

# ***WORLD FUTURES***

## ***A Complexity Approach to Co-creating an Innovative Environment***

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### **Abstract**

The distinguishing characteristic of complex co-evolving systems is their ability to create new order. In human systems this may take the form of new ways of working or relating, new ideas for products, procedures, artefacts, or even the creation of a different culture or a new organisational form. The paper will explore the creation of new order using the principles of complexity and the concepts of creativity and innovation. It will argue that innovation can be facilitated by an enabling environment based on the logic of complexity and describe how one organisation (the Humberside Training and Enterprise Council) co-created an innovative environment and changed its culture, ways of working, thinking and relating.

**Key words:** Complexity, complex evolving systems, creation of new order, innovation, creativity, connectivity, interdependence, self-organisation, co-evolution, far-from-equilibrium, exploration of the space of possibility, emergence, feedback, exaptation, next adjacent, culture.

### **Introduction**

The paper will describe the innovative environment that the Humberside Training and Enterprise Council (TEC) co-created over a 10-year period (between 1991 and 2001) which facilitated the continuous evolution of its culture and influenced hundreds of organisations and thousands of individuals within its geographic region of Humberside. By 1995 the TEC was familiar with complexity theory to the extent that they described the organisation as a CAS (complex adaptive system). From 1995 onwards however they started using complexity principles actively to understand, describe and explain the change process they were both initiating and experiencing. The paper will use two perspectives: the internal view of the TEC and how they used complexity concepts, and a more analytical perspective

looking at the TEC as a complex social system with specific inter-related characteristics.

### *The Humberside Training and Enterprise Council*

The Humberside Training and Enterprise Council (TEC) was one of a national network of 72 TECs set up by the Government in 1991 (to replace the then Manpower Services Commission) to help individuals and organisations within their geographic area with training and growth. The TECs were responsible for Government training programmes such as Modern Apprenticeships and Investors in People, development work with Colleges of Further Education, economic development, business support and for developing local initiatives to meet local needs. Although TEC funding was largely from the public sector they were independent private companies, which 'traded' with the Government rather than receiving grant aid. This meant that they were subject both to Government accounting and auditing as well as private company accounting and auditing. They were companies 'limited by guarantee' rather than shares and all profits were ploughed back into the local community.

Although the Humberside TEC was one of the larger TECs with an annual turnover of £35m it was a relatively small organization with just over 200 people. Nevertheless it operated within a much larger social ecosystem and worked with 200 training and enterprise organizations and 2,000 employers within the Humberside region. It directly funded the jobs of 1,000 people and was responsible for the training of 10,000 people at any one time.

### *Complexity Theory*

There is no single unified Theory of Complexity, but several theories arising from various natural sciences studying complex systems, such as biology, chemistry, computer simulation, evolution, mathematics, and physics. The theory used in this paper focuses on human systems and posits that complex social systems have a set of characteristics, which they share with other complex systems, that enables them to create new order. In human systems the creation of new order is taken to mean the ability to create and innovate, within a broad range, to include new ideas, artefacts, cultures, etc. According to the theory all human systems are complex, but machine-type systems, however intricate, are complicated. The set of characteristics includes, but is not limited to, the following: multiple interacting dimensions, non-linearity, connectivity, interdependence, emergence, feedback, self-organisation, co-evolution, exploration of the space of possibilities, far-from-equilibrium, historicity and path dependence (Mitleton-Kelly E. 2003a). However, although human systems share these generic characteristics with all other complex systems, they are fundamentally different as humans are able to reflect and to act with intentionality. It is therefore essential to test generic principles for appropriateness and relevance to human systems.

The literature on Complexity often uses the term Complex Adaptive Systems (CAS), but this paper will use the term *Complex Co-Evolving Systems* (CCES) as being a more accurate descriptor. (The term Complex Evolving Systems was introduced by Peter Allen and was further developed by Mitleton-Kelly to Complex Co-Evolving Systems). CCES not only adapt to changes in their environment or

ecosystem, but also influence and affect that ecosystem. The process is not unilateral but reciprocal or co-evolutionary. Furthermore, *CCES have a set of interrelated characteristics that influence each other and enable them to create new order.*

### *Creativity & Innovation*

Innovation needs to be distinguished from creativity. The former is when a new idea is put into practice while creativity is the thinking up of the new idea. Innovation cannot happen without the creative idea, but the latter can occur in the absence of the former.

