



Applying Systems Thinking in Business Intelligence Tools

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Abstract:

Business intelligence is the set of tools, processes, practices, and people that are used to implement useful information to support decision making in the organisation. System thinking is a new paradigm that enhance decision making by describing dynamic relationships that influence the behaviours of systems. This paper illustrates the importance of implementing system thinking in BI Tools by providing the ability to see the world as a complex system, where “you cannot just do one thing” and that “everything is connected to everything else”. It is a holistic worldview that enables people to act in consonance with the best interest of the system as a whole and thus enhance the learning loop through various system thinking tools such system dynamics approach.

Keywords: Business Intelligence, Systems Thinking, Systems Dynamics, Simulation

Business Intelligence:

The term business intelligence was first used in 1989 by Howard Dressner, then a research fellow at Gartner Group, as an umbrella term to describe concepts and methods to improve business decision making by using fact-based support. Business intelligence is one of the information technology areas that has grown and evolved the most in the last few years. According to a recent research by MIT, the total spending on business intelligence and performance management by 2008 was 57.1 billion dollars, in a market growing 4.2% per year. Through business intelligence it is easy nowadays to improve the decision making process in virtually any department, organisation or industry. Business intelligence tools have evolved in the last few years offering more functionality to the manager or analyst, and also provide solutions for more users [1,2,3]. But managers today are expected to cope with increasing complexity, change and diversity. They have to continue to ensure that organisational processes are efficient and that they are served by the latest developments in technology. As the world becomes more complex, many people and organisations find themselves bombarded with lots of problems to solve, less time to solve them, and very few chances to learn from their mistakes. Managers will need to deal with complexity and with these changes. Also they need to develop their new capabilities to be able to create an effective learning process in complex dynamic systems to overcome the different barriers to learning which are created by complex dynamics systems, and thus to get a significant insight into their simulated problems. This can be done by allowing the managers to develop new ways of thinking that allows deeply understanding of the simulation process, the relations between the variable, and the consequences of their experiments more effectively.

Lots of philosophers, scientist and managers have been calling for a fundamental new ways of thinking that improve the ability to see the world as a complex system. As Sterman [4] stated, “a system in which we understand that you can’t just do one thing and that everything else is connected to everything else. He argued that it’s crucial to develop new ways of system thinking. He states that “if people had a holistic worldview, they would then act in consonance with the long term best interest of the system as a whole, identify the high leverage points in systems, and avoid policy resistance”.

This can be done by using new simulation methods that increase the capabilities of managers to experiment their decisions more effectively by using system dynamics simulation tools.

Systems Thinking:

Systems Thinking concept was produced as the world of systems found that there is a need to shift from the more linear, analytic way of thinking that many of us are used to, to a non linear, dynamic and holistic thinking.

Moving to new Paradigm in analysing complex problems enables the managers and the analyst to understand dynamic relationships and complexity that influence the behaviour of a system as shown below, and thus improve business intelligence in organisations

Features of Systems Thinking**Dynamic and Non-Linear Thinking**

The static thinking assumes that causality runs only one way and any system’s factors are independent which is quite primitive. Dynamic thinking offers effective alternatives to see and understand systems or problems. This creative thinking allows viewing the world with ongoing, interdependent relations, dynamic process. Each of the causes in the dynamic thinking is linked in a circular process to both the effect and to each of other causes. These circular processes are the feedback loops which enable us to better understand what is going on in the system; these circular loops represent a non-linear and dynamic thinking, Richmond [5].

Taking into consideration this type of thinking, the analyst or the manager can understand the problem in a better way as the feedback process inside a firm clarifies the dynamic relations inside a firm, analysing the causes and effects and their interconnection and allows for observing the behaviour over time.

For example, if a firm decreases its product's price, this decision has an effect on the sales as it increases the sales, but on the other hand the firm's profits will be less than usual, which affects the firm's pricing policy and push the firm to increase the prices.

