

The Sage Handbook of Complexity and Management

Edited by Peter Allen, Steve Maguire & Bill McKelvey

Sage Publications (2011) Reviewed by Jean Boulton

ISBN: 978-1847875696

Theme of the Book

The first substantive scholarly work to provide a map of the state-of-the-art research in the growing field emerging at the intersection of complexity science and management studies. Edited and written by internationally-respected scholars from management and related disciplines, the Handbook is a reference source for understanding the implications of complexity science for management research and practice. The book is not primarily aimed at practitioners but offers the opportunity to browse, to get a feel for the thinking in this field, to pick up snippets and new perspectives, to be challenged and provoked.

Contents

Part One Foundations: introduces complexity science and its implications for the foundations of scientific knowledge, including management knowledge.

Part Two Applications: presents examples of how models, tools and thinking from complexity science are being applied to management and organizational issues.



Part Three Interfaces: highlights how complexity science is transforming various non-management fields and, in so doing, creating exciting interfaces between management and related disciplines.

Key Points

- Organisations are complex – emergent, evolutionary, systemic and contingent on the detailed history of decisions and actions.
- Complexity theory provides a new scientific perspective on what it means to say the world – and organisations - are complex.
- It brings into question the efficacy of prediction and control and changes emphasis when it comes to strategy, leadership and change – more participation, greater focus on the potential for shifts into new regimes with new features, on uncertainty and the need for a diversity of approach.
- The handbook presents multiple perspectives, worthy of browsing to gain an overview of current interests and thinking.
- The editorial provides a comprehensive overview of complexity thinking and its history and features many leading thinkers.
- The need for more research into practice to explore complexity in action is highlighted.



Introduction

The Handbook comprises 36 chapters and spans 650 pages. It covers a very wide range of issues centred on the application of complexity theory to management practice and is a tour de force. The editors have deliberately not attempted to present a single story, a coherent version of what *is* complexity theory and what it means for organisations and management; the book incorporates many perspectives. Many chapters are theoretical – suggesting in principle what complexity theory might mean for organisations, rather than empirical – describing research into practice.

Some chapters consider particular issues – innovation, strategy, organisational learning and economics. Other chapters are more philosophical and consider the nature of complexity itself.

Before providing some more detailed examples and giving a flavour of the Handbook, it is helpful to summarise, from the perspective of the author of this summary, what complexity theory *is* and how it applies to management thinking. In some places, quotes from the book further elucidate the descriptions.

What is complexity theory?

Complexity theory provides a scientific theory of open systems. A *system* conveys the notion of a group of interacting elements and an *open system* can exchange information and energy with its environment.

The argument is that complexity theory is relevant for managers of organisations because an organisation can be considered as an example of such a complex system



– a bunch of people in contact, relating and inter-relating, and who are also, collectively and individually, in contact with the wider world.

How and what do we know about the behaviour of complex systems? The main approach to gaining insight into open complex systems is through mathematical modelling and such modelling has provided various and varying perspectives as to how such systems behave.

Whilst not every sort of model leads to the same conclusions, there are certain key features on which there is general agreement. So complexity theorists would agree that complex systems are:

- **Organic**
 - Complex systems have more in common with ecosystems, with evolving organisms than with machines; they are not in general predictable or programmable. As the editors say (p19) *Complexity science confirms that our world is not one resembling a machine set in motion at the beginning of time and changing deterministically in an event-free manner since. Rather, it more resembles an ecosystem or organism in the process of developing.*
- **Self-organising patterns of relationships**
 - Complex systems often display patterns or structures which can be relatively stable but still display some variation and fluctuating behaviour and may indeed evolve, eventually, into some new patterns.
- **Path dependent**
 - The future depends on the *detail* of what happens, does not smoothly follow from the past. (p21) *Knowledge of the future in the form of accurate predictions does not exist in the present awaiting discovery through human cleverness or the raw application of computational power. Rather multiple possible futures exist.*
 -



- **Affected by multiple causes**
 - In general there are not simple cause-and-effect chains; outcomes are influenced by several factors acting together – affected by chance, impacted by many local interactions acting together, constrained by current patterns of relationships, shaped by the past and sensitive to occurrences in the wider environment.
- **Non-linear, leading to change being spasmodic**
 - Sometimes current patterns are very resilient, sometimes change can be fast and radical
- **Emergent**
 - Change can lead to the emergence of features qualitatively different from the past. *This new scientific approach...accepts and anticipates the appearance of qualitatively new features and the disappearance of old ones (p3).*

How is this relevant to managers

What does that mean for managerial processes such as strategy development and leadership? Some perspectives on this question are sketched below.

Limitations of strategy development

If an organisation displays these features of a complex system, then managers are presented with a scientific justification as to why strategies – both market and change strategies - however well-researched and conceived and implemented, may not achieve what was planned. Although there is no suggestion that the future is random, the future is affected by many interacting factors. What happens next depends in part on the *detail* of what happens and on how behaviours and actions – both internal and external - work together. The future may not just be a little different from what was expected, it may be radically different.



