EVALUATING SYSTEM THINKING WITH BSC APPROACH: A CASE STUDY ON BEHNOOSH CORPORATE

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Abstract
Yet, no comprehensive model of the evolution of systems thinking may be found in the literature despite its necessity. System thinking is unclear, but based on some ideas it is conceptual, and it seems a quality expression, so we need to a suitable tool for measuring of systems thinking. There are very limited researches Evaluate systems thinking in management science. This paper measures system thinking by Balance Score Card (BSC) for the Behnoosh corporate in Iran. This article uses following structure based on four perspective of BSC (Learning and Growth, Internal Processes, clients, and Financial). First, some factors in vertical linkages within the systems measured. Thereafter, other factors on a horizontal basis are measured in the connections from suppliers to buyers. Finally, relationship between vertical linkages and horizontal connections measured. The results of this study seem to suggest that system thinking is existed in Behnoosh, because implemented vertical linkages and horizontal connections in four perspective of BSC, and there is meaningful relationship between them. At the end of the article, there are some implications for managers and some suggestions for the future studies.

Keywords: Balanced Score Card (BSC), System Thinking Evaluation, Vertical Linkages, Horizontal Connections, Behnoosh Corporate

1. Introduction
Systems thinking answer the basic questions while finding the solution to the problem at hand (Inelmen, 2002). Systems thinking as an idea permeate both popular culture and numerous scientific fields including: planning and evaluation, education, business and management, public health, sociology and psychology, cognitive science, human development, agriculture, sustainability, environmental sciences, ecology and biology, earth sciences, and other physical sciences. Systems thinking can influence many of the existing concepts, theories and knowledge in each of these fields. Yet, systems thinking can also be ambiguous and amorphous. There are numerous conflicting models and claims about systems thinking that need to be reconciled, and while attempts have been made in the past to reconcile the myriad models in the systems “universe”, most of these efforts can
best be described as methodological pluralism (Gregory, 1996; Jackson, 1991, 2000; Midgley, 2000; White & Taket, 1997).

There are many ways to think about systems thinking. Some scholars and evaluation practitioners view it as a specific methodology, such as system dynamics, while others believe it is a “plurality of methods” (Williams & Imam, 2006). Others see systems thinking as systems science, while others see it as a general systems theory. Still others see systems thinking as a social movement (Cabera et al, 2008: 299-310).

Because the construct of systems thinking is unclear, people who view systems thinking as a kind of solution see its potential even while they do not yet entirely understand what it is. We suggest that this is true for many evaluators and their clients, funding agencies, program planners, field staff, and other stakeholders involved in the evaluation process.

This study offer the way for assessment system thinking so that the reader can evaluate systems thinking by introduce the structure, aspects and their elements.

2. Literature Review

System thinking is an approach derived from the physical sciences and, in its application to management, from the work of such thinkers as Ackoff (1999), Chekland, Forrester, and Senge (1990). Systems thinking differ from the mechanistic approach that became the staple of science over the last 400 years. He attempt to understand matter by breaking it down into ever smaller components typifies the mechanistic approach. It seeks to apprehend the whole by reducing it to its parts. The system approach starts with the premise that the whole is more than the parts, more than even the sum of the parts. It seeks to understand the whole as a whole and as a set of interactions between the parts. A system approach can lead and has led to the intentional design of more effective systems (steele, 2003).

In an analysis of scholarly publications, Cabera (2006) found that systems thinking is interdisciplinary and may act as a bridge between the physical, natural, and social sciences, systems thinking appeared 48% in the literature from social sciences, arts, and humanities, with the remainder dispersed across the disciplinary spectrum from business, administration, finance, and economics, to engineering, computer science, and mathematics, to physics, astronomy, and planetary science (Cabera et al, 2008: 299-310).

Systems thinking may also act as a bridge between the academic, professional and lay communities, providing feedback between “what we know about systems” (e.g., systems sciences) and “the conceptual patterns of how we think systemically” (e.g., systems thinking) (Cabrera, 2006).

