Systems Thinking
Introduction and Case Study

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The unleashed power of the atom has changed everything save our modes of thinking, and we thus drift toward unparalleled catastrophes.

Albert Einstein

Systems Thinking is a holistic way of thinking about the world, work and life based on the primacy of relationships. Systems Thinking is rooted in scientific disciplines of mathematics, physics, biology and psychology – It is a science that unifies all sciences.

Peter Senge describes Systems Thinking in the following words:

"Systems Thinking. A cloud masses, the sky darkens, leaves twist upward, and we know that it will rain. We also know that after the storm, the runoff will feed into groundwater miles away, and the sky will grow by tomorrow. All these events are distant in time and space, and yet they all connected within the same pattern. Each has an influence on the rest, an influence that is usually hidden from view. You can only understand the system of a rainstorm by contemplating the whole, not any individual part of the pattern.

Business and other human endeavours are also systems. They, too, are bound by invisible fabrics of interrelated actions, which often take years to fully play out their effects on each other. Since we are part of that lacework ourselves, it's doubly hard to see the whole pattern of change. Instead, we tend to focus on snapshots of isolated parts of the system and wonder why our deepest problems never seem to get solved. Systems thinking is a conceptual framework, a body of knowledge and tools that has been developed over the past fifty years, to make the full patterns clearer, and to help us see how to change them effectively." [1]

Complexity underlies most business, economic, natural and social systems. Systems Thinking deals with hidden complexity, ambiguity and mental models. It provides tools and techniques to leverage change and to create lasting interventions. On a practical and personal level Systems Thinking can be viewed as a *language* for understanding change and complexity. It helps us understand the world through relationships and to anticipate the long-term consequences of our decisions and actions, polices and strategies, through unfolding cause and effect over time.

Systems Thinking has three distinct but related dimensions: a Paradigm or philosophy, a tool or language, and a computer modeling technology, as follows:

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[1] Peter Senge, "The Fifth Discipline – The Art & Practice of the Learning Organization", Random House, 1990, pp 6-7

a) Paradigm provides a way of thinking about the world and relationships. Systems Thinking paradigm can be explained by the following types of thinking: [2]

- Forest thinking – ability to see the big picture – the forest *and* the trees
- Dynamic thinking – recognising that the world is not static and that things change constantly
- Operational thinking – understanding the 'physics' of operations and how things really work and affect each other
- Closed-loop thinking – recognising that cause and effect are not linear and that often the end (effect) can influence the mean/s (cause/s).

b) Language: for understanding complexity, change, and uncertainty. The Systems Thinking language uses diagrams to explain non-linear cause and effect relationships. Systems thinking language: [3]

- is visual
- has a set of precise rules (syntax)
- translates perceptions into explicit pictures
- emphasises closed interdependencies (it is 'circular')

c) Methodology: Systems thinking incorporates a set of modeling and learning technologies. The modelling tools can be used to create powerful simulation models to understand the structure of a system, the interconnection between its components, and how changes in any area will affect the whole system and its constituent parts over time. Systems models can (i.e. strategy, pricing polices, process design, re-engineering, etc), can be used to study and foresee the behaviour of systems, as well as to facilitate and accelerate group and organizational learning. Systems thinking tools include:

- Causal Loop Diagrams (CLD)
- Stock and flow models
- Learning laboratory
- Microworlds
- Group model building

Why Corporations Fail?

"Most commercial corporations are dramatic failures—or, at best, underachievers. They exist at a primitive stage of evolution; they develop and exploit only a fraction of their potential. For proof, you need only consider their high mortality rate. The average life expectancy of a multinational corporation—Fortune 500 or its equivalent—is between 40 and 50 years. This figure is based on most surveys of corporate births and deaths. A full one-third of the companies listed in the 1970 Fortune 500, for instance, had vanished by 1983—acquired, merged, or broken to pieces.) Human beings have learned to survive, on average, for 75 years or more, but there are very few companies that are that old and flourishing … Even the big, solid

[2] Barry Richmond, 1977

[3] Anderson and Johnson, 1997, pp 20–21

companies, the pillars of the society we live in, seem to hold out for not much longer than an average of 40 years… A recent study by Ellen de Rooij of the Stratix Group in Amsterdam indicates that the average life expectancy of all firms, regardless of size, measured in Japan and much of Europe, is only 12.5 years.