When a team or an organisation is faced with a problem or a constraint it needs to find a new solution. It tries out several alternatives until it finds the most appropriate. Not everyone in the team or the organisation need be involved but a few individuals will come together, or self-organise, to explore the space of possibilities; working together, they bounce ideas off each other until they find a creative solution. However they will only be able to be creative if they move away from their usual way of thinking, in other words if they move away from their norms of behaviour or move away from equilibrium. When they have moved into a different way of thinking then they are more likely to find an innovative solution, which can be implemented.

### **The TEC and Complexity**

The TECs were in operation for approximately 10 years. By 1995, when the Humberside TEC started working with the LSE Complexity Group, it was already thinking of itself as a 'complex adaptive system' and over the next 3-4 years while experimenting with the ten principles of complexity (Mitleton-Kelly E. 2003a) it changed its ways of working and relating and its culture quite significantly. In one sense it created a new culture where innovation was a strong thread interwoven throughout everything they did. It was a constant in the new culture, which was quite different from the previous bureaucratic civil service culture they had inherited. The new TEC culture put emphasis on helping companies and individuals to find new ways of working, but it also meant that most people in the TEC were themselves constantly experimenting with different procedures, processes, relationships, etc. For example, in due course they had removed what they called the 'stabilisers' and what every other organization considers essential: plans, budgets, hierarchy charts, job descriptions, targets and objectives.

In any organizational context removing all these staples, would have been unusual, but for the TEC being part of a Civil Service framework meant having a double identity. One they showed their Civil Service masters, and the other the one that they employed day-to-day and shared with their clients. They were one of 72 TECs and the only one working in such a different way. They were of course criticized and many doubted the effectiveness and efficiency of their new methods of working. They therefore took a benchmarking test devised for the TECs. The results, to every one's surprise (including their own), showed that the Humberside TEC was, among other indicators:

- The most cost effective among the 72 TECs

- Made bigger surpluses than most and spent more back with the community than others

Had achieved low unit costs

The only TEC with a clear strategy, which concentrated on outcomes (not inputs)

Paid more than average

The indicators overall showed that the Humberside TEC had achieved better performance overall and had lower costs. Part of their success could be attributed to the approach of their Managing Director Peter Fryer and to his team, which included a psychologist as a full-time member of the team. Together they identified the conditions for the co-creation of a new culture by involving all the TEC employees on a continuing basis. They therefore took advantage of the distributed intelligence in the organization both as co-creators of a new TEC culture but also as contributors to improving the relationship with their clients and helping them to change their ways of working.

### **Some CCES Characteristics**

To understand what it means to look at an organisation as a complex social system with specific inter-related characteristics, we need to become familiar with the terms used to describe those characteristics. The following section will introduce some of those terms (used to describe the characteristics of CCES) and illustrate them using examples from the TEC. Complex characteristics tend to be *scale-invariant* and could apply at all scales from an individual to a team, organisation, industry, economy, etc.

*Multiple interacting dimensions:* Complex systems are *multidimensional*, and all the dimensions interact and influence each other. In a human context the social, cultural, technical, economic, political and global dimensions may impinge upon and influence each other. But not all multidimensional systems are complex; machine-type systems for example may have many inter-related parts but if they cannot create new order then they are complicated not complex..

Multiple dimensions in a social context such as the TEC's, may be government policy, the strategies and actions of local firms, public sector and voluntary organisations, the international, national and local economies. These dimensions do not exist in isolation, they influence each other and are part of a multi-dimensional *social ecosystem* within which single organisations operate. Furthermore, each organisation will have a set of endogenous socio-cultural and technical dimensions such as its culture, organisational norms and various technical systems that again influence each other. The Humberside TEC existed within a political, geographic and economic environment and all three

dimensions influenced each other. At the same time it had a set of endogenous socio-cultural and technical dimensions that not only affected each other but were also influenced by the exogenous conditions.

As described above the TEC was set up by the UK Government and was subject to its accounting and auditing procedures, while at the same time being a private company and thus being influenced by the market and the national and local economic environment. While a relatively small organisation of 200 people, it operated within a much larger social ecosystem as it worked with 200 training and enterprise organizations and 2,000 employers within the Humberside region, and was responsible for the training of 10,000 people at any one time. It was therefore influenced by its environment while at the same time influencing that environment in a reciprocal process.

*Connectivity and interdependence:* Complex behaviour arises from the inter-relationship, interaction, and inter-connectivity of elements within a system and between a system and its environment. In a human system, connectivity and interdependence means that a decision or action by any individual (group, organisation, institution, or human system) may affect related individuals and systems. That affect will not have equal or uniform impact, and will vary with the 'state' of each related individual and system, at the time. The 'state' of an individual or a system will include its history and its constitution, which in turn will include its organisation and structure. Connectivity applies to the inter-relatedness of individuals *within* a system, as well as to the relatedness *between* human social systems, which include systems of artefacts such as information technology (IT) systems and intellectual systems of ideas.

