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

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A Complexity Approach to Co-creating an Innovative Environment

- Complexity theory perspective: innovation as the creation of new order
- The story of the Humberside TEC
- Co-creating an innovative, learning environment

A story about a different way of organising

A UK organisation - Humberside Training & Enterprise Council (TEC), one of 72 Government funded bodies set up in 1991 to help individuals and organisations within their geographic area with training and growth

Humberside TEC

Small organisation:

- One of 72 TECs throughout the UK
- Started with 95 staff in 1991
- Growing to 165 by 1999
- Over 200 people by 2001

Working with:

- 200 training and enterprise organisations
- 2000 employers
- Directly funded the jobs of 1,000 people
- Responsible for the training of 10,000 people at any one time.

Innovation – a definition?

- Adoption of idea or behaviour that is new to the organisation (Hage 1999)
- A mentality that expresses itself through learning + Creation of new knowledge (Harkema 2003)
- An ongoing learning process (Nonaka 1994)
- Creation of new order (Mitleton-Kelly 2003, 2006)

TEC

- The TEC created a new culture where innovation was a strong thread interwoven throughout everything they did
- Emphasis on finding new ways of working and on experimenting – with different procedures, processes, relationships, etc.
- Created an innovative environment based on continuous learning and change, on developing relationships and new knowledge

Outcome:

Better performance
and lower costs

Benchmarking studies showed:

- Most cost effective TEC
- Made bigger surpluses than most and spent more back with the community than others
- Low unit costs
- Only TEC with a clear strategy, which concentrated on outcomes (not inputs)
- Paid more than average

Complex Behaviour

Arises from the:

- *interrelationship*
- *interaction* and
- *interconnectivity* of elements *within* a system and
- *between* a system and its environment.

Complex systems are *multi-dimensional* and *non-linear*

Multiple social dimensions

Social Ecosystem:

Social

Cultural

Technical

Physical

Economic

Political, etc

- All dimensions interact and influence each other
- TEC existed within a political, geographic and economic environment + endogenous and exogenous socio-cultural and technical conditions

Theories

Natural sciences

Dissipative structures
chemistry-physics (Prigogine)

Autocatalytic sets
evolutionary biology (Kauffman)

Autopoiesis (self-generation)
biology/cognition (Maturana)

Chaos theory

Social sciences

Increasing returns
economics (B. Arthur)

*Generic
characteristics
of complex
co-evolving
systems*

self-organisation

emergence
connectivity
interdependence
feedback

far from equilibrium

space of possibilities

co-evolution

historicity & time

path-dependence

creation of new order

Connectivity & Interdependence

- In human ecosystems there are networks of relationships with different ***degrees of connectivity***
 - strength of coupling
 - epistatic interactions
 - i.e. the fitness contribution made by one individual will depend upon related individuals
- Essential element of ***feedback***

Connectivity

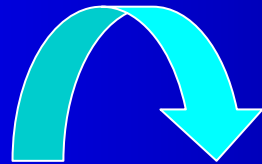
Diversity

Density

Intensity

Quality

of interactions between
human agents



Determine network of *relationships*

TEC

- Emphasis on *relationships* both internally and externally
- Internally, encouraged to talk to each other across function and hierarchy boundaries
- Externally with other organisations
 - ‘Investors in People Club’
 - TEC organised events to celebrate successes of its members – so successful as connectivity events that became an incentive to become Investors in People
 - Outcome was *emergent*

Emergence

- Emergent processes, qualities, patterns
- Arise from *interaction*
- Cannot always be predicted
- More than the sum of the parts
- *Process of transition* from micro-agent interaction to macro-structures
 - An example: learning, innovation & the creation of knowledge
- New ways of organising/organisational forms

Emergence

Two-way process

- Bottom-up – through interaction

+

- Top down – the emergent, constrains in two ways
 - a) in what actions participating agents can enact and this may limit their options
 - b) at the same time it opens up new possibilities to individuals within an interacting group that are not available to individuals on their own

(Alicia Juarrero)