Holistic Thinking

Holistic thinking is one of the most significant features of systems thinking as it allows us to see the "Big Picture". So instead of examining each part of the system, the whole system is examined. Whatever the problem we are experiencing and searching for its source, we must always widen our focus to include that bigger system. Dealing with the wholes rather than parts is a very effective idea in system analysis. Each part or department in a firm is not isolated from other department, so trying to solve a problem in one process; we must first look the whole firm and the interconnections inside it to understand the nature and the reasons for such problem.

This research illustrated how systems thinking tools provides managers and analysts with a creative holism to enhance their decision making process.

Systemic Thinking

In recent years, systems thinking has provided new effective methods for tackling issues in a systemic than a reductionist way. Systems thinking allow us to look for various patterns of behaviour, to seek underlying systemic interrelationships which are responsible for these types of behaviour and events.

A recent study by Bartlett [6] defines systemic thinking as a technique that provides a deeper insight into complex situation very quickly. It stated that Systemic thinking "combines analytical thinking (breaking things apart) with synthetical thinking (putting things together)" as the next figure shows.

This provides more effective holistic and systemic analysis of the system.

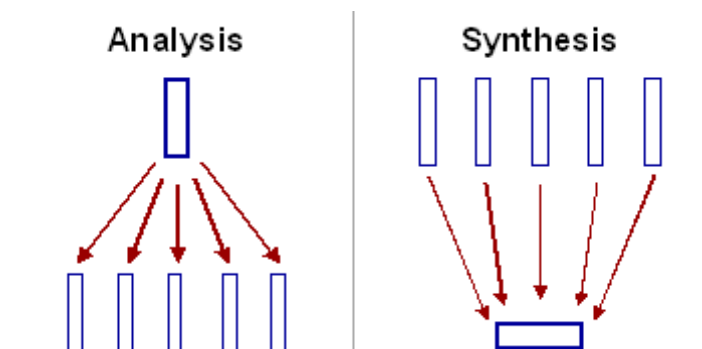


Figure 1: Analysis and Synthesis. Bartlett [6]

Systems Thinking Approaches

Systems thinking approaches can be divided into two categories, hard systems and soft system. Hard systems thinking is a generic title defined by Checkland [7] to various types of systems approaches for solving problems in the real world. The approaches related to hard systems are operational research, system analysis and system dynamics. It is a useful way of thinking which gives the managers and the decision makers the ability to optimize and control the system's performance in pursuit of clearly identified goals. Another approach is introduced to help to decide what purpose the organisation should pursue which is soft systems methodology and Cybernetics.

In this paper, we will introduce system Dynamics methodology, and later how SD models can theoretically improves the decision making process in the organisation.

System Dynamics

System Dynamics methodology is considered an important approach which has a sophisticated tools such as Virtual world (formal models, Microworld, management flight simulators, computer simulation) in which decision makers and managers can refresh decision making skills, test their scenarios and strategies, and conduct experiments through effective simulation by using system Dynamics simulation tools

System Dynamics is a computer-aided method for analysing, framing, understanding, and solving problems in complex real world systems. Jay W. Forrester's work at the Massachusetts Institute of Technology was the major move towards developing this field to extend the range of applied system thinking to more strategic problems in complex systems.

System Dynamics approach uses a perspective based on information feedback and delays to understand the dynamic behaviour of complex physical, biological, and social systems. It also helps the decision maker untangle the complexity of the connections between various policy variables by providing a new language and set of tools to describe. It even models the cause and effect relationships among these variables [4, 10, 11]

Furthermore, System Dynamics method enables the decision makers or the modeller via its tools in any system to identify the underlying structure of their system or issue and how this structure determines the system's behaviour as shown in the diagram in figure 2, The left arrow symbolizes the relationship while the right arrow indicates the deeper understanding that happens from analysing a system structure. System Dynamics can also be used to study the changes in one part of a system in order to observe its affect on the behaviour of the system as a whole. Martin [8]. Sterman [4] gives an insight that the real value of an SD model should be to eliminate problems by changing the underlying structure of the system rather than anticipating and reacting to the environment. This allows the model to interact with the environment and gives/alerts feedback for structure changes. This is what the term (Dynamics) refers to. To The changes in the system's variables while interacting which stimulate changes over time?

