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Fuzzy cognitive strategic maps in business process performance measurement

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ABSTRACT

This paper elaborates on the application of Fuzzy Cognitive Maps (FCMs) in strategy maps (SMs). The limitations of the Balanced Scorecards (BSCs) and SMs are first discussed and analyzed. The need for simulated scenario based SMs is discussed and the use of FCMs as one of the best alternatives is presented. A software tool for the development, simulation and analysis of FCM based SMs is also presented. The effectiveness of the resulting software tool and FCM theory in SMs is experimented in two case studies in Banking.

1. Strategy maps and the balanced scorecard

Organizations are operating in a continuously changing environment. Market competition requires from management to continuously adapt their business objectives and revise strategic plans. Organizational performance measurement systems provide the linkage between strategic goals and daily operations. Traditional solely financial based performance measure systems cannot longer meet management expectations. For the last decade managers and academic researchers are focusing on frameworks, methodologies and tools that provide integrated performance measurement systems (PMSs) that analyze organizations from both financial and non-financial perspectives. The most notable example of this type of PMSs, is the Balanced Score Card (BSC) (Kaplan & Norton, 2004). It consists of four perspectives, financial perspective, customer perspective, internal process, and learning and innovation. Usually, 20 to 25 key performance indicators are allocated to each of perspective.

The aim of the BSC is to link business objectives with operational objectives in a balanced way. The first version of BSC or also called First Generation of BSC has many limitations: for example it contains a too simplistic unidirectional causality mechanism, it neglects the notion of cause and effect relationships in time; and it presents high level of vagueness in linking strategic and operational goals.

A big evolution for the BSC was the introduction of strategy maps (SMs) (Eccles & Pyburn, 1992). SMs focus on the causal-effect relationships even amongst measures of different perspectives and objectives, and the alignment of intangible assets. Strategy maps (SMs) represent visually relationships among the key components of an organization's strategy (Eccles & Pyburn, 1992). We could argue that SMs describe strategy in a picture; they are powerful tools which show how value is created through cause and effect relationships. Kaplan and Norton argue that they create "the missing link between strategy formulation and strategy execution" (Kaplan & Norton, 2004).

Strategy maps are particularly helpful for:

- Promoting understanding and clarity of strategy.
- Encouraging greater engagement and commitment to strategy.
- Ensuring alignment of resources.
- Identifying gaps or blind spots.
- Making more effective and efficient use of resources.
- Aligning remuneration with strategy – particularly in the soft areas and where objectives have a duration >12 months.

A strategy map describes how an organization creates value by connecting strategic objectives in explicit cause and effect relationships. They provide an excellent snapshot of strategy and are supported by measurable objectives and initiatives.

Strategy maps enable organizations to (Lawson & Desroches, 2007):

- describe strategy in a single picture.
- Clarify strategies and communicate them to employees.
- Identify the key internal processes which drive success.
- Align investments in people, technology and organizational, capital for maximum impact.
- Expose gaps in strategies so that early corrective action can be taken.
- Identify explicit customer value propositions.
- Map the critical internal processes for creating and delivering. the value proposition.

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- Align human resources, information technology and organization culture to internal processes.

Strategy maps can be used for developing and reviewing strategy at organizational, departmental and even project level.

The strategy map (Kaplan & Norton, 2000, 2004, 2008) evolved from the four-perspective model of the balanced scorecard, adding a visual dimension which improves clarity and focus.

There are five main principles behind strategy maps:

- strategy balances contradictory forces.
- Strategy is based on a differentiated customer value proposition.
- Value is created through internal business processes.
- Strategy consists of simultaneous complementary themes.
- Strategic alignment determines the value of intangible assets.

Strategy maps are used in many frameworks as part of their strategy and change management offerings an example of a strategy map can be seen in the picture below.

The balanced scorecard (Kaplan & Norton, 2000, 2004, 2008) is a performance management system that enables organizations to implement a business vision and strategy.