Ephemeral processes

- Some emergent processes, will be ephemeral
- An emergent is not a final product – it is a constantly changing ephemeral property of the interaction, which in turn influences the emergent processes that are generating it
- Result: both top-down and bottom-up processes, which are simultaneous and bi-directional
- Circular or reciprocal causality?
- Non symmetrical relationship between local and global levels

(Keith Sawyer, Thompson & Varela)

Emergence

- 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 further evolution of those entities: e.g. the generation of knowledge and of innovative ideas

TEC

- Encouraged connectivity and most had unpredictable emergent outcomes
 - e.g. open plan, use of Boardroom
 - Set up café
 - Open meetings – others joined in
 - Enhanced connectivity
 - So successful - outsiders asked to use it
 - Changed mindset of what an office looks like and how it can be used

TEC: Emergent Outcomes

Café

‘Pod’ – quiet room

IT room

- Physical aspects of an innovative environment, which facilitated connectivity and emergence
- + changed the culture and mindset of what an office looks like
- *Emergence* is part of the process that creates new order & innovation together with *self-organisation*

Self-organisation

- Spontaneous ‘coming together’
- Needs **variety & diversity**
- Based on **co-operation**
- Not directed or designed by someone outside the group
- The group decides what needs to be done, how, when ...
- Can be a source of **innovation** – creation of new knowledge or new ways of organising or new culture

TEC: Self-Organisation

- Staff from 3 functional areas: Investors in People team, Marketing team and Accreditation of Learning team, devised a common programme
- Became a new offering from the TEC
- Facilitated interface with the community
- Those involved identified the opportunity and took the initiative
- Senior manager outside the group did not mandate it
- The teams and the community *co-evolved*

Co-evolution

- The evolution of one domain is partially dependent on the evolution of the other
or
- One domain changes in the context of the other
- Reciprocal influence and change in the interacting entities

Co-evolution within an ecosystem

TEC: Co-evolution

- TEC used the concept in a very sophisticated way
- They learnt how to co-evolve with a constantly changing environment through continuous organic restructuring
- 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
- Constantly explored new ideas

Exploration of the space of possibilities

- Exploration of new options, different ways of working and relating
- The search for a single 'optimum' strategy is neither possible nor desirable, in a turbulent environment – multiple micro-strategies + distributed strategies, power, intellectual cap
- But variety alone is not enough. New connections or contributions also need to be '*seen*'

Exaptation

- Often not expensive R&D which produces major innovations, but ‘*seeing*’ a novel function, in a new light.
- “*Exaptation* is the emergence of a novel function of a part in a new context. ... Major innovations in evolution are all exaptations. Exaptations are not predictable”

[Kauffman, Complexity and Technology Conference, London, 11 March 1997]

e.g. post-its, viagra, non-stick pans, etc. etc.