As the editors say (p2) *The new vision afforded by complexity science forces us to confront the idea that managerial and organizational knowledge pertaining to actions and policies in evolved – and evolving – social systems is necessarily limited and incomplete instead of being based on objective truth about eternal natural laws governing unchanging systems.*

Complexity thinking positions strategy development as more provisional and encourages experimentation and taking a portfolio approach. Actions are experiments which (p19) *explicitly recognize opportunities for learning which flow from distributed judgements and yield knowledge which is contingent and provisional.* It places focus on fore-sighting, on scenario planning – scanning the horizon for signs of impending change, for innovations or shocks or new entrants that have the potential to reshape the market. And it re-affirms the importance of ‘managing by walking about’ – there may be unexpected successes emerging that were not intended but can usefully be nurtured; there may be a need to connect up people and resources and facilitate synergies and there may be a need to change direction if the current intentions are just not working out. So strategy development and strategy implementation become much more closely entwined.

Leadership

Complexity thinking shows the limits to top-down management. If there is not a simple relationship between input and output, and if the current patterning of relationships holds sway, the leaders must in part ‘nudge’ and encourage and facilitate what works rather than seek to impose what to do and how to do it. That is not to say that clarity of intention and direction are not vital ingredients but how such intentions are implemented may need to be more provisional and more sensitive to context and to the potential for change. Leadership may be more effective if it is more distributed, where learning is shared, where intentions are woven together by bringing together many perspectives rather than imposing a view from above. And, from a psychological viewpoint, leaders in complex contexts must be able to handle ambiguity and make judgments when the ‘facts’ are unclear; it is impossible to analyse ‘unknown unknowns’ in a world that is changing fast and in qualitative ways.



As the editors say (p3), *both the dream of omnipotence and the nightmare of impotence in a fully knowable but deterministic world dissolve with complexity science. And they continue (p19) in a complex world, hubris can lead to disaster.*

Multiple perspectives

Although the *key* features of complex systems (as described above in the section 'what is a complex system') would be agreed upon by most if not all complexity thinkers, this is not the case when it comes to more detailed concepts, where there are many perspectives. Why is this?

There are two reasons, perhaps, for the differing perspectives between academics in this field of complexity. The first is that our understanding of complex systems is based, in the main, on mathematical models, and models inevitably must simplify real situations. Depending on the *nature* of those simplifications, different conclusions can be reached. As Maguire says, it is unavoidable that (p87) *defining and understanding what constitutes complexity involves defining and understanding what constitutes information within and about a system which raises the question as to whose perspective, ontology and assumptions get to dominate, an obviously political matter.*

So in the Handbook the reader will find, variously, mention of fractals, sensitivity to initial conditions, use of simple rules, the notion of the edge of chaos, and talk of power laws. These are precise concepts emanating from particular (and different) classes of assumptions. Other authors are less inclined towards embracing these concepts and prefer to focus on a more general representation of complexity as already described. Cilliers, for example, points to the limitations of so-called restricted complexity, the understanding that comes from reductive approaches to modelling, which, as he says (p144) assume *if you work hard enough, you can uncover the structure of the system.* He says, (p143): *if one is concerned with*



complex (social) phenomena which are volatile, self-reflexive, adaptive and where boundaries are ill-defined, restricted complexity is less useful.

The second reason that there are differing perspectives is that models are not reality and thus how different authors choose to interpret the models and complexity concepts and consider what they mean for practice leads to a second level of difference of opinion. We move into the realm of metaphor.

Two examples

As a way to illustrate how the handbook sheds light on such matters, let us consider two examples of detailed concepts that lead to differing opinions as to their usefulness; these are the idea of 'simple rules' and an exploration of the 'edge of chaos'.

Simple rules

Some complexity theorists have adopted the idea of 'simple rules'. A classic example of simple rules in action is of flocking birds; from three rules regarding separation, direction and cohesion in respect of the behaviour of neighbouring birds, the flock (in computer simulations on 'boids' undertaken in 1987) can keep together, respond to environmental changes and keep heading forwards.

The questions that arise, though, are whether this concept is of general validity, whether it is appropriate for organisations and, if it is, what it suggest you do in managing organisations.

With respect to the first question, Hodgson says (p590) *Stephen Wolfram (2002) argues that complex phenomena can be generated by simple, algorithmic rules... A danger here is the conflation of reality with a computer simulation. Simple algorithms can give rise to complex outcomes but that does not mean that the complexity we find in reality has an equivalent and equally simple outcome.*



With respect to organisations, Eoyang (p322) explains that the metaphor [of simple rules] has been evoked to suggest ways to gain alignment during organizational change without over-constraining individual actors. Eisenhardt (p511) seems very clear of the validity of this method. She asserts that the *'strategy of simple rules'* is *central to the complexity perspective... [and] proposes simple rules to guide autonomously-acting BUs such that each BU agent acts according to some schemata or rules. These rules guide behaviour in the absence of central coordination.* Eoyang provides a more critical perspective. She (p322) points out that *simple rules have also been critiqued as inappropriate in describing self-organizing phenomena in human systems* and tells us that two arguments stand out. *The first involves free will: rules do not constrain the actions of people. The second involves specificity: rules that are general enough to apply to all are devoid of local or individual significance.*

The editors, too, add a view which seems to challenge the adoption of simple rules (p19). They say *humans and their organizations are guided by imperfect schemata that are revised as a consequence of experience, leading to changed behaviours and innovations.*

So, it seems there is no simple rule about simple rules!

