

# Systems Thinking and Complex Problems in a Volatile, Uncertain, Complex and Ambiguous (VUCA) World

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Updated February 2019

## 1. An introduction to complex systems thinking

### The world as machine

Do things *always* go to plan? Do things *often* go to plan? Do things *ever* go to plan? What do you do when detailed planning is not enough, cannot stretch over uncertainty and cannot address the complexity of many of the issues we face in working and living in the volatile and messy and sometimes fast-changing 'real' world?

How do you deal with 'wicked problems':

- that have seemingly conflicting goals
- where we need to balance short-term wins with the need for long-term sustainability
- where there is incomplete information and uncertainty and ambiguity
- where cause-and-effect links are unclear and have many interconnected strands
- that reside in volatile or changing or complex contexts?

Part of the problem we face is caused by ways of thinking, mindsets that come from traditional science and have been transferred to the social and natural world. We are encouraged to plan and to act as if things operate like a machine – predictable, measurable and controllable. The belief is, that if we:

- undertake detailed analysis,
- design clear organisational structures,
- clarify logical plans setting out inputs and consequent outputs,
- and establish best practice ways of working,

then we will have an efficient and effective organisational machine with all elements playing their part to achieve established and well-researched goals.

Although we are aware that the world, our markets and economies and indeed our organisations do not really work in such a programmable and predictable way, we are concerned that, if we do not keep a tight grip, things will spiral out of control, people will do their own thing, we will have chaos. There is a sense that, to be scientific and professional, we have to construct clear and detailed plans and budgets and structures and processes and show that we believe that they will succeed and achieve their intended outcomes. And part of this demonstration of faith in our plans and processes can mean that we continue to implement them even when we know they are no longer fit for purpose, or we hide the ways

in which we 'bend the rules' and take other 'below the radar' action in order to be effective in the real and changing and complex reality which we encounter.

### **The world as organism**

This 'machine' view of the world is rooted in the physics of Newton and explains the behaviour of closed systems – groups of objects which can be treated as if they do not interact with the wider world. The solar system and a table of billiard balls are examples of such systems. But is this a good model of the social world? There has been a further development in science, the science of open systems – systems whose essential nature comes from interacting with the world around them – and this is called complex systems science. This science shows that human and natural systems function much more like organisms (such as trees or ecologies on a pond) than like machines. They show form or structure, but this is subject to change; there are classifications (such as oak trees or birch trees) but no one (tree) is quite the same as another.

### **How do complex systems behave?**

Complex systems display the following behaviours:

- The different aspects of the system interact *systemically* and *synergistically* –that is, we cannot understand outcomes by analysing things independently, by reducing things to independent building blocks as we could in analysing a machine. It is the mutually reinforcing or antagonistic interactions between differing aspects that contribute to outcomes.
- The detail matters; each situation is unique and depends on history and on the particular nature of the context – its geography, the importance of particular people and events and the order in which things happen.
- Change is not smooth and linear but happens in 'fits and starts'; sometimes there is little to see for our efforts, at other times, things change rapidly and/or radically.
- When things 'tip' into new eras new features emerge, which could not have been predicted.

### **An example: our own lives**

We can gain a deeper understanding of this perspective through reflecting on the story of our own lives. If we considered what has contributed to the history of our life to date, we would offer a story unique to each of us. Unlike cogs in a machine, each life is individual and particular to our situation, personality and story. Our story would include our history (the circumstances of our family and upbringing, where in the world we were born, the prevailing economic and political and social conditions). It would include the particular people we met along the way (teachers, partners, opponents), the particular decisions we made, the particular chance events, for good or ill, that came our way. The outcome to date – who we have become and what has happened on the way – is a complex combination of context, chance and choice – all sensitive to the *sequence* in which things happened, and sensitive to the way things combine. There can be vicious circles (if your father dies and you become the only source of income for your siblings when you are twelve, in a region of the world with very fast population growth and poor economic opportunities anyway, you will be very lucky to make any headway out of your social and economic circumstances); or virtuous circles (the very thing that interests you and you are good at (engineering) has many career

opportunities in the region in which you live and your start in life is aided by some business contacts of your father).