Why, then, do so many companies die prematurely? There are many speculations about the reason, and this area undoubtedly needs much more research. However, there is accumulating evidence that corporations fail because the prevailing thinking and language of management are too narrowly based on the prevailing thinking and language of economics. To put it another way: Companies die because their managers focus on the economic activity of producing goods and services and they forget that their organizations' true nature is that of a community of humans." [4]

Systems Thinking Tools [5]

One of the Systems Thinking modeling tools is known as Causal Loop Diagram (CLD). CLD reveals the *causal* relationships amongst a set of variables (or factors) influencing a system. The basic elements of CLDs are **variables** (factors) and **arrows** (links).

A 'variable' is a condition, situation, action, or decision which can influence, and can be influenced by, other variables. A variable can be quantitative (measurable) such as profit, productivity, or absenteeism, or it can be qualitative (soft). Examples of soft variables are motivation, trust, morale, burnout, reputation and so on. Qualitative variables do not generally lend themselves to direct measurement. One of the strengths of causal loop methodology is its ability to incorporate qualitative variables in the systems thinking approach.

An arrow (or link) indicates a causal association between two variables, or a change in the condition of these variables. For example, advertising would increase demand and higher price can cause a fall in demand. In general, if variable X directly affects variable Y (or influences, has an impact on, or causes a change to variable Y), then an arrow drawn between X and Y indicates this relationship.

Systems Thinking Case Study

The following case is set in a global executive recruitment and consulting organization. The CLD model is developed by the management team during their Systems Thinking training course. The driving question for this case was:

What are the key trends that are troubling your organization?

The participating team identified two key patterns (or KPIs) that have persisted and worsen over the last few years. They are market share and staff turnover. The team sketched the following "behaviour over time" (BoT) patterns for these variables.

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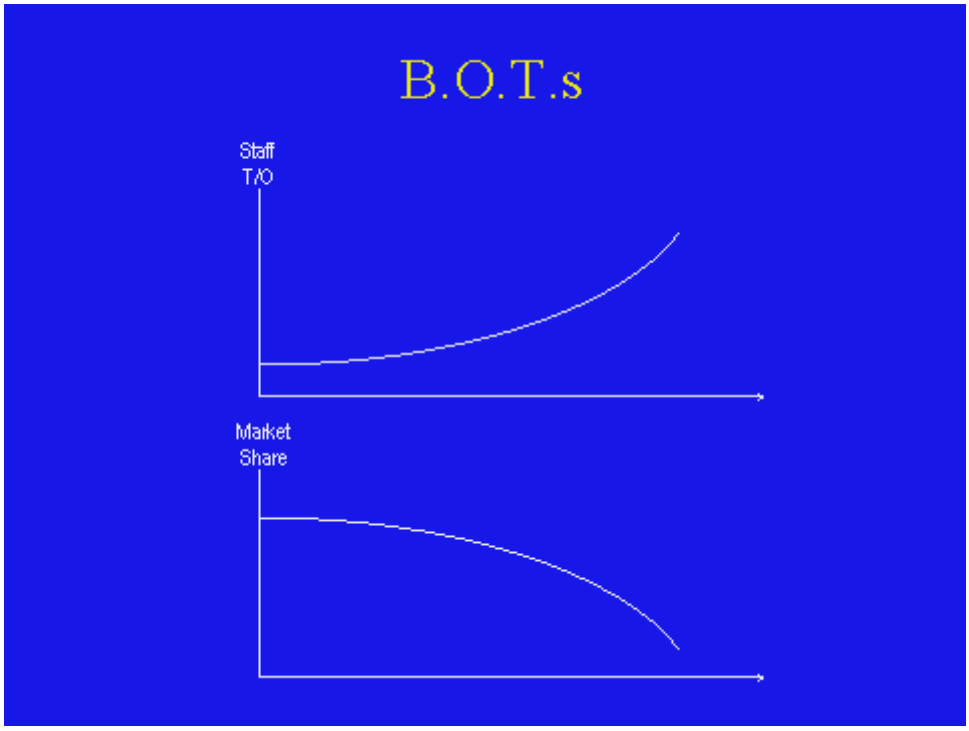
[4] Arie de Geus, The Living Company, Harvard Business School Press, Boston, Mass 1997