The subject of performance measurement has attracted a lot of attention in the literature of business and operations strategy (Neely, 1999; Avella et al., 2001; Unahabhokha et al., 2006; Quezada et al, 2009). Although the construct of system thinking is unclear, but based on some ideas it is conceptual (Cabra et al, 2008), and it seems a quality expression, so we need to a suitable tool for measuring of systems thinking in management science.

leidtka (1998) described a model of the elements of strategic thinking. One of these elements is Systems Perspective. She said that Strategic thinkers must appreciate the inter-relationships among the internal pieces that, taken together, comprise the whole. We have talked much about the importance of fit between the corporate, business, and functional levels of strategy (leidtka, 1998). This model is whole, and it isn’t measurable. So, we identify a new pattern that measured systems thinking by leidtka model and balanced scorecard construction. BSC consist four perspectives from learning and growth to financial. In Gomes et al (2004) literature review found that the BSC is the most cited in the literature in terms of implementations.
In the first years of 1990s, Robert Kaplan, Professor of business School of Harvard University, and David Norton, manager of a research organization, surveyed reasons of success of 12 best American companies and compared their performance evaluation systems. Having provided suggested successful companies do not evaluate just financial dimensions but also other dimensions including customers, internal processes and learning and development. Kaplan and Norton suggested BSC as an evaluation instrument including four dimensions of finance, customers, internal business processes and development and learning. Therefore, objectives and standards of balanced evaluation system are derived from organizational missions and strategies and organizational performance is evaluated in terms of this vision. This method is a performance evaluation system that not only evaluates traditional financial issues but also evaluates three other dimensions including customers, internal business processes and development and learning. Nowadays, this method gives serious consideration into intangible organizational property so it provides the opportunity for organization to evaluate, monitor and judge the quality of intangible property and modify weaknesses and remedy defects (Kaplan and Norton, 2006, 2001).

The Balanced Scorecard originally was found as an improved performance measurement system. However, soon became evident that it has the potential to be used as a management system to implement strategies at all levels of the organization by facilitating the following functions (Norton and Kaplan, 1996a):
1. Clarifying strategy - the translation of strategic objectives into quantitative measures clarifies the management team's understanding of the strategy and helps to develop a consensus.
2. Communicating strategic objectives - the BSC can serve to translate high level objectives into operational objectives and as a tool to communicate the strategy effectively throughout the organization.
3. Planning, setting targets, and aligning strategic initiatives - achievable targets are set for each perspective and initiatives are developed for aligning efforts to reach the targets.
4. Strategic feedback and learning - executives receive feedback on whether the formulated strategy implementation is proceeding according to plan and on whether the strategy is successful ("double-loop learning") (Kordnaeij et al, 2011: 269).

3. Research Methodology
- Major objectives to be representation of system thinking evaluation pattern in management science.
  – Targets of this study are: Evaluation of vertical linkages and horizontal connections in BSC structure, and measuring relationship between the two perspectives.
  - The major hypothesis is “The corporate achieves system thinking”.
- According to this research method the minor hypothesis are:
  H1. The corporate achieves vertical linkages.
  H2. The corporate achieves horizontal connections.
  H3. There is significant relationship between vertical linkages and horizontal connections.
This study uses “A Systems Perspective” delivered from “A Model of the Elements of Strategic Thinking” by Leidtka (1998) and BSC construction.
The balanced scorecard is a strategic management control system that was proposed by Kaplan and Norton (Quezada et al, 2009). In the BSC, strategic objectives are derived from the vision and strategy of the organization and then, according to Kaplan and Norton (2004), the four aspect of BSC are Financial; Clients; Internal processes; and Learning and growth.
The strategic thinker sees vertical linkages within the system from multiple perspectives. He or she sees the relationship between corporate, business level, and functional strategies to each other, to the external context, and to the personal choices he or she makes on a daily basis (Gilaniinia et al., 2012). In addition, on a horizontal basis, he or she sees the connection across department and functions, and between communities of suppliers and buyers (Leidtka, 1998). The study was done in Behnoosh corporate in Iran. So, the measurement instrument of system thinking will create by combination of BSC construction and a systems perspective (Figure 1). Based on this method, goals of four aspect of BSC explore from the elements of “A System Perspective”; on a vertical linkages those are corporate, business level, functional strategies and the external context. In addition, on a horizontal basis, the goals are department, functions, suppliers and buyers. The research benefited from a mixed qualitative-quantitative methodology. The qualitative methodology was used to identify elements of questionnaire. We used booklets in corporate and interviews with the managers and employees in order to gain data for questionnaire preparation. The quantitative survey was prepared based on these qualitative results. It was used of cluster sampling and some of sample population was selected by random. Validity and reliability are two necessary features for every measuring material such as questionnaire because these materials should analyze data and provide final conclusions for researchers. To sum up, validity means that a measuring material is used to measure the characteristics. In a pretest the survey was completed by experts to see if the items were adapted accurately to the culture and Industrial units. These experts were chosen from universities and top industrial managers (Gilaniinia et al., 2012 a).
For evaluating system thinking, two questionnaires were used: vertical linkages’ questionnaire and horizontal connections’ questionnaire. For the measurement of vertical linkages and horizontal connections’ indexes participants responded on a five-point Likert-Type scale, ranging from strongly disagree to strongly agree. The vertical linkages’ questionnaire has 15 questions and the horizontal connections’ questionnaire has 47 questions. The obtained overall Cronbach’s Alpha based on standardized items is 0.91 and shows that the questionnaire is reliable.