These examples are, in one sense, stating obvious truths. The issue is that the past, present and future of an organisation or society are similarly affected by context, choice and chance and yet it can often seem that we ignore this complex reality and prefer to operate as if the future, and the way to achieve our goals, is more certain and open to analysis and decision than it is.

It is important to point out, though, that 'embracing complexity', whilst it *does* bring into question the machine mindset that we can know everything, does *not* suggest that the world is in chaos – i.e. that we can know nothing. Complexity thinking occupies a middle ground between these two positions.

### **Summary – complex systems thinking**

1. Complexity theory is the science of open adaptive systems (like organisations and economies) and emphasises:
  - We can't reduce problems to independent parts, like in a machine – things are systemic and synergistic
  - We have to adapt to different contexts and local conditions
  - The past shapes the present – there is path dependency, where detail and sequence matter
  - Change is not smooth but episodic, often going in 'fits and starts'
  - New factors which could not have been predicted can emerge at tipping points.
2. This is in contrast to our normal view of what is scientific and professional, which arises from a machine mindset.
3. Complexity thinking accords with our personal experience of life.
4. Complexity thinking sits between a machine view (we can know everything) and chaos (we can know nothing).

## **2. What does this mean for how we operate in a complex world?**

### **An approach contingent on context**

The dilemma we face as managers and leaders is that we have to face the tension, the polarity, between efficiency and responsiveness. Efficiency can take us into the machine world of standardisation, adopting best practice, seeking economies of scale and designing and implementing standardised processes and procedures. Responsiveness leads us into taking account of the particularities of context. What are the particular circumstances and history of the region in which we are acting or planning to act? What are the particular characteristics of the team and its leaders? What is the extent of the political and economic

and environmental uncertainty and volatility in the region? What is the stability in the political context out of which we are acting? Too much seeking after efficiency can limit our ability to respond and adapt to local circumstances. Standardisation, in limiting our ability to adapt, to be agile can, paradoxically, mean we are less effective and consequently less efficient. But too much local autonomy can be costly and create duplication and confusion. How do we decide to where the pendulum should swing and in what circumstances? How can we create clarity and yet allow for responsiveness – not just to local conditions but also to what emerges; how can we spot and respond to changes in the context as they occur?

### **How to analyse the VUCA world? Past-present-future and systemic PESTE**

The phrase VUCA has become a shorthand for the idea that the world is both speeding up and becoming more intertwined; it stands for volatile, uncertain, complex and ambiguous. Analysis of this VUCA context or environment is typically undertaken with a PESTE analysis: Political, Economic, Social, Technological, and Environmental. Complex systems thinking changes the way we do this in two ways: first, it emphasises that we need to think more dynamically, analyse things over time. An understanding of the past gives us an understanding of the current context – the cultural norms of the region, the particular histories and geographies that shape how life is lived, how to intervene, how to gain advantage, support or shift the status quo. And, whilst complex systems thinking explains that the past shapes the present, it also reminds us that what emerges in the future may not follow on seamlessly. We also need to ‘foresight’ into the future and look for signs of emerging change – and we need to ‘future proof’ our current operations. Future-proofing need not require huge shifts in approaches and use of resources but thinking about what scenarios may emerge might lead us into making small changes to our plans to either make some of the scenarios less likely, or to make us more ready to adapt if unlikely but problematic scenarios start to emerge.

Secondly, as well as this need to do a dynamic analysis – to review past, present and future – we also need to analyse *systemically*. To give an example, a government is considering whether or not to expand an airport. If we do a PESTE analysis in the normal way, then we would conclude that, from an economic viewpoint this makes sense, as it brings in more wealth into the area. However, from an environmental viewpoint, it does not, as it increases air travel. If we polarise the argument in this way, and feel we have to choose between the two perspectives, then the economic argument typically wins. However, if we think systemically, then we might argue that the expansion of our airport could be used to turn the airport into an exemplar. We could improve air traffic control to reduce the time aircraft spent circling; we could insist on exemplary minimum levels of air pollution and noise that could kickstart the industry into improving standards and so on. In that way, we could improve things from an environmental perspective (and the traffic would only have gone to a neighbouring country if we did not expand our own airport so not really changing the environmental impact) *as well as* boosting the economy *as well as* taking into consideration the social issue of noise. This systemic thinking can lead to win-win, both-and solutions, if we take the time to think in this way.