Next Adjacent

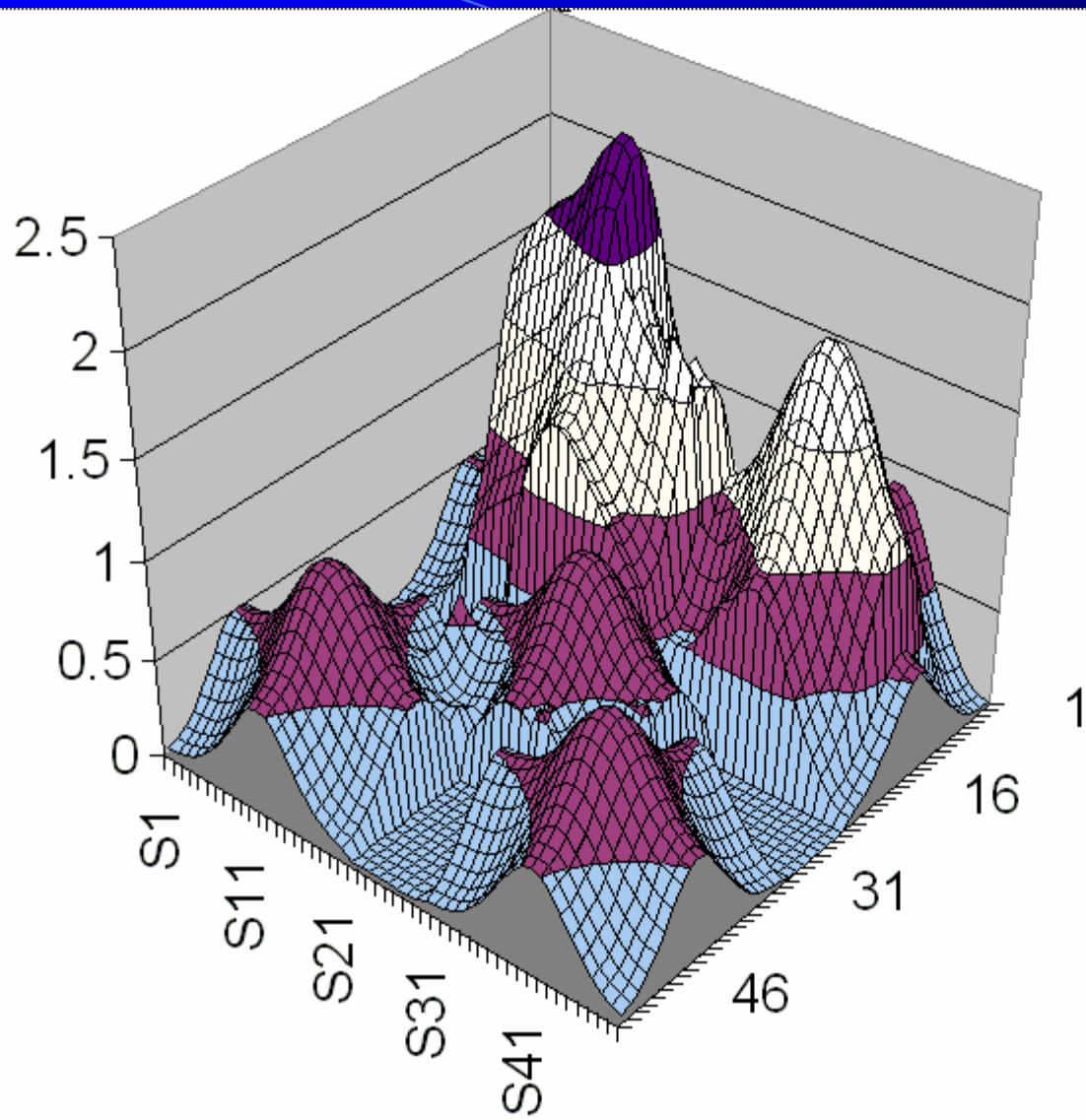
- When searching the space of possibilities, whether for a new product or a different way of doing things
- It is not possible to explore all possibilities
- But it is possible to consider change one step away from what already exists
- Although the rate at which novelty can be introduced is restricted, the adjacent possible is indefinitely expandable (Kauffman 2000)

TEC: Next Adjacent

- Familiar with the concept and used it
- The TEC opened 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 what would have been unthinkable at the beginning of each exploration

TEC: Exploration of the Space of Possibilities

- 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
- 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
- Why is exploration of alternative solutions necessary?



Fitness ‘Landscape’

- In the competition for survival, species attempt to alter their make-up by taking ‘*adaptive walks*’ to move to higher ‘*fitness points*’, where their viability is enhanced.
- *Adaptive walks* are an optimisation technique for searching a space of possibilities.
- Powerful technique – able to search many parts of the space in parallel
(Kauffman)

Organisational Fitness Landscapes

- Concept may be applied to evolutionary journey of an organisation
- Consider multiple micro-strategies, exploring the space of possibilities
- Success of strategies of an organisation is determined by the strategies of the other entities in the same ecosystem
- Inter-coupling of landscapes + richness of individual *interactions* – alter the co-evolutionary dynamics

Far-from-equilibrium

- When open systems are pushed ‘far-from-equilibrium’ they are able to create new structures and order
- In a social context ‘far-from-equilibrium’ is taken to mean moving away from established norms, procedures, ways of working and relating

