepts of Programme and Portfolio management to attempt to deal with this type of complexity and address the issues of interdependencies. Using strategies for dealing with messes is fine as long as most of us share an overriding social theory or social ethic; if we don’t we face ‘wickedness’. **Wicked** problems are termed as ‘divergent’, as opposed to ‘convergent’ problems. Wicked problems are characterised by high levels of behavioural complexity. What confuses real decision-making is that behavioural and dynamic complexities co-exist and interact in what we call wicked messes. Dynamic complexity requires high level conceptual and systems thinking skills; behavioural complexity requires high levels of relationship and facilitative skills. The fact that problems cannot be solved in isolation from one another makes it even more difficult to deal with people’s differing assumptions and values; people who think differently must learn about and create a common reality, one which none of them initially understands adequately. The main thrust to the resolution of these types of problems is stakeholder participation and ‘satisficing’. Many risk planning and forecasting exercises are still being undertaken on the basis of tame problems that assume the variables on which they are based are few, that they are fully understood and able to be controlled. However uncertainties in the economy, politics and society have become so great as to render counterproductive, if not futile, this kind of risk management that many projects and organisations still practise.

> “We propose instead to develop the concept of risk leadership which is intended to capture the required activities and knowledge”

> “Project managers must accommodate the disorder and unpredictability inherent in project environments through flexible practices leading to negotiated solutions”

Chaos and Projects

At best I believe projects should be considered as deterministic chaotic systems rather than tame problems. Here I am not using the term Chaos as defined in the English language which tends to be associated with absolute randomness and anarchy (Oxford English Dictionary describes chaos as "complete disorder and confusion") but based on the Chaos theory developed in the 1960’s. This theory showed that systems which have a degree of feedback incorporated in them, that tiny differences in input could produce overwhelming differences in output. (The so called Butterfly effect see Box 1[1]). Here chaos is defined as aperiodic (never repeating twice) banded dynamics (a finite range) of a deterministic system (definite rules) that is sensitive on initial conditions. This appears to describe projects much better than the linear deterministic and predictable view. In which both randomness and order could exist simultaneously within those systems. The characteristics of these types of problem are that they are not held in equilibrium either amongst its parts or with its environment but are far from being held in equilibrium and the system operates ‘at the edge of chaos’ where small changes in input can cause the project to either settle into a pattern or just as easily veer into total discord. For those who are sceptical consider the failing project that receives new leadership it can just as easily move into abject failure as settle into successful delivery and at the outset we cannot predict with any certainty which one will prevail. At worst they are wicked messes.

Conclusion

How should the project and risk professional exist in this world of future uncertainly? Not by returning to a reliance on quantitative assessments and statistics where none exists. We need to embrace its complexities and understand the type of problem we face before deploying our armoury of tools and techniques to uncover a solution, be they the application of quantitative data or qualitative estimates. To address risk in the future tense we need to develop the concept of **‘risk leadership’** which consists of:

- Guiding rather than prescribing
- Adapting rather than formalising
- Learning to live with complexity rather than simplifying
- Inclusion rather than exclusion
- Leading rather than managing
- The implications of the new concept of risk leadership are described in Table 1.

What does this all mean? At the least it means we must apply a new approach for project and risk management for problems which are not tame. That we should look to enhance our understanding of the behavioural aspects of the profession and move away from a blind application of process and generic standards towards an informed implementation of guidance. That project and risk management is more of an art than a science and that this truly is the best time to be alive and being in project and risk management.

References

[1] J. Gleick. Chaos: Making A New Science. Penguin, 1987.