Such systemic thinking also allows us to spot future critical junctures – points in the future likely to become critical turning points, or so-called ‘tipping points’, which we need to consider now. For example, take the situation in the Yemen in 2016. The Yemen has one of the fastest population growths in the world; over half of its population are under fifteen. It has very low educational levels, little land, increasing frequency and severity of droughts, almost

no industry. Saudi has been sending back migrant workers, there is huge political and sectarian unrest and conflict - and the oil is expected to run out in 2017. Any of these factors separately may not have been too disastrous, but when there is such a vicious circle, when every factor seems to reinforce the negative impact of every other, then this is a crisis indeed and, if the reduction in income from oil does indeed suddenly stop, the likelihood of an enormous meltdown at that time does indeed seem highly likely (and indeed did happen). Such 'foresighting' can help us either to mitigate this probability, or at least be alert to what might happen.

### **The organisation as a system**

Complex systems thinking not only affects how we view the external world of markets and societies and economies but also affects how we think about organisations. An organisation is a system comprising structures, formal processes (such as planning or budgeting), informal processes (such as meetings, and ways to inform or influence people) and culture (the general norms of ways of working, values and things that are prioritised). These differing aspects of an organisation influence and affect each other, can be mutually reinforcing or create confusion, time-wasting and dilution of effort. How this is designed (or grows up over time) and how this works in practice (i.e. where the power really lies) depends on the prevailing mindset. If we believe in the efficiency of the machine, then a centralised organisation may prevail, seeking standardisation and economies of scale. If we believe that to win we have to adapt, then the power may lie closer to the customer (whatever the organisation structure suggests). If we do not address the polarity between these two views, we may end up with a very complicated organisation which is hard to navigate, is confusing and/or needs a great deal of attention on internal processes (rather than focusing on the market and external world) – who and how to influence, how to get around standardised processes, how to get what is best for the local market, or how to drive for state-of-the-art manufacturing technology worldwide. If we are not careful, we end up with the worst of both worlds not the best of both worlds. And this dialogue is not helped by the fact that cost-saving of, say, global purchasing, is relatively straightforward to measure, whilst the cost of time-wasting due to navigating overly complex structures and processes which are trying to balance centralist and decentralist priorities, is not.

So, we need to consider in our organisational design and the way we work with it:

- How to reflect the legacy of the past, both its constraints and its opportunities
- How to balance different and sometimes conflicting foci (cost, service, innovation, flexibility, values)
- How to keep the emerging future in mind, and 'future proof' our approach.

Analysing existing structures and ways of working *systemically* can often lead to new win-win solutions which both ensure sufficient clarity and economy whilst at the same time allowing more flexibility and autonomy to adapt to change and volatility.

### **A complexity view of strategy**

With strategy, having a complexity mindset does not mean we throw away all our existing methods, rather that we use them in a different way, and maybe work with different people. For example, we would continue to clarify aims and objectives, gather intelligence (maybe more widely with complexity in mind as already discussed) and analyse that intelligence to

create strategy. But we would be likely to build in frequent reviews to explore not only whether objectives have been achieved but also what is actually happening on the ground. Are there unintended outcomes, has the context changed, have other players acted differently than we expected, are there successes and opportunities that we did not envisage but suggest a change of tack?

Equally, we need to rethink the scope of strategy. It is hard to conceive of an economic strategy without consideration of an environmental strategy, or a strategy for international development without consideration of a defence strategy. Do we need to broaden our sense of what strategy is, who develops it, and do we need to consider the impact and outcomes more systemically? Strategy in a complex context cannot just imagine simple links between tangible inputs and outputs; rather we have to consider in what ways we would like the whole system to move towards. What combination of nudges, actions, connections, communications and powerful choreographed pushes from strong alliances are needed to shift the whole system? How to embed a connected set of incentives that facilitate the future system that we are aiming towards?