2. Shortcomings of strategy maps

Although there may be benefits related to the design and use of strategy maps, a number of authors have highlighted possible shortcomings (e.g. (Ahn, 2001; Buytendijk, 2008; Norreklit, 2000)).

2.1. Feedback loops

The development of strategy maps could be criticized as too much of an inward-looking exercise. Also, the cause-and-effect relationships depict a one-way, linear approach often starting with the 'learning and growth' perspective and culminating in financial results instead of depicting non-linear, two-way linkages. However since the Balanced Scorecard perspectives are not independent, feedback loops should be included in the maps (Franco & Bourne, 2005).

2.2. Need for fuzziness in causal relationships

Predictions about the future state of a market and values that business goals and objectives can reach always contain the issue of uncertainty. Also the influence values of cause and effect relationships in strategy maps contain by themselves the issue of vagueness or fuzziness as more than one cause node can be linked to the same effect node with different levels of influence. There is a need therefore for a theory that will accommodate this fuzziness in causal relationships.

2.3. The missing element of time

Norreklit (2003) argues that strategy maps do not discriminate amongst logical and causal links. Typically, in many organizations, there are inconsistencies in the frequency of gathered values and the range in which the values vary over a period of time.

Othman (2007) argues that a very serious drawback of strategy maps is the lack of representing the time evolution element in strategic plans. This missing time element also influences the ability to model performance indicators in SMs.

2.4. Need for dynamic-flexible SMs

According to Buytendijk (2008) relying on a static SM over the mid and long term, is equivalent to assuming not only that the organization and its strategy will stay the same, but also that competitors will continue to behave in the same way. Furthermore, if strategy maps are supposed to have predictive abilities, one could question the validity of analyzing past data to predict future states.

2.5. Need for tools with simulation capabilities

Currently there are no tools in the literature that provide simulation capabilities of composed-decomposed and linked strategic maps. There are only tools that allow the composition of performance calculation of performance measures that are based on values of other performance measures the values of which need to be calculated beforehand.

3. Strategic scenario simulations in SMs

A model is essentially an imitation of something real and simulation is a process of using a model to imitate the behavior of something real. A model is only an imitation of reality and is not in itself reality. This is both an advantage, in that it is usually much easier to manipulate and understand the behavior of a model than reality, and a disadvantage in that one must be careful in generalizing from conclusions drawn from examining the behavior of a model.

Ackoff (1962), Ackoff (1979a) and Ackoff (1979b) suggest that models fall into three categories: iconic, analogue and symbolic; he includes mathematical models under the symbolic category.

Based on the solution approach: analytical or simulation. Many mathematical problems cannot be solved analytically and simulation offers a means of 'solving' such problems.

Simulation is a process of 'driving a model of a system with suitable inputs and observing the corresponding outputs' (Paul, Fox, & Schrage, 1987); in effect simulation is a means of experimenting with a model of reality. Nelson and Winter (1982) see a computer program as 'a type of formal theoretical statement' and simulation as 'a technique of theoretical explanation'.

Simulation is particularly useful where it is impossible, dangerous or inordinately expensive to experiment with reality. This is generally speaking the case with real-life business firms or economies and hence simulation offers the business researcher a means of examining and experimenting with economic and business systems.

Phelan and Wigan (1995) point out that it is particularly difficult for researchers in the strategy field to successfully carry out experiments in order to determine the 'laws' of successful strategic management. They suggest that three distinct difficulties arise: that of observation, manipulation, and replication; they go on to suggest that simulation may assist strategy researchers in overcoming some of these difficulties.

The tools and technique of simulation can be useful to practising managers in two ways: for training in strategy-making and for use in actual strategy-making. Simulation is used as an aid for training managers in the art and science of strategy-making by universities and by management training consultants. Within academia, simulations are increasingly becoming an integral part of strategy textbooks; It is interesting to note that the simulations being used in universities have tracked the movement in theories underpinning strategic thinking from industrial organization economics theory to the resource-based view to systems and complexity theories.