Complexity theory, however, does not argue for ever-increasing connectivity, for high connectivity implies a high degree of interdependence. This means that the greater the interdependence between related systems or entities the wider the 'ripples' of perturbation or disturbance of a move or action by any one entity on all the other related entities. Such high degree of dependence may not always have beneficial effects throughout the ecosystem. When one entity tries to improve its fitness or position, this may result in a worsening condition for others. Each 'improvement' in one entity therefore may impose associated 'costs' on other entities, either within the same system or on other related systems.

One of the factors, which contributed to the success of the TEC, was its emphasis on relationships both internally and externally. Within the TEC employees were encouraged to talk to each other across the conventional boundaries of function and hierarchy. This connectivity was found to be so beneficial that the conventional boundaries became fuzzy. They were also encouraged to develop their connectivity externally with the organisations and the individuals they worked with. One of the outcomes was the 'Investors in People Club'. It was not a real club in the sense that it had been formally set up with a constitution, but an informal club in the sense that it had members. To belong, organisations had to become Investors in People. The TEC

organised events to celebrate successes of the club's members and these became so successful as connectivity events that belonging to the club had become an incentive in itself to become Investors In People. This outcome was *emergent* in the sense that it had not been foreseen and arose out of the connectivity and interaction between the individuals and their organisations.

*Emergent* properties, qualities, patterns or structures, arise from the interaction of individual elements. They are the structures or patterns that appear at the next macro level as a result of interaction at a lower micro level. They are often described as 'more than the sum of the parts' and they usually cannot be predicted.

Emergence in a human system tends to create irreversible structures or ideas, relationships and organisational forms, which become part of the history of individuals and institutions and in turn affect the evolution of those entities: e.g. the generation of knowledge and of innovative ideas when a team is working together could be described as an emergent property in the sense that it arises from the interaction of individuals and is not just the sum of existing ideas, but could well be something quite new and possibly unexpected. Once the ideas are articulated they form part of the history of each individual and part of the shared history of the team - the process is not reversible - and these new ideas and new knowledge can be built upon to generate further new ideas and knowledge.

The TEC encouraged connectivity in several ways and most had unpredictable, emergent outcomes. After they changed to open plan offices they found that they needed to book the few meeting rooms and sometimes there were not enough meeting rooms. They tried sharing the large Boardroom but that did not work. They then set up a 'café' area with many tables, which did not have to be booked in advance. Anyone who needed to talk to anyone else could just go and sit at one of the tables. The background noise gave more privacy than the meetings in the four corners of the Boardroom. The café became a very popular meeting place. Since meetings were in open view others would join in or might be called in. It enhanced connectivity and became so successful that people from outside the TEC asked to use it.

It also changed the mindset of what an office looks like and how it can be used. It fostered the idea that one did not have to come and sit at a desk all day but could move to the most appropriate environment. Apart from the café, there was also a quiet room called the 'Pod', which was next to the café. It had an oblong table and a sitting area with armchairs. The Pod was surrounded by soundproofed screens which were half-solid and half-smoked glass. People who needed to work in silence used the Pod. The IT room on the other hand, was full of electronic equipment, which enabled several people to work collaboratively on a document. All these could be seen as physical aspects of an innovative environment, which facilitated connectivity and emergence. They also contributed to changing the office culture and moving away from the idea that work meant sitting at a desk.

Emergence is part of the *process* that creates new order together with self-organisation.

*Self-organisation:* The innovative enabling environment in the TEC also facilitated self-organisation. In an organisational context, *self-organisation* may be

described as the spontaneous coming together of a group to perform a task (or for some other purpose); the group decides what to do, how and when to do it; and no one outside the group directs those activities.

In a biological context, Kauffman in the 'Origins of Order: Self-Organization and Selection' (1993) brings the importance of self-organisation in the evolutionary process to our attention. He calls Darwinian natural selection a "single singular force" and argues that "It is this single-force view which I believe to be inadequate, for it fails to notice, fails to stress, fails to incorporate the possibility that simple and complex systems exhibit order spontaneously." (Kauffman, 1993: xiii) That *spontaneous order* is *self-organisation* and he argues that natural selection is not the sole source of order in organisms and suggests that both natural selection and self-organisation are necessary for evolution; he then proceeds to expand evolutionary theory to incorporate both evolutionary forces.

Self-organisation became a key concept in the TEC. When something became necessary someone volunteered to lead it and the process quickly became self-organising. For example organising the events for the Inventors in People awards, someone volunteered to organise them and the events became self-organising in the sense that those involved in them decided when and how they would be organised. No one outside that team told them what to do.