Far-from-equilibrium

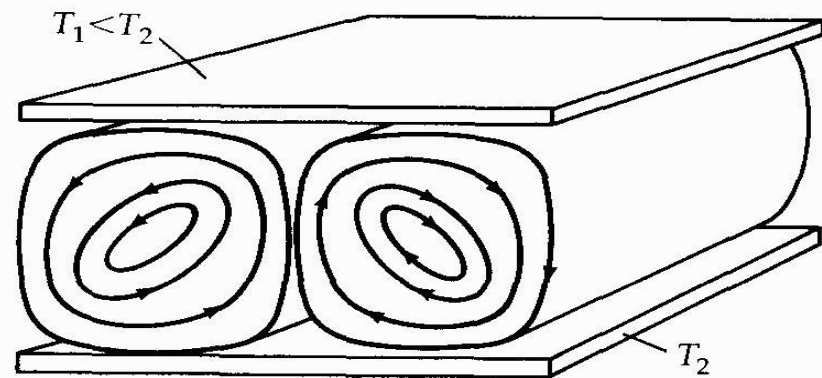
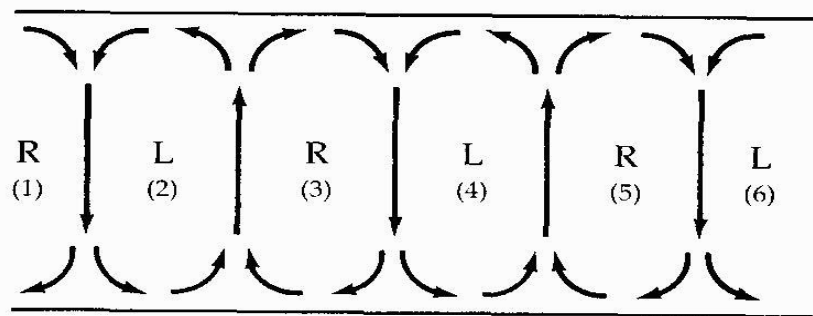
- The original work on dissipative structures, by Ilya Prigogine (described by Prigogine and his co-authors Nicolis and Stengers)
- It applied to physical and chemical systems, but it was of such significance in explaining complex behaviour that the concept has been adopted in other fields.

Far-from-equilibrium

- 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, before the system settles into one solution, several alternatives were possible