Many approaches to strategy development major on how to develop strategic plans. But we also need to design methods that allow the ongoing gathering of information about progress, and those processes ideally need to involve many stakeholders and people at a variety of levels both within the organisation and outwith it. We need to create ways of feeding back this intelligence that do not get stifled by hierarchy and do not wait until people are so sure of the facts that it becomes too late to act. Giving people permission to report what they see as 'tiny shoots' of change and as qualitative data is important with a worldview which suggests that new features may emerge in ways that are hard to predict analytically and hard, at the beginning, to spot.

Finally, having designed processes for gathering new information and for establishing channels for feedback, we need to create ways to adapt to this information. How can we shift strategic direction in a timely manner and ensure there is a common understanding of such changes? How can we allow the right level of local autonomy whilst ensuring that the general direction of travel is still understood?

So, with complexity in mind, we cannot entirely separate strategy formulation from implementation. The two become interdependent and we need to ensure that the consideration of strategic processes includes these processes of dynamic data-gathering, sense-making, and adaptation. These are not easy processes to design and are even harder to implement in cultures which favour certainty, clarity and reward achievement to plan.

### **Systemic change**

How to try and engender change in a whole system is in itself a complex and interesting question. There are a number of aspects to this. Sometimes we are trying to '*strengthen the system*'. There may, for example, be aspects of an organisational culture which we want to safeguard and bring to the fore, for example a focus on sustainability, or on innovation or customer service. How can we operate to ensure that such behaviours are rewarded and encouraged and don't get lost in a focus on cost-cutting, or rewarding people for displaying other more tangible competencies? How do we nudge, incentivise those parts of the system we want to develop or preserve in a way that is consistent and joined up? How do we enable

the establishment of mechanisms which both bring people and resources together and achieve multiple goals?

For example, in one local community a share shop was established, through the coming together of an empty shop, a local organisation training social entrepreneurs who wanted a project to focus on, and some seed funding from the town council. The share shop was expected both to reduce waste through recycling and sharing, and also to save money for people and make goods available (such as a keyboard or chain saw) for many who could not afford them. What was slightly unexpected was that the space has become a place where people meet and socialise, share skills such as weaving and crochet, and are taught to mend electrical goods. So many outcomes have been achieved with minimum resources.

Sometime such behaviours are best to happen quietly, bringing from different stakeholder groups people together in a community or organisation through workshops or social events or social media, finding ways to shift perspectives and grow new relationships. The evidence that such processes are starting to gain traction, is when thought leaders and those with power and influence start to take an interest.

Sometimes the task is to 'create an environment where anything can happen', to 'follow people's energy, passion and intelligence and insights', to support experiments and 'be prepared to be taken in many directions'<sup>i</sup>. We are creating the conditions for 'shoots of change' to emerge and be nurtured and we are not working against this through too much control – of method, of direction, of outcome.

However, the task in engendering change is not *always* about strengthening the system. There certainly are times when we want to work with the prevailing patterns – in organisations, in markets, in communities - and harness and grow strengths and relationships. But there are *other* times when the task at hand is not so much to preserve and develop what we have, but to *destabilise* it, to *disrupt* it. Moving from very hierarchical structures, or from very discriminatory cultures may need a shock, or major change, where there is new leadership, where structures are entirely reconfigured, or laws changed. Very locked-in situations which require a radical redistribution of power cannot always happen carefully and slowly and indeed sometimes change results from consumers or citizens deciding they have had enough and forcing change through collective buying choices or boycotts or protests.

Thirdly, systemic change can sometimes happen because we are adept at finding critical moments or opportunities where change can be *catalysed*. Sometimes change happens through individuals holding out, refusing to feel defeated by prevailing norms and standing for what they believe it. Sometimes change happens because particular opportunities present themselves which, if seized, can be really influential and really move things forwards, really make a difference.