Another example is that staff from three functional areas (Investors in People team, the Marketing team and the Accreditation of Learning team) devised a common programme – this became a new offering from the TEC, which facilitated the interface with the community. Again, those involved identified the opportunity and took the initiative to create the new programme. A senior manager outside that group did not mandate it.

The TEC appraisal system was also an emergent effect in that no one specifically designed it, but it arose by trying to meet some diverse requirements. It also became self-organising. This was a 360° process when this kind of appraisal was not generally used or widely known. It arose because the MD also needed to be appraised but in a meaningful way. They experimented with upward appraisal but that did not work well. So they used the idea from the 'whole brain model' they had been experimenting with and incorporated the categories of stop, start, continue and change. The appraisee invited colleagues as well as people outside the organisation who knew the person to be appraised well. The appraisers would start by making suggestions on flip charts under each of the four categories of stop, start, continue and change and would then invite the appraisee in the room to look at the suggestions and discuss them. The TEC trained a facilitator and made the process available to all. It was however voluntary and self-organised as the appraisee decided when and whether they would have it and invited the appraisers. The process evolved over time and changed as well as changing people's approach to what an appraisal was like. The form of the appraisal became emergent and self-organising but it also co-evolved with those using it.

*Co-evolution:* Co-evolution may be described as *reciprocal influence and change in the interacting entities*. In a biological context, as entities and organisms interact and adapt within an ecosystem they alter "both the fitness and the fitness

landscape of the other organisms”. (Kauffman 1993: 242) The way each element influences and is in turn influenced by all other related elements in an ecosystem is part of the process of co-evolution, which Kauffman describes as “a process of coupled, deforming landscapes where the adaptive moves of each entity alter the landscapes of its neighbors.” (Kauffman & Macready, 1995)

Another way of describing co-evolution is that *the evolution of one domain or entity is partially dependent on the evolution of other related domains or entities* (Ehrlich & Raven 1964, Pianka 1994, Kauffman 1993 & 1995, McKelvey 1999a & b); or *that one domain or entity changes in the context of the other(s)*.

The main point however to note is that co-evolution involves ***reciprocal influence and change within a co-evolving ecosystem***. If influence and change are entirely in one direction then that would be more accurately described as ‘adaptation to’ a changing environment. However, short-term adaptation may result in long-term co-evolution if the entities in due course influence and change each other.

The TEC used the concept, within a social context, in a very sophisticated way. They learnt how to co-evolve with a constantly changing environment through continuous organic restructuring. This was a dual but very subtle bottom up and top down approach. It was difficult to know where the latest idea for change emanated. They worked in such a collaborative way that ideas were shared from the earliest point and the ideas themselves changed and co-evolved through discussion. They also talked in terms of the ‘co-evolution problem’ and contrasted it to linear thinking. When the latter is involved the approach is “do something to solve the problem” but the TEC came to realise that such a solution will change the environment but may not solve the original problem. An example is when they were faced with a shortage of parking spaces. They rented a car-parking space and thought that they had solved the problem. But that solution changed the environment and set up new problems. Those that did not have a car asked whether their bus fares could be paid while others asked whether their partner could also use the car parking space. They then came to realise that they needed to be more aware of what constituted a problem. Could they live with it? Would it co-evolve and how would it change the environment?

When the TEC tried to help three Chambers of Commerce merge it did not know how to go about it. It did not try to “score points”, the TEC had a different function from the Chambers of Commerce and could be genuinely disinterested. They all however had one goal, which was to have “a single strong business voice”. The TEC helped to fund the merger process and this action changed the environment and the



social ecosystem but they did not interfere with the actual process and allowed the 3 bodies to interact with each other, to co-evolve and to find that single business voice.

Another example was when five Business Link companies became one. They again did not know how to achieve the goal of a single company and they “danced with the situation” for 18 months while progressing towards the goal of a single hub. They trusted the process of gradual co-evolution – that is exploring ideas and influencing each other until an appropriate outcome emerged. They were clear about the goal and about the first step. They were also familiar with the concept of the ‘*next adjacent*’ and at each point the next possible step became clear, although two steps earlier it had been totally opaque.