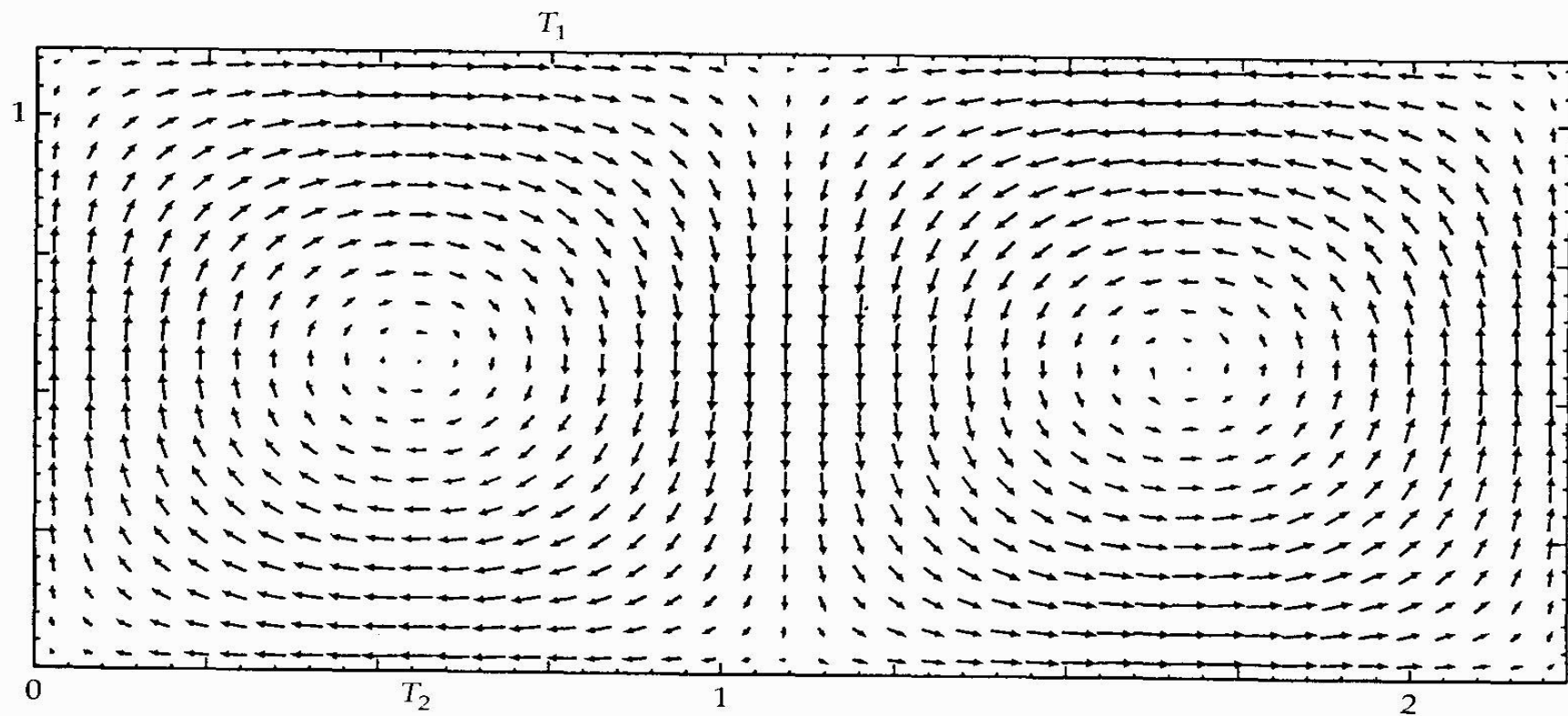
Dissipative Structures

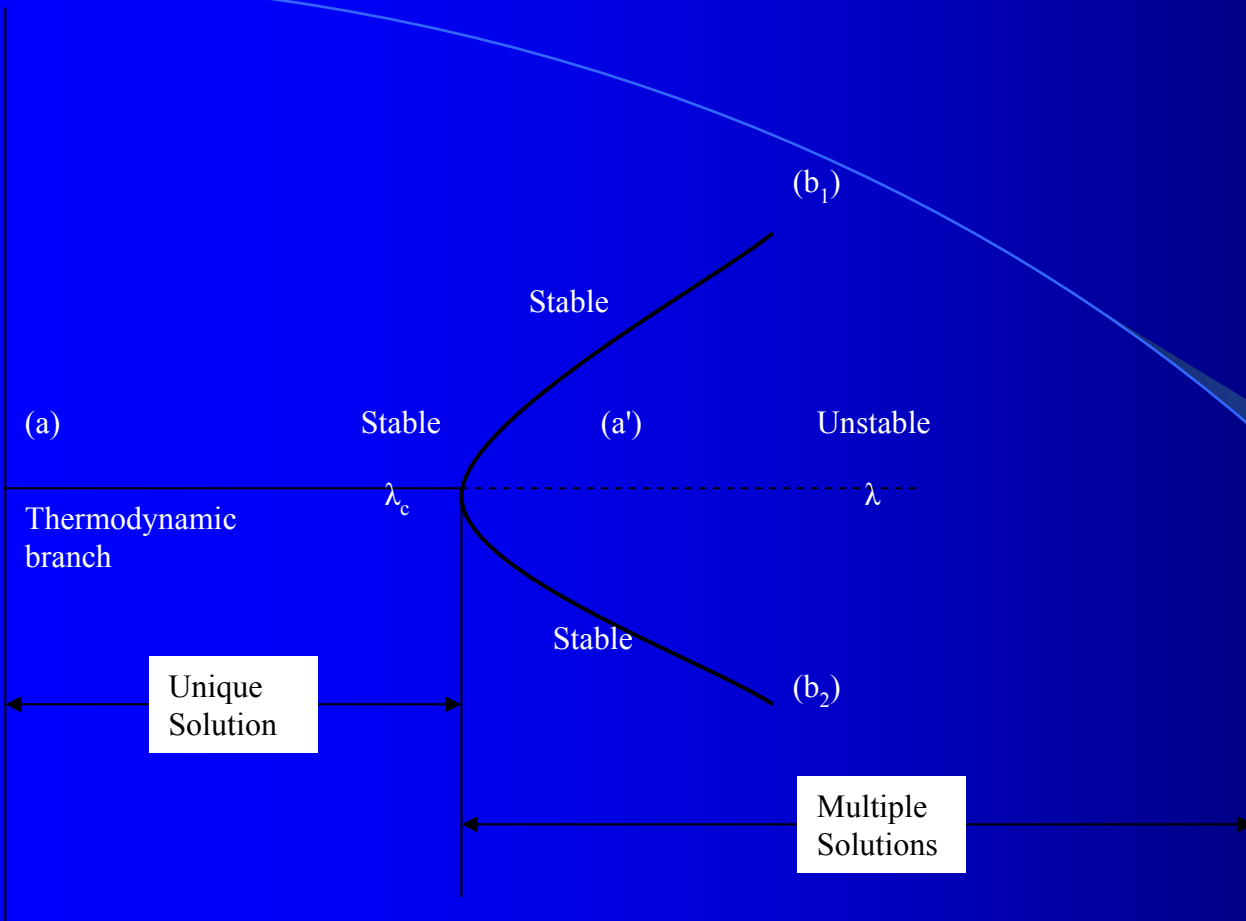
- **Benard cell** - example of a physico-chemical dissipative structure
- *“By applying an external constraint we do not permit the system to remain at equilibrium.”*
[Nicolis & Prigogine 1989, p10]