[5] Maani, K and R Cavana, "Systems Thinking and Modeling – Understanding Change and Complexity", Prentice Hall, 2000, Chap 3



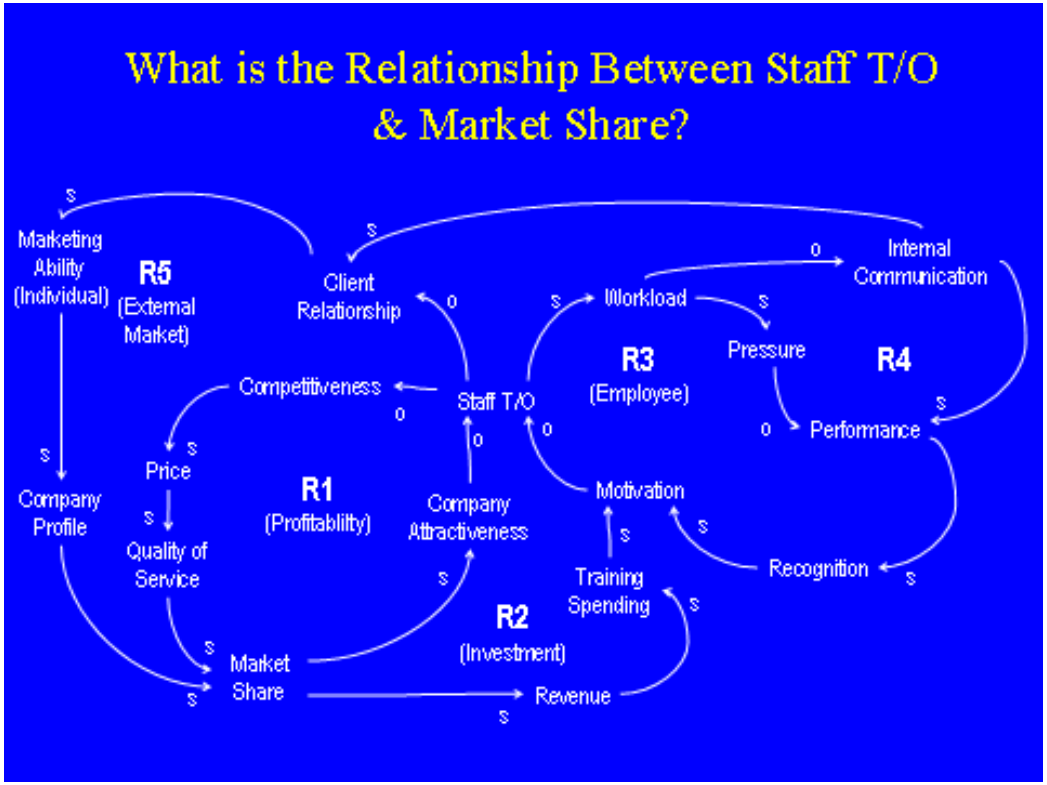
Discussion

The group were asked to describe the relationship between the above patterns through a systems diagram (CLD). Ordinarily this kind of question is not asked in organizations as each set of KPIs (e.g. above patterns) is under the purview of a separate department or function - in this case, HR and marketing, respectively. This fragmentation of functions (silo model) masks critical links and vital dynamics between business functions and their effect on the organization as whole.

The Systems Thinking course participants were grouped into cross-functional teams to develop a systems model in relation to the key question. The CLD below, developed by the participants, explains the dynamics that have given rise to company's predicament.

From the systems diagram we can see that the relationships between the key variables are far from simple and linear. They form a number of closed loops (R1-R5) which indicate reinforcing effects and interdependent dynamics within and between the loops. The CLD further demonstrates the influence of 'soft' variables such as *motivation* and *recognition* on "Staff T/O" and their flow on effect on other key performance areas.

The CLD shows that staff turnover and market share are not isolated and independent but are rather dynamically linked and cause symbiotic growth or decline in each other as well as in other key performance areas of the company.



Legend
‘s’ indicates a change or influence in the “same” direction- that is an increase (or decrease) in one variable causes an increase (or decrease) in the other variable.
‘o’ indicates a change or influence in the “opposite” direction- that is an increase (or decrease) in one variable causes a *decrease* (or increase) in the other variable.
‘R’ means a “Reinforcing Loop” which leads to continuous growth or decline