*The Next Adjacent* is the exploration of change one-step away from what already exists in the ‘*adjacent possible*’ (Kauffman 2000) using ‘building blocks’ already available, but put together in a novel way. According to Kauffman (2000:22) the push into novelty in the molecular, morphological, behavioural, technological and organisational spheres, is persistent and happens through exploration of the adjacent possible. The rate of discovery or mutation, however, is restricted by selection to avoid possible catastrophes that could destroy a community. Bacteria and higher cells have a mutation rate well below the error-catastrophe, which is the phase transition that renders a population unsustainable. There seems to be a balance between discovery and what the ecosystem can effectively sustain. Both the biosphere and the econosphere seem to have “endogenous mechanisms that gate the exploration of the adjacent possible such that, on average, such explorations do successfully find new ways of making a living.” (Kauffman 2000:156) In the biosphere adaptations are selected by natural selection and in the econosphere by economic success or failure, at a rate that is sustainable. The recent slowing down in the mobile telephone market could well be an indicator of intolerance to the rate of innovation, which cannot be assimilated by the market.

Although the rate at which novelty can be introduced is restricted, the adjacent possible is indefinitely expandable. (Kauffman 2000: 142) Once discoveries have been realised in the current adjacent possible, a new adjacent possible, accessible from the enlarged actual that includes the novel discoveries from the former adjacent possible, becomes available. The constant opening up of niche markets in areas and products that only a few years earlier had not even been thought of, is an example of the ever expanding possibilities of the adjacent possible. What the TEC had achieved over time was to gradually open up the space of possibilities by pushing the boundaries of the adjacent possible. Each step was feasible, thinkable and acceptable and once established it opened fresh areas to explore that would have been unthinkable at the beginning of each exploration.

The next adjacent is one way of exploring the space of possibilities.

*Exploration-of-the-space-of- possibilities:* Complexity theory suggests that to survive and thrive an entity needs to explore its space of possibilities and to generate variety. Complexity also suggests that the search for a single 'optimum' solution may be neither possible nor desirable. Any solution can only be optimum under certain conditions, and when those conditions change, the solution may no longer be optimal. If however, a variety of possible solutions exists, then as the environment changes the system is able to draw on these alternative which may have become more appropriate in the new circumstances.

The Humberside TEC actively *explored its space of possibilities*. Each employee was empowered to try out new ideas, provided that it did not risk the well-being of the organization. Freedom of action had to carry full responsibility for those actions. However, if things went wrong they did not blame or punish. All exploration for alternatives means that not all attempts will be equally successful, and 'mistakes' will happen. These 'mistakes' of exploration however do need to be distinguished from mistakes or failures based on thoughtlessness or carelessness. One 'filtering' process in the TEC was that employees were encouraged to consult their colleagues and to invite their critique. Peer support (not pressure) ensured that mistakes did not damage the organization, but helped make it stronger by actively learning from them. The various examples given above were innovations arising from an exploration of what was possible. Some were successful and some failed, but each 'success' needed several attempts which may be called 'failures' or 'mistakes' but in may also be seen as necessary preparation for the successes through learning and co-evolution. Exploration of different alternative solutions also means that when the environment changes the organisation can respond flexibly and innovatively to the new conditions.

*Feedback:* An important element in connectivity, emergence, co-evolution, exploration etc is feedback. Feedback is traditionally seen in terms of positive and negative feedback mechanisms, which may also be described as reinforcing (i.e. amplifying) and balancing. Putting it another way, positive (reinforcing) feedback drives change, and negative (balancing, moderating, or dampening) feedback maintains stability in a system. Arthur (1990, 1995, 2002) has written extensively on the role of positive feedback on increasing returns, particularly in the context of new technologies.

In a social context feedback may be seen as a process that influences behaviour. In the TEC it was used formally and methodically in, for example, the 360° appraisal process while informally it was part of the collaborative culture of the TEC. Everyone talked to everyone else, to bounce ideas, get advice, find out what was happening within the TEC, in Humberside, in the country, etc. They also talked to their clients to find out what they needed, how they were doing and also to inform

them of new ideas, events, etc. They talked to the local authority of Yorkshire and Humberside, to the Chambers of Commerce and other institutions. Formally they also had different reviews such as their stakeholder review, economic reviews, and others where feedback was actively sought in a formal way. The TEC used both positive and negative feedback processes formally and informally and they found that areas that had overlapping boundaries did better because people were encouraged to work in partnership and collaborate. In consequence they created areas with massive overlapping, with fuzzy boundaries that needed collaboration and constant feedback.

They also found that feedback facilitated connectivity, they needed active feedback to maintain their internal and external networks. It was also necessary in emergence: without interaction and feedback emergent qualities or patterns would not arise. Feedback was essential in the innovative environment they had created to sustain it and to help it co-evolve with its changing environment.

*Far-from-equilibrium:* Another key concept in complexity is that of ‘far-from-equilibrium’. When open systems are pushed ‘far-from-equilibrium’ they are able to create new structures and order. The original work was done by Ilya Prigogine and his co-authors (Nicolis, Stengers); it applied to physical and chemical systems, but it was of such significance in explaining complex behaviour that the concept has been adopted in other fields. In a social context ‘far-from-equilibrium’ is taken to mean moving away from established norms, procedures, ways of working and relating.