(a)

(b)





Bifurcation Diagram
 (from Nicolis & Prigogine, 1989, p72)

Showing how a state variable X is affected when the control parameter λ varies. a unique solution (a), the thermodynamic branch, loses its stability at λ_c . At this value of the control parameter new branches of solutions (b_1, b_2), which are stable at the example shown, are generated.

Several things have happened:

- (a) *self-organisation*: the water molecules have spontaneously organised themselves into right-handed and left-handed cells
- (b) from molecular chaos the system has *created order* and a *structure has emerged*
- (c) the handedness or direction of rotation *can neither be predicted nor controlled* although we can predict that the cells will appear

- (d) the system was pushed far-from-equilibrium by an *external constraint or perturbation*
- (e) the homogeneity of the molecules at equilibrium was disturbed and their *symmetry was broken*
- (f) the particles behaved in a *coherent* manner, despite the random thermal motion of each of them

This coherence at a macro level characterises *emergent* behaviour, which arises from micro-level interactions of individual elements

- In classical thermodynamics heat transfer or dissipation was considered as waste, but in the Benard cell it has *created new order*
- It is this ability of complex systems to *create new order and coherence*, which is their distinctive feature

Ilya Prigogine's contribution

- Reinterpretation of the Second Law of Thermodynamics.
- Time-irreversible processes are a source of order
- Arrow of time need not be associated with disorder
- Dissolution into entropy is not a necessary condition – but “*under certain conditions, entropy itself becomes the progenitor of order.*”

Critical Point: Innovation

- 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

Exploration

- When an individual, group, organisation, industry, economy, country, etc is faced with a constraint, it finds new ways of operating
- At far-from-equilibrium systems are forced to experiment and explore their *space of possibilities*
- Discover and create new patterns of relationships and different structures

TEC: Far-from-equilibrium

- Meant moving away from the norm
- Transition from a Civil Service to a more entrepreneurial and innovative culture
- 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
- Did not appear fully formed; they emerged through self-organisation, co-evolution and constant feedback

