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Systems Thinking 101: The Magic of Systems Thinking

Systems Thinking: Both New *and* Old

Systems thinking is not new. The principles of systems thinking have been known and adopted for hundreds (even thousands) of years. Famous-thinkers through history include Leonardo da Vinci, Isaac Newton, Charles Darwin and Albert Einstein.

The wisdom and knowledge inherent in systems-thinking crosses cultural and language barriers, and is implicit in the teachings of ancient Hindu scriptures, sufis, zen buddhists and Native American culture.

The modern world, however, is only now beginning to understand the relevance of systems-thinking. Now, school children are routinely taught about how complex systems such as climate change work and how small changes in the balance of things can have disproportionate effects and unintended consequences in other areas. Thirty or forty years ago these ideas were simply unthinkable to the mainstream.

You are about to realise that you've been a systems thinker all your life.

Definition of a System

A system is:

"An interconnected set of elements that is coherently organised in a way that achieves something".

- Donella H. Meadows

Many things in your life are systems. Your own body, for example, is a perfect example of a system comprising a digestive system, immune system, temperature regulation system etc. Other systems might include a car, a forest, a school, or an organisation. Systems are all around you.

System "Elements"

A key principle of systems is that they are comprised of "elements" or components. Hence, your car for example has an ignition system, fuel system and braking system.

These components can work alongside each other, or they can be contained or embedded within each other. I remember being fascinated with this embedding of elements as a child and went through a phase of always writing my address as "… United Kingdom, Europe, The World, Solar System, The Milky Way, The Universe".

Elements within an organisation for example, could include specific business units, department or divisions. At a higher level, for example, a group of companies could be composed a set of companies within a group.

System “Interconnections” and “Interrelationships”

The elements that comprise a system are interconnected and are interrelated. These element can effect the other elements within the system in a myriad of ways.

For elements that are embedded within each other within an organisation, for example, a business unit operating within a division will be affected by the actions of the division. In the same way, the division will be affected by the actions of the business unit itself.

Elements operating at the same “level” may also be interconnected. For example, there may be a specific process “flow” at work in a manufacturing organisation … where a particular part is assembled in Department A and then might be passed to Department B where it might be combined with another part and then perhaps operated on in some way (bolted, welded, sprayed, polished or whatever).

The “interconnection” and “interrelationship” within an organisation may also mean that there is a flow of information from one team or department to another. The information that flows across departments is often the “lifeblood” that holds the organisation together.

WIthin an organisation, the fact that these various elements also operate independently mean that there needs to be a flow of information up and down, as well as across. This also suggests that there needs to be a certain amount of coordination across the elements, as well as overall management and control of each element to ensure that they operate together in some sensible way. This is the unfolding of complexity that takes place in every organisation at every moment. It proliferates and requires management.

“Emergence”

A key principle of systems-thinking is the idea that the “whole is greater than the sum of its parts”. This is the principle of emergence, and says that when elements of a system come together and interact in some way, that something else emerges from the interaction of those elements that was not present in the elements themselves.

On Friday night, we went to see the fabulous Justin Adams and Juldeh Camara in at the Bluecoat in Liverpool. This was a perfect example of emergence. The band comprised Justin Adams on guitar, and Juldeh Camara on the ritti (a West African one-stringed fiddle) and Martin Barker on drums. Now, the music from each of these instruments on their own is interesting and unique. Put together and the effect is mesmerising. Something distinctive and unique and very special is emergent from the combination of each unique element. Interestingly, the action and energy of the audience also affect the playing of the band and vice-versa, so there are interactions at this “higher” level too.

So, systems thinking is really a way of understanding the world that emphasises the relationships among a system’s parts rather than the parts themselves. When we look at the world in this way, some rather interesting things start to become apparent. We can begin to see, for example, what is happening at several different “levels” of a system and this can give us some very useful information about what is happening and why. This, in turn, can give us clues as to why what we expected to happen didn’t happen and what we need to do at the level of the system itself in order to achieve the outcome we want.

System Purpose

This is a good time to talk about purpose.