We used SPSS for analyzing the data. The sample T-test was applied in order to test the H1and H2 hypotheses and; The Spearman correlation coefficient used in order to test the H3 hypotheses.

This research considers 30 objectives for measuring the company’s system thinking. The major practical steps of conducting this study are:
• Finding the suitable system thinking model
• Identify elements of questionnaire [in above model] according to BSC structure
  - Determining vertical linkages’ indexes according to BSC structure
  - Determining horizontal connections’ Indexes according to BSC structure
• Evaluate vertical linkages’ and horizontal connections’ in Behnoosh corporate
• Evaluate the strength of association between the vertical linkages’ and horizontal connections’ and significantly of the correlation coefficient.

Table 1: Perspectives and Indexes of vertical linkages

<table>
<thead>
<tr>
<th>Perspective</th>
<th>Objectives</th>
<th>Measures</th>
</tr>
</thead>
</table>
| Learning and Growth Perspective | - Culture of social awareness and responsibility  
- Clean Technology  
- Investment in human capital development                  | - Booklets and publications to inform employees of the company  
- Create a website for public awareness  
- Buy some good quality equipment  
- Training courses to enhance skills of employees and managers |
| Process Perspective       | - Solid waste management  
- Environmental mitigation  
- Safety and Health  
- Social programs                                             | - Non-hazardous waste recycled  
- Non-hazardous waste  
- Provide appropriate information to managers and employees on how to reduce environmental risks  
- Reduce the risk of environmental disaster prevention activities  
- Reduce the cost of environmental events with their rapid response  
- Accident rate (per dozen)  
- The sick leave rate (per dozen)  
- Allow students to visit  
- Free product placement for some special social ceremonies |
| Customer Perspective      | - Partnerships in the community                                              | - Partnership managers and staff                                         |
Table 2: Perspectives and Indexes of horizontal connections

<table>
<thead>
<tr>
<th>Perspective</th>
<th>Objectives</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning and Growth</td>
<td>- Skill in quality/ process improvement</td>
<td>- Increasing the percentage of employees trained in quality management techniques</td>
</tr>
<tr>
<td>Perspective</td>
<td>- Technology that will facilitate the improvement process</td>
<td>- Increasing the percentage of employees trained and skilled in the activity-based management and timely delivery</td>
</tr>
<tr>
<td></td>
<td>- Culture of continuous improvement</td>
<td>- Increase the percentage of employees who have direct feedback from operations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Increase the percentage of customers that can track the status of their order (using the telephone and mail)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Notify employees about the culture of continuous improvement and sharing information using publications, meetings and word of mouth</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Increasing the number of ideas raised in the case of process improvement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Suggestions to improve the process of increasing the percentage of employees (program to encourage employees)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Increasing the number and quality of process improvement ideas that have emerged in various organizational units</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Recommendations and actions to improve the performance of employees</td>
</tr>
<tr>
<td>Process Perspective</td>
<td>- Reduce the cost</td>
<td>- Supplier Rating: quality, delivery, cost</td>
</tr>
<tr>
<td></td>
<td>- Acquire the ability to provide timely</td>
<td>- Reduced latency to receive the Order</td>
</tr>
<tr>
<td></td>
<td>- Development capabilities to provide quality</td>
<td>- Decreasing permanent failures and inspection's recommendations received</td>
</tr>
<tr>
<td></td>
<td>- Reduce the production cost of goods/ services</td>
<td></td>
</tr>
<tr>
<td>Continuous improvement processes</td>
<td>- Improve the accountability process (process cycle time)</td>
<td></td>
</tr>
<tr>
<td>----------------------------------</td>
<td>----------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>- Improvement of fixed assets account</td>
<td>- Improve the efficiency of working capital</td>
<td></td>
</tr>
<tr>
<td>- Cost Reduction Services</td>
<td>- Post responsibly the customer (time order)</td>
<td></td>
</tr>
<tr>
<td>- Quality improvement</td>
<td>- Increase the percentage of suppliers that without inspection, quality products are required</td>
<td></td>
</tr>
</tbody>
</table>