When an external event disturbs the behaviour of a system significantly, then at a critical point it ‘jumps to a new level’ and creates new order. The splitting into alternative solutions is called *bifurcation*, but the term is misleading in that it means a separation into *two* paths, when there may be several possible solutions. Before the system settles into one solution, several alternatives were possible.

An observer could not predict which state will emerge; “only chance will decide, through the dynamics of fluctuations. The system will in effect scan the territory and will make a few attempts, perhaps unsuccessful at first, to stabilize. Then a particular fluctuation will take over. By stabilizing it the system becomes a *historical object* in the sense that its subsequent evolution depends on this critical choice.” (Nicolis & Prigogine, 1989: 72)

Innovation takes place at the critical point, when the existing order can no longer be sustained and new order comes into being. Once the decision is made, there is a historical dimension and subsequent evolution may depend on that critical choice; but *before* the decision is finalised, the alternatives are sources of *innovation* and *diversification*, since the opening up of possibilities endows the individual and the system with new solutions. When a social entity (individual, group, organisation, industry, economy, country, etc) is faced with a constraint, it finds new ways of operating, because away-from-equilibrium (established norms or patterns of work and behaviour) systems are forced to experiment and explore their *space of possibilities*, and this exploration helps them discover and create new patterns of relationships and different structures.

For the TEC, far-from-equilibrium meant moving away from the norm. At the beginning, the transition phase they were going through from a Civil Service to a

more entrepreneurial and innovative culture was such a move. It meant rethinking existing norms of behaviour, processes and procedures, structures and ways of working. It meant moving into a zone of discomfort and uncertainty while new ways were found. These new ways did not of course appear fully formed; they emerged through self-organisation, co-evolution and constant feedback. They created a new order, which was significantly different from the old. But before it emerged many alternatives were possible. But the new order was not a permanent and fixed state. They were constantly challenging whatever existed long enough to become a 'norm', moving far-from-equilibrium became a state of being at the TEC. Later changes were not as dramatic as the original change but the way of thinking persisted and they became used to living with stability and turbulence at the same time.

The new way of thinking included jettisoning numbers in contracts, times of working, budgets and managers. These were what they called the 'stabilisers' and what most organisations see as fundamental to the smooth running of an organisation. **They also came to see that the** 'stabilisers' as such were not the problem, but the *constructs* around them, as they give the wrong boundaries. For example, a budget creates a boundary around the cash and behaviour becomes driven by cash rather than by needs. While if behaviour becomes focused on the activity rather than the money then the approach changes. For instance if a new desk or computer was needed, what dictated the type ordered would depend on real need and requirement for the job not what budget was available. This again meant that every individual carried responsibility for making that choice. It would have been easy to take advantage of the system, but somehow no one did. The relationships between employees meant that they could speak out and criticise if necessary. It also meant that they had to trust each other and that trust was reciprocal.

Trust also included the hours people worked. Not everyone worked 9-5. They all had to work a core time but beyond that they were trusted to do the job they had to do in the best way possible, honouring personal commitments such as collecting children from school or looking after a sick relative, etc. They also had no office 'uniform'. They could wear what felt appropriate and comfortable. Eventually they did not have individual offices. The MD started this process by moving his desk outside his office and the office became available to everyone for meetings.

One of their successful innovations was the café area with tables, where anyone could go for a coffee or a chat or a meeting. Another was the quiet room or 'Pod' and the IT room. All these meant that they were rethinking what it meant to work in an office and that one did not have to sit at a desk all day but could move to the most appropriate environment necessary to the task at hand.

Over time the TEC had reframed the constructs around the 'stabilisers', but this involved a great deal of unlearning and a lot of support before removing the 'stabilisers'. They were replaced by *processes* that concentrated on *connections* and *emergent patterns* rather than on the agents. The new culture and ways of working and relating were not seen as a change programme but as an *emergent and evolving process*.

They asked questions such as "What do we want to **be**? (not **do**)" and spent time on exploring the likely answer. Although they had no organizational charts they

were not structure *less*; they simply had evolved a different kind of structure based on a set of Design Principles which included structure, processes, relationships, values and culture. The Design Principles were emergent and ongoing and continued to evolve through a long iterative process. The ideas started small, or as the MD called them, they were ‘trojan mice’. They appeared innocuous and started small but often had a significant impact through connectivity, interdependence and positive feedback, which reinforced any small changes and increased their effect.