What is emergent from a system is not necessarily the same as what we intended.

Think about that for a while. What this means is that our declared intentions for the system have nothing to do with what the system actually does.

So, if your organisation is constantly declaring that "our people are our greatest asset" but actually do nothing to demonstrate this (and absenteeism and staff turnover may be as high as ever, whilst training and development opportunities may continue to be extremely limited. for example)… then what you are hearing in that "declaration" is merely a pipe dream.

Stafford Beer summed this up with his statement that "the purpose of a system is what it does". Again, think about that statement because that has lots of powerful implications.

The purpose of a system has nothing to do with rhetoric, and everything to do with behaviour.

Going back to elements for a minute. Consider what happens when you have one element nested within another (say a business unit within a division). The purpose of the business unit will be operating within the division, and may be either in harmony or in conflict with the purpose of the division.

Complexity Over Time

When we consider the various combinations of interaction of elements, interrelationships and interconnections … there's quite a lot going on isn't there?

All of this complexity is, as mentioned yesterday, unfolding over time. There are also different kinds of complexity. There is detail complexity if there are lots of different elements. There is dynamic complexity if there are a large number of connections between the elements where each element could have a number of different states.

So how do you know what effect change an element, or a relationship or a purpose is going to have? Whilst the answer is quite possibly (and rather unhelpfully) "an infinite number", there are certain guidelines and principles that are useful to bear in mind when we consider possible changes to system and the effect this might have…

- Changing an element of a system will always have side effects.
- Changing an interconnection is likely to have a disproportionate effect compared to change a part of an element.
- Changing the purpose of a system (for example changing the purpose of a business from "making money" to "making people happy") is likely to change the system significantly.
- Removing elements or parts of a system (for example, removing the Research and Development function form a Pharmaceutical company) would have a significant impact on the performance of the whole system.
- In the same way, altering the relationship of elements in the system (so a set of parts is first polished and then soldered and then bolted to another part, for example) can have a significant impact, such that the nature of the system itself is radically altered.
- Generally, there is a time delay between cause and effect in systems.

Dynamic Systems

Most complex systems are "dynamic" … that is they have multiple parts or elements of the system that are changing, whilst the system itself remains distinctive, recognisable and retains its overall nature. Sometimes it is the process of change itself that keeps the system functioning.

The system of a bicycle and rider, for example, has two main sub-systems with each sub-system having many moving elements and both sub-systems heavily influencing the other. When moving, the bike and rider together create sufficient forward momentum (through energy expended by the rider) that the bike and rider are able to stay upright. Dynamic systems (or systems in constant movement) can therefore reach a state of stability, without any external intervention.

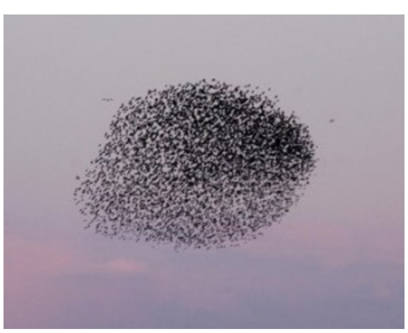
This is known as self-organisation, and is possible because of the flow of energy that connects the system with its environment. A flock of birds appears as a single entity because each bird within the flock is able to respond to the currents of air surrounding them created on a moment-by-moment basis by the changes in position of neighbouring birds. It is this energy – constantly flowing through the system from the environment – that allows the system to remain in its stable state. Hence, when both bike and rider come to a standstill, there is insufficient energy to keep them both upright … and they will both fall over.

Bike and RIder

Open Systems

Self-organising systems all exchange energy with their environments in this way, and are therefore all characterised as “open systems”. Hence, if you are managing a complex system and you want that system to operate effectively, maintain order and stability, then it is essential for the system to remain open. A variety of tools, methodologies and models, allow system-thinkers to examine closely the nature of this energy interchange with a system’s environment. The Viable System Model (VSM), for example, has a specific model component (known as “System 4”) that explores the system’s relationship with its environment. VSM practitioners are able to examine various aspects of an organisation’s structure, information flow, processes etc. and make diagnostic assessments of the organisation’s viability based on its fit with the VSM model principles.