One final point to be made concerns ethics and values. In a complex system, each action contributes towards the system and plays its part in shaping the future. And the future, whilst not random, is not certain either. To quote Aldous Huxley (1937):

*'the end cannot justify the means for the simple and obvious reason that the means employed determine the nature of the ends produced.'*

If we say one thing and do another, or if we skate the truth or manipulate others in order to bring about a particular outcome, then it is those actions and intentions that are added to the system. What we contribute is tangible, but we cannot ever guarantee we will achieve 'the end', the outcome for which we have worked and planned. This can create both a sense of humility (I cannot be sure I will achieve what I set out to do) and yet also a sense of purpose and agency (every action and intention counts).

And yet this is not to take away the importance of clarifying intentions, ideally 'woven' with many stakeholders and open to challenge and review. Surfacing this vision is a key aspect of change and can guide experiment, channel energy and allow for diversity of approach.

### **Leadership in a complex world**

In conclusion what sort of competencies does complex systems thinking suggest we need for leading in a complex world?

#### 1. A dynamic orientation

We need to be interested in the past, the present and the future, and interested in many things. We need to take the time to understand the past – of the external world and of our own organisation so we can spot patterns and opportunities and work around locked-in norms and difficulties.

We need to scan and join things up, think systemically and see how different issues work together or against each other.

We need to be future-focused, motivated to look around at what is happening, what is changing, well networked in to politicians, thought leaders, local representatives and local staff, interested in the political and social and economic and environmental issues *and* able to spot new trends, opportunities and threats. We need to scan and fore-sight and anticipate, both internally and externally.

#### 2. Handling ambiguity and complexity - ambidexterity

Handling ambiguity and complexity and doing systems thinking comes more easily to some than others; in part it is a preference but in part it is a mindset which can evolve. Handling ambiguity is a competency that requires emotional intelligence as well as cognitive skills as it is about acting when there is uncertainty and sometimes being bold when things are unclear. It is about making judgements when data is patchy and contradictory.

#### 3. Weaving a vision

Visions and intentions become even more important in a world where detailed planning realistically is not possible. We want people to have clarity about where we are heading and share values and a sense of priority which can then allow decisions of 'how to' and 'what' to be made in ways that allows some flexibility and response to local conditions. This requires being able to handle complex information and synthesise it to create a way forward as well



as having the skills to involve many stakeholders in this process of weaving a sense of collective direction.

#### 4. Empowering to allow learning, adaptation and customisation

If things are less certain and are affected by local conditions, by emerging change, by the unexpected and unclear, then we need to be able to empower people to act who are tuned into these changes, as well as convey the constraints on this autonomy coming from overarching goals and visions. Empowering is not the same as abdicating, nor is it the same as granting complete autonomy.

We also need to be able to allow others as well as ourselves to experiment, try things out, try several things out at once - and to 'make mistakes'. In an uncertain world, not everything will turn out as we hoped.

We need to believe that control does not generally give the best results and we need emotionally to be able to relax such control and handle the anxiety in ourselves that that can produce. We need to be able to respond to actual situations as they arise and not be held back by sitting too tightly with previous perspectives and plans.

#### 5. Collaborating

Collaboration can be key to building joined up approaches, to work with a range of intelligence, to engage with stakeholders and bring together disparate views and foci and create a way forward that takes all this into account, systemically.

These are sophisticated competencies and not easy to embody. And, of course, it is also the case that we need the more tangible competencies of action-orientation and the ability to organise and plan. And there are times for taking decisive action, standing against the norm, taking the role of outsider, rather than working with others. There is an incommensurable tension in complex situations between order and chaos, between fixedness and change, between sameness and difference, between the individual and the community. And this requires a leadership style which is contingent on the situation, which can flex and adapt, which can be sometimes shared and collective and sometimes incisive and direct. The ability to think and act in a complex world requires a high level emotional and intellectual maturity.

#### **More information**

If you would like to learn more about complex systems thinking, please look at [www.embracingcomplexity.com](http://www.embracingcomplexity.com) or Embracing Complexity (2015) written by Boulton et al and published by OUP.

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<sup>i</sup> Quote by Sally Byng, CEO of Barnwood Trust