- Cost of sales, distribution and administrative
- Processes increase with a significant improvement
- Remove non-efficient processes to increase
- Destruction and waste reduction
- Budget increases the inspection and testing
- Increase the quality of budget
- Evaluation cycle time and improve its production
- Increasing capacity utilization
- Increasing equipment reliability
- Flexibility (the variety of goods/services, processes) to the community needs
- The number of inventory days, inventory turnover
- Increasing the output storage
- Days of receipt of accounts receivable
- Liquidity cycle
- Cost of delivering goods to customers’ warehouses
- Percentage of low-cost customer channels
- Order to reduce the delay of delivery
- Reducing the interval between the completion of the goods/services to be ready for customer use
- Increasing percentage of the goods without Failure to deliver has been
- Reduce the number and frequency of customer complaints

<table>
<thead>
<tr>
<th>Customer Perspective</th>
<th>- Each customer to reduce costs, increase revenue per customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Shipping and impeccable customer service (good quality)</td>
<td>- Timely delivery of goods</td>
</tr>
<tr>
<td>- Choice of goods</td>
<td>- Price in comparison with competitors</td>
</tr>
<tr>
<td></td>
<td>- Reduce the number and percentage of customer complaints</td>
</tr>
<tr>
<td></td>
<td>- Increased percentage of timely delivery</td>
</tr>
<tr>
<td></td>
<td>- Reduced order fulfillment time</td>
</tr>
<tr>
<td></td>
<td>- Increase the percentage of complete orders</td>
</tr>
<tr>
<td></td>
<td>- Cover customer needs with the goods or services provided</td>
</tr>
</tbody>
</table>
4. Research Findings

The data are qualitative; the hypotheses were studied in the next stage. The determinants were evaluated with one sample t-tests and spearman correlation Coefficient.

**Table 3:** The corporate achieves vertical linkages

<table>
<thead>
<tr>
<th>Hypothesis 1</th>
<th>T-value</th>
<th>Mean</th>
<th>Sig*</th>
<th>d.f</th>
<th>T0.05 (d.f)</th>
<th>Test-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.857</td>
<td>0.0246</td>
<td>0.217</td>
<td>41</td>
<td>1.3</td>
<td>0</td>
</tr>
</tbody>
</table>

As shown in Table 3, T-value (0.857) for the first hypothesis is less than t 0.05 (d.f) (1.3), so this hypothesis is confirmed. It means that there are vertical linkages in the Behnoosh corporate.

**Table 4:** The corporate achieves horizontal connections

<table>
<thead>
<tr>
<th>Hypothesis 2</th>
<th>T-value</th>
<th>Mean</th>
<th>Sig*</th>
<th>d.f</th>
<th>T0.05 (d.f)</th>
<th>Test-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.836</td>
<td>0.0205</td>
<td>0.197</td>
<td>37</td>
<td>1.1</td>
<td>0</td>
</tr>
</tbody>
</table>

As shown in Table 4, T-value (0.836) for the first hypothesis is less than t 0.05 (d.f) (1.1), so this hypothesis is confirmed. It means that there are horizontal connections in the Behnoosh corporate.

**Table 5:** There is significant relationship between vertical linkages and horizontal connections

<table>
<thead>
<tr>
<th>Hypothesis 3</th>
<th>vertical linkages</th>
<th>horizontal connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation Coefficient</td>
<td>1</td>
<td>0.966*</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>0</td>
<td>0.000</td>
</tr>
<tr>
<td>Number</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Correlation Coefficient</td>
<td>0.966*</td>
<td>1</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>0.000</td>
<td>0</td>
</tr>
<tr>
<td>Number</td>
<td>30</td>
<td>30</td>
</tr>
</tbody>
</table>

Table 4 indicate that the strength of association between the variables is very high (r = 0.966), and that the correlation coefficient is very highly significantly different from zero (P < 0.001). Also these findings confirm the hypothesis 3.

5. Conclusion

The goal of this study is to evolution of systems thinking in management science. The researchers consider Behnoosh corporate in Iran. They investigate the hypotheses and the results confirm all of the hypotheses and it means that the Corporate has systems thinking. In another word the organization successfully implemented the vertical linkages and horizontal connections, and there is relationship between them.

The suggestion for managers is: according to benefits of system thinking in corporates, managers implement representation model in this article according to their corporate.
The suggestions for the future researches are:
• To examine this research indexes in some successful companies and comprise with no successful companies to confirm the representation model.
• To find relationships between four perspective of BSC in companies with system thinking

There are some limitations in the current study. First of all, applying the BSC and systems thinking in Iranian. These studies are new subjects in Iran, and there isn’t any model of the evolution of systems thinking in management science. Therefore, there is limited experience in this area in Iranian companies.

References