The **Design Principles**, were based on some complexity principles, and illustrate the kind of culture that emerged:

**1. Make connections**, meant that everyone could talk to anyone and should try to do so. Everyone was responsible to make connections and to network extensively both within the organization and outside it with their clients. This increased connectivity and interdependence and improved communication and trust. It also helped to create the conditions for new insights and innovation and led to the second design principle.

**2. Learn continuously**. Learning is an emergent process and is based on the connection of ideas and on new insights. Learning also arose from exploring different possibilities and acknowledging that ‘mistakes’ were not failures leading to blame or punishment but provided a valuable means of learning. It also meant learning how to respond to the environment, how to both adapt but also to co-evolve. To appreciate that any decision or action affects others and that there is a constant reciprocal influence, which can change patterns of behaviour. Finally it meant learning by doing, experimenting and putting ideas into action – in other words innovating.

**3. Make processes ongoing**, meant that learning, planning and evaluating were a continuous cycle. That processes and systems were based on their best people (not the worst). This idea was quite revolutionary. Usually processes and systems are designed to protect an organization from abuse or fraud or less effective working. In the TEC they were based on the best people and their behaviour. Furthermore, processes and systems were usually based on outcomes rather than inputs, e.g. not on how many hours an employee put into a job but on the quality of the outcome. The TEC reversed this thinking and based its processes and systems on outcomes. They also believed that structures and systems should follow not lead. They emerge to support ways of working not the other way around, i.e. ways of working should not be dictated by the systems and structures.

One of the complexity principles underlying this Design Principle was self-organisation. The TEC encouraged the self-organisation of teams to set and fulfil appropriate tasks and it trusted them to do so responsibly. Furthermore, if learning was a continuous cycle it meant that no single solution applied universally or in perpetuity. As the environment changes and conditions alter, solutions and strategies need to change; they need to co-evolve with the changing social ecosystem.

### **Complexity Principles and the Creation of New Order in the TEC**

The TEC started by questioning its current way of doing things and what it wanted to be. By doing so it moved itself *away-from-equilibrium* or away from its accepted norms and standards and ways of working and relating. They continued their questioning and re-evaluation and together *co-created a new culture*. In the process it acknowledge the importance of *relationships, of connectivity* and cooperation and co-

created an atmosphere of cooperative *interdependence*. It introduced diversity in its people through its hiring policy but also through *exploring the space of possibility*, thus generating new ideas and creating different solutions. It achieved this through the *self-organisation* of agents at a micro level and by facilitating *emergent patterns or qualities* at the next macro level. Emergence is the process of transition from any micro to the next macro level. Emergent processes, behaviours and patterns therefore appeared at all levels from the team, the organisation and the industry, to the whole Humberside geographical social *ecosystem*. The influence however was not one-sided, but was reciprocal. Individuals and teams influenced each other and the whole organisation influenced and affected other organisations. In other words they *co-evolved* and created new order. They created a new culture within the TEC but also a new culture of cooperation, support and exploration of the new, throughout Humberside.

Thus an *innovative environment emerged* which was based on the following **key beliefs**, expressed in the words of the TEC:

1. Our purpose is to release potential by helping individuals and organisations learn and grow.
2. All our activities should add value to the learning and growth of individuals and organisations.
3. Doing the right thing in relation to achieve our purpose is more important than any targets, numbers or indicators.
4. If we do the right thing we believe the numbers will follow (if they don't the targets were probably wrong).
5. Our people know best what is in the best interests of the business and are empowered to act on behalf of the TEC in its best interests for their areas of responsibility.
6. All our people are adults, behave like adults, and are treated like adults.
7. Our organisation is based on trust and that we trust everyone to do the right thing to support their colleagues and to achieve our outcomes.
8. Our people will take full responsibility for their own development and use it for the benefit of the business.
9. People come to work to do something worthwhile and to have fun.

Beliefs 1, 2 and 3 put the emphasis on the importance of individual and organisational development, on relationships and on learning. These three elements facilitate efficacious co-evolution in a social context. Beliefs 3, 4 and 5 mean that clarity was essential "If they're clear about what the organisation is for, the function, the task - they should be able to work out the rest - to do the most appropriate thing". And so was truth and congruence "we modelled internally what we wanted externally" and corporate consistency, which meant that the same message and the same standards applied to everyone.