Empirical work: the 'edge of chaos'

Another example where differing perspectives are presented in the handbook centres on the idea of organizations 'at the edge of chaos'. This is explored in detail by Maclean and MacIntosh (pages 235-254) in one of the few chapters in the book to report on research work undertaken in organisations, to test theory against practice. What is the edge of chaos? Chris Langton, in 1990, using a form of modelling based on cellular automata, found a phase transition (like the change between water and steam). This idea was very exciting at the time and gained traction.



But how is the idea viewed more latterly? Goldstein (p69) says: *too many proponents have mistakenly argued that emergence is more likely to take place in what is believed to be a particularly 'pregnant' zonetermed the 'edge of chaos'*. Goldstein explains that this notion was taken up by Kaufmann (1995:25-28) who said *'the best exploration of an evolutionary space occurs at a kind of phase transition between order and disorder... as if by an invisible hand, the system may tune itself to the posed edge of chaos'*. Maclean and MacIntosh (p236) further tell us that: *organizations 'on the edge of chaos' are attributed with the ability to exhibit spontaneous, prolific, complex and continuous change.*

How, if there is one, do you reach the edge of chaos? Maclean and MacIntosh build on Pascale's (1999) work, who describes the managerial processes to get to this edge as (p249) *'decentralising, encouraging the use of small teams and introducing stress through increased transparency and increased contact between senior managers and front-line staff.* They believe, however, that (p237) *much of the advice offered in the literature to date [about how to reach the edge of chaos] is misleading, self-contradictory, ineffective and counter-productive.*

Maclean and MacIntosh justify their criticisms through undertaking research with eighteen organisations to find out whether these organisations achieved an existence on the 'edge of chaos'. Maclean and MacIntosh found in their research that not all organisations that adopted the suggested practices did produce the self-organising processes that were anticipated.

They found that (p249) *some organisations can operate whilst positioned between a stable structured state and one of total randomness....but that such a position requires constant management vigilance to avoid slipping into pure chaos or pure structure.* In fact they found that only two out of their sample achieved it. They also concluded that (p250) *there was no evidence that the adoption of these practices improved the performance of the company.*



Maclean and MacIntosh's work helpfully raises many questions. First, is there such a thing as an 'edge of chaos'? Second, if it exists, how do you get there? Third, if you get there, does being there improve organisational performance?

Conclusion

Complexity thinking has a very important contribution to make to the world of management. Acting as if the world is measurable, controllable and predictable when it is not does not make it so. And yet neither is the world chaotic and random; there are patterns of relationships such as market dynamics and patterns in demography and economic behaviour. The issue of judgement is about how stable and universal are such patterns, how we anticipate impending change and how we respond to emerging futures that may have many different features that the past.

Complexity thinking does not throw away every management practice, but it does change our attitude to their likely success and to the relative emphasis on focusing on stability rather than handling uncertainty, novelty and change.

The handbook provides a wide-ranging overview of the principles of complexity thinking. It also brings attention to the fact that some specific concepts, like the edge of chaos, which are not general features of complexity thinking, but are derived from very unique and particular mathematical models, cannot just be taken into practice without some sound empirical evidence that they both exist and are beneficial. And it raises the need for a greater focus on empirical research so that managers and others gain confidence and understanding as to what is implied by the idea that the world is complex.



About the Editors

Peter Allen is Emeritus Professor at the Complex Systems Research Centre at Cranfield School of Management, Co-Editor-in-Chief of *Emergence: Complexity and Organization*, Director and Co-Founder of The Complexity Society. Professor Allen has worked for 25 years on the mathematical modelling of change and innovation in urban, social, economic, financial and ecological systems. He has written and edited several books and published well over 200 articles in a range of fields including ecology, social science, urban and regional science, economics, systems theory, and physics.

Steve Maguire is Associate Professor of Strategy and Organization in the Faculty of Management at McGill University. He recently completed a comprehensive review (with Prof Bill McKelvey and others) of the field of "Complexity Science and Organization Studies" for the 2006 second edition of the *Handbook of Organization Studies*.

Bill McKelvey received his Ph.D. from MIT in 1967 and is currently Professor of Strategic Organizing and Complexity Science at the UCLA. His book, *Organizational Systematics* (1982) remains the definitive treatment of organizational evolution and taxonomy. In 1997 he became Director of the Center for Rescuing Strategy and Organization Science (SOS). He was a founder of UCLA's Center for Human Complex Systems & Computational Social Science.