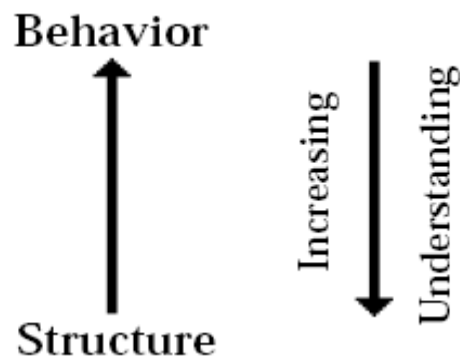


Figure 2: the link between structure and behaviour

Lyneis [9] stresses the importance of System Dynamic simulation and its power to forecast a market demand for instance and compares this with a statistical forecast. He mentions that an SD Model provides more reliable forecasts than the statistical (non-structural) models and tries to understand the underlying structure that created the data stream.

Implementing SD Modelling in Decision Support System, Data warehouse, Data mining, and OLAP powers the managers ability to get a deeper insight into the problem and analyse it by testing different scenarios by using SD models and simulators

4 Conclusion:

This paper briefs how Systems Thinking tools especially System Dynamics Could be a significant tool because it can easily deal with non-linearities and time which are not considered by a static analysis.

By applying System Dynamics, one can enhance the usefulness of the model to address and analyse problems in a complex situations and provide more significant, rational and pertinent policy recommendations, and of course better understanding of the problems which finally leads to effective decision making process.

In summary, the process is to "observe and identify problematic behaviour of a system over time and to create a valid diagrammatic representation of the system, capable of reproducing by computer simulation the existing system behaviour and facilitating the design of improved system behaviour. Existing business simulators are designed to allow the users to play a realistic role in management decision making. Users can make decisions and receive outcome feedback about their performance, by

rehearsing strategies and observing results, the managers in the case study were able to discover how to make better decisions and hence improve their performance and reduce the risk of losing money and thus increase the business intelligence tools efficiency.

References:

- [1] McMurchy, N., Survey of BI Purchase drivers shows need for new approach of Business Intelligence, July, 2008
- [2] Gartner., Gartner identifies the top 10 technologies for 2010, <http://www.gartner.com/itlpage.jsp?id=1210613>, 2009
- [3] Reyes, E., A systems Thinking approach to business intelligence solutions based on cloud computing, MIT, Boston, 2010
- [4] Sterman, J., Business Dynamics: System Thinking and *modelling for a complex world*, USA, 2000
- [5] Richmond, B., Systems thinking: critical thinking skills for the 1990,s and beyond. *System dynamics review*, 9(2), pp. 113-133, 1993
- [6] Bartlett, G., Systemic thinking: a simple thinking technique for gaining systemic focus. *In the international conference on thinking, breakthroughs*, USA, 2001
- [7] Checkland, P., *Systems Thinking: Systems Practice*, John Wiley &sons, 1981
- [8] Martin, L., *Mistakes and Misunderstandings: System Dynamics in Education Project*. System Dynamics Group, Sloan School of Management, Massachusetts Institute of Technology, 1997
- [9] Lyneis, J., System dynamics for market forecasting and structural analysis. *System Dynamics Review*, 16(1), pp. 3-25, 2000
- [10]Gonzalez, C., The use of Microworlds to study dynamic decision making. Dynamic Decision Making Laboratory, Carnegie Mellon University, USA, 2004
- [11]Langley, P. & Morecroft, J., Performance and learning in a simulation of oil industry dynamics. *European Journal of Operational Research*, (155), pp. 715-732, 2004