The exchange of energy with the environment, and the dissemination of this energy though the system is an important point. It is the role of leadership to “pump” this energy through the system so that in the case of a sales team, for example, a state of high-performance can emerge. Systems-thinking provides the practitioner with a whole set of principles and guidelines for creating and managing high-performing teams.



Flock of Birds

However, in order create and maintain a high-performing team, it is sometimes necessary to constrain the action and behaviour of the individual for the benefit of the team (or system) as a whole. For example, in the same high-performing sales team, we might establish geographic territories in order to restrict the operation of individual salespeople to each territory that is assigned to them, so that we avoid the likelihood of more than one salesperson contacting the same client. In order for the team to operate successfully, feedback will also need to exist, so that each team member can share information about important changes and opportunities across territories.

Self- Correction

The behaviour of the system may also be impacted by external interventions or external “perturbations”. In these circumstances the dynamic system may be able to react to the external intervention and correct itself accordingly. For example, using the example of driving again, when a pedestrian steps into the road the driver is able to swerve out of the way. Shortly after this event, a set of principles (such as the rules of the road, usual speed limits etc.) all act to encourage the system to stabilise. Car and driver return to normal operation, and (adhering to the rules of the road) arrive back at their usual position in the road to gradually resume normal speed. Hence, the system is able to react to this small external perturbation, and resume normal functioning very quickly.

If, on the other hand, another car comes out of a side road unexpectedly and crashes into the first car, the energy of this larger external perturbation is too great for the system to handle and both car and driver come to an abrupt halt. Hence, when an external perturbation acts on a dynamic systems outside of the limits it can handle, the system as a whole will return to a static state.

The ability for dynamic systems to self-correct, is similar to the process of homeostasis that operates in the human body to ensure our temperature stays close to 36.9 degrees centigrade. When we get too cold, we naturally begin to shiver so the body is able to generate heat. When we get too hot, the body produces sweat which has a cooling effect. However, there are limits to this. If we get too cold for too long, hyperthermia will set in. If we get too hot for too long, we get heat stroke. Hence, whilst we are usually able to cope with feedback from the external feedback, there are usually limits within which the system must operate to remain stable. In other words, there needs to be a balance in the feedback loops that exist within the system.

Finding Balance

Finding balance within complex systems such as organisations is not always easy. Whether we notice them or not, limits are always present. The world appears to have a surfeit of managers who deliver results at great expense to those around them. A surprising number of individuals appear to achieve seniority by focusing on short-term delivery, them moving on and leaving others to deal with their mess. A great many issues (including corporate scandals, high staff turnover, unsustainable growth etc.), tend to follow the attitude of short-termism. Systems-thinkers are very wary of short-term thinking … and for good reason. Systems that operate at (or beyond) limits for any length of time, don’t survive for very long.

Native American tribes, on the other hand, considered the impact of their key decisions on “seven generations hence”. The corporate world as a whole, it seems, is yet to learn the wisdom of this philosophy and find the balance that is required. The move away from short-termism is, however, already beginning.

At Watt Works (and hopefully you'll forgive the shameless plug here), our philosophy and approach is built on delivering sustainable performance improvement. Systems-thinkers have a variety of tools at their disposal to tease apart the relationships and dynamics that exist within a system to really understand what is going on – often revealing unique insights as to the nature of the system and what interventions are required to bring the system back into balance.

Are you able to find the balance required to ensure your organisation is able to create and sustain a high-level of performance?

See-Saw

Finding this balance is about much more than not straining the system to its limits – it requires understanding the inflows, outflows and dynamics happening in each area of the system in order to highlight interventions that are likely to improve things for the long-term …. not just the short-term.

As you are already more than half-way through this series, as a budding systems-thinker you should be beginning to gain glimpses of the value that a systems-thinking focus could add to your business.

Tomorrow, we'll explore some more of the difficulties that arise when we attempt to intervene in the functioning of systems.