TEC: Far-from-equilibrium

- TEC created a new order, which was significantly different from the old
- But before it emerged many alternatives were possible
- 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
- They became used to living with stability and turbulence at the same time
- Process based on co-creation, co-operation and a new way of thinking

TEC Innovative Environment

- New way of thinking included removing a lot of the **'stabilisers'** :

Plans

Budgets

Hierarchy charts

Job descriptions

Targets

Objectives

- Problem: not the stabilisers, but the *constructs* around them
 - they give the wrong boundaries
 - e.g. a budget gives a boundary around the cash and behaviour becomes driven by cash rather than by needs
- Focused on the activity not the money
- Reframed the constructs (stabilisers)
- Unlearning & providing a lot of support before removing the stabilisers
- Replaced stabilisers by **processes** that concentrated on *connections* and *patterns*

- **Not a change programme but an emergent process**
- What do we want to be? (not do)
- **Not structure less - but a different kind of structure based on **Design Principles****
- **Emergent & ongoing:** design principles, structure, values, culture - through long iterative process
- **Trojan mice** - small ideas

Design Principles

1. Make connections

Everyone can talk to everyone and should

Everyone is responsible

Network extensively

2. Learn continuously

Love mistakes to death

Respond to the environment

Learn by doing

Design Principles

3. Make processes ongoing

Learning, planning and evaluating are a continuous cycle

Processes and systems are based on:

- our best people
- outcomes

Structures and systems should follow not lead

Self organising teams

Self responsibility

Innovative Environment

- Emerged
- Based on key beliefs

Key Beliefs

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)

Key Beliefs

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 - 5

Beliefs 1, 2, 3

- Put the emphasis on the importance of individual and organisational development, on relationships and on learning
- These three elements facilitated efficacious co-evolution in a social context

Beliefs 3, 4, 5

- Meant 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”

Beliefs 5 - 8

- Meant that individuals were responsible for their own actions and decisions
- 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 organisational system had to be self-regulating “*do it, keep adjusting it, learn and co-evolve with it*”
- Most systems are 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 9

- Encapsulated the ethos that had developed
- The TEC had articulated a deep desire in individuals to do something worthwhile and to have fun
- By saying so, it quite revolutionised the workplace
- The TEC also articulated its values

Values

- Honest
- Open
- Learning
- Integrity
- Supportive
- Trust
- *Innovative*
- Considerate

TEC Strategy

1. Focused Development & Growth of Local Economy

**2. Helping
Businesses grow**

**3. Helping
people learn**

Initiatives

Part of Innovative Environment

- Exploration Fund

Going to Conferences e.g. on space

Inviting sculptor to talk about creating spaces

What does space mean in the context of the TEC?

About stretching, challenging the thinking

- Collective space - cafe area

- Quiet space (with sound screens) in open plan offices

Enabling Environment

- The TEC example shows that *innovation is not a single major initiative*
- It is more about *co-creating an 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
- From small personal initiatives they will expand into major initiatives involving others

Far-from-equilibrium + Next Adjacent

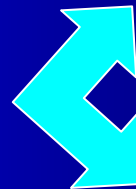
- Social evolution happens both in small and large steps
- The large steps move a system to a new way of organising: *creation of new order, far from equilibrium*
- Small steps may involve exploration of the *next-adjacent* and is a fruitful means of innovation
- May involve relatively small initial changes, but requires a significant change in thinking and in ‘seeing’ new possibilities
- Individuals can do it unaided but if an enabling environment is created then innovation becomes a way of life

Creation of New Order

- Connectivity, diversity & co-operation
- +
 - Self-organisation of agents at micro-level
- +
 - Emergence
 - process of transition from micro to macro
- +
 - Exploration & Co-evolution



New Order



entities (e.g.
institutions)

relationships

Conclusion

- Understanding the characteristics of organisations as complex co-evolving systems
- The TEC illustrated that innovation can be facilitated through the **co-creation of an enabling environment**
- Also a **learning environment**
- Innovation is **not a single event but a continuing process**, a way of thinking and behaving
- EE help organisations to **become more creative and innovative by creating new order**; i.e. new ideas, new products, procedures, processes, structures and a new culture