**Beliefs 5, 6, 7 and 8 mean that individuals were responsible for their own actions and decisions, but also that they needed support to develop thinking and learning skills and confidence. They were accountable for their own mistakes and to those affected by the mistake. The TEC focussed on the process that allowed the mistake and did not blame individuals who were seen as autonomous agents with freedom and responsibility. The organisational system therefore had to be self-regulating and they expressed it thus: do it, keep adjusting it, learn and co-evolve with**

it. Beliefs 6 and 7 mean that systems were usually based on the worst person rather than the best, while the TEC chose to do everything based on the assumption that everyone was going to do a good job, was intelligent, etc. Belief 8 introduced a 360-degree appraisal based on giving and receiving feedback from colleagues one trusted and who helped one improve and develop. Finally, belief 9 encapsulated the ethos that had developed and meant that the TEC had articulated a deep desire in individuals and by making it possible to do something worthwhile and to have fun, and saying so, quite revolutionised the workplace.

The TEC also articulated its values, which were: Honest, Open, Learning, Integrity, Supportive, Trust, Innovative, Considerate. The acronym from the values (in that order) spells 'Holistic' which captures the complexity-based perspective of the TEC. Having integrity and being honest, open, supportive and considerate created an environment of mutual trust and support, which also facilitated innovation. It is important to note that innovation is given as one of the TEC's values.

Part of the innovative approach of the TEC was the different initiatives they put into practice, such as the Cultural Wheel. Every year they looked at what the current culture looked like and what they wished it to be, which indicated what further changes needed to be made. This was a collaborative exercise with all the employees taking part. Culture therefore was seen both as an intentional and an emergent process. The interplay between intention, self-organisation, co-evolution and emergence.

Another initiative was the TEC Stakeholders Study, which provided feedback from all main stakeholders and this was published. The findings helped the TEC to understand the implications of their actions with regard to the individuals and organisations in Humberside and to make appropriate changes. They also had a strong supportive training programme for everyone within the TEC, which addressed beliefs 1, 6 and 8 in releasing the potential of individuals but also emphasising that those individuals were adult and therefore responsible for their own development. Serious Thinking Sessions were another initiative; for example one session was on Northern Ireland to help them understand the logic of different positions.

They also had an 'Exploration Fund' to help them explore different ideas. For example it funded some employees to attend a conference on space. This led to the TEC inviting a sculptor to talk about creating spaces and opened the discussion on "what does space mean in the context of the TEC?" It led to the idea of collective space and the setting up of the highly successful cafe area. Having open plan offices also meant that they needed quiet space and these were provided with sound screens. This initiative was about stretching and challenging the thinking, helping them towards new insights that further facilitated and supported innovative behaviour.

The TEC example shows that innovation is not a single major initiative. It is more about creating the enabling environment to generate a constant stream of innovative ideas; it is a way of thinking. Once individuals realise that they have the capacity, the support and the power to think in a fresh way they will continue to explore and from small personal initiatives they will expand into major initiatives involving others.

Change takes place at a micro-agent level continuously. We become aware of it when we 'see' a new pattern emerging at the next macro level. Occasionally the micro-changes reach a 'critical' point and the entire system has to change significantly and choose a new order or new way of operating. That is the bifurcation point when moving far-from-equilibrium. However, until one alternative is chosen there are always several possible alternatives. The point here is that social evolution happens both in small and large steps. Small steps sometimes involve exploration of the *next-adjacent* and is a fruitful means of innovation. It may involve relatively small initial changes but requires a significant change in thinking and in 'seeing' new possibilities. Individuals can do it unaided but if a generative environment is created then innovation becomes a way of life. That is precisely what the TEC had achieved. They were familiar with complexity theory, had been working with the LSE Complexity Group since 1995, had been introduced to the idea the next-adjacent which became part of their vocabulary.

At the beginning, the TEC explored these ideas intuitively, later the theory supported what they were doing, and they continued their exploration with increased confidence. After a decade of working on the development of a theory of complex social systems and its application in practice with many organisations, we understand both the theory and its application better. Other organisations can now use these ideas to create enabling environments that facilitate innovation. However the theory also warns that specific innovations can never be guaranteed or predicted; they are emergent and as such unpredictable. But an enabling environment is also an exploratory and a co-evolutionary one, and the generation of new ideas or new product development can be guided, but it cannot be 'designed' or imposed.

## **Conclusion**

Understanding the characteristics of organisations as complex co-evolving systems can help organisations to use these characteristics to stimulate innovation, instead of inadvertently blocking it. The paper used the example of the TEC to illustrate that innovation can be facilitated through the co-creation of an enabling environment. Also that innovation is not a single event but a continuing process, a way of thinking and behaving facilitated through the co-creation of innovative environments that enable connectivity, emergence, self-organisation, co-evolution, feedback, exploration of the space of possibilities and working far-from-equilibrium. Such environments help organisations to become more creative and innovative and by creating new order; that is new ideas, new products, procedures, processes, structures and a new culture.

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