Comparing Sense and Respond based Critical Factor Index Methods for Optimizing Operations Strategies

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ABSTRACT

How to make improvements to adapt company’s operations strategies in a fast-changing environment are getting more important than before in all sort of companies. This article aims to enrich sense and respond (S&R) approach in dynamic and agile strategic adjustment via presenting new method called scaled critical factor index (SCFI) in comparison with older S&R approaches like critical factor index (CFI) and balanced critical factor index (BCFI). Besides, the practical examination in this paper displays the difference among them and the privilege of SCFI model. The results of analysis illustrate that the newest method contribute to the operations strategy improvement based on clear objectives in new business environment.

Keywords: Operational competitiveness; operations strategy; sense and respond (S&R); scaled critical factor index (SCFI); manufacturing industry
INTRODUCTION
These days, making adaptable modification on operation strategy in a fast changing business environment is getting more important than before to all sort of enterprises. The paper is going to address differences between scaled critical factor index (SCFI) and previous sense & responds factors such as critical factor index (CFI) and balanced critical factor index (BCFI). The case study of this paper will show advantages of SCFI compared to other CFI and BCFI.

SENSE AND RESPOND THEORY AND ITS MODELS
Haeckel (1992) used sense and respond (S&R) method in management concepts for the first time. This concept was developed later by Bradley and Nolan in 1998 and also by Markides in 2000.

Based on what Bradley and Nolan (1998) discussed in their article sense and respond is more than a desired behavior; that is a framework which can be scaled managerial concepts for the ability to adopt improvements. It means that it is relevant to any leader, regardless of the size of his or her company or even his unit. The common framework which is been using by companies is ‘Make & Sell’ but it does not satisfy today’s competitive and turbulent business environment any more (Ranta& Takala, 2007).

The general aim of S&R is the executing of the best practices in a highly changing environment by sensing changes and responding to them accurately, in other words, using external opportunities and internal strengths to overcome company’s weaknesses and environmental threats.

Sensing in advance then responding accurately to potential events and predicting what will happen in the future requires a complete decision-making supporting system. Critical Factor Index (CFI) methodology, thus, was presented by Nadler and Takala in 2010.

In above mentioned methodology researchers use Operations Questionnaire (OP) which was proposed by Daniel Nadler and Josu Takala (2010). The questionnaire should be filled out by managers of under researching company with some data just to give an idea of how it should look after the completion.
The OP questionnaire has the main responsibility of detecting various critical factors which directly affect the manufacturing and the production cycle of a company. It is worth mentioning that there is obviously twenty one attributes which help in evaluating the questionnaire. These attributes are mainly divided into four specific sections. Evaluating the company’s path for development, various expectations and experiences involved and comparing the attributes to the already existing ones of the competitors are some of the ways of testing these attributes. Direction of development and comparison to competitors portray the overall performance of a company whereas the expectations and experiences are marked from the scale of 1 to 10 for the condition of each attribute. It is widely believed that in a concurrent economy the ability to be able to adjust to various processes is an important factor.

The S&R method was first utilized by Ranta and Takala (2007) with the purpose of developing an operative management system which can introduce the topic of critical factor index (CFI). Reverence there has been three developmental stages:

- CFI model
- BCFI model
- SCFI model

Table 1 is a good way for illustrating the differences between the above three mentioned stages. Moreover, the twenty one critical factors and the analysis of the four main factors in S&R including knowledge & technology management (PT), processes & work flows (PC), organizational systems (OR) and information systems (IT) are compared in the Figure 1. The three mentioned models do also have some common grounds which can be seen in Table 2 (Liu 2011).
CFI is put forward by Ranta and Takala (2007) by the purpose of interpretation and evaluation of critical factors for strategically adjustments supporting the decision making in a process. The BCFI model was formed by Nadler and Takala (2010) based on the principle used in CFI model. The difference being, BCFI is developed by making some changes in the formula of the CFI. The change is as following: Std{experience} index and Std{expectation} index into SD Experience index and SD Expectation index.

Furthermore, a performance index has also been introduced to the model. The SCFI model was proposed and also developed by Takala et al. (2011) has also put forwards the SCFI model.
Table 1: The differences between CFI, BCFI and SCFI models

<table>
<thead>
<tr>
<th>Name</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFI</td>
<td>[ CFI = \frac{\text{Std}{\text{experience}} \cdot \text{Std}{\text{expectation}}}{\text{Importance index} \cdot \text{Gap index} \cdot \text{Development index}} ]</td>
</tr>
<tr>
<td></td>
<td>SD Expectation index = [ \frac{\text{Std}{\text{expectation}}}{10} + 1 ]</td>
</tr>
<tr>
<td></td>
<td>SD Experience index = [ \frac{\text{Std}{\text{experience}}}{10} + 1 ]</td>
</tr>
<tr>
<td>BCFI</td>
<td>BCFI = [ \frac{\text{SD Expectation index} \cdot \text{SD Experience index} \cdot \text{Performance index}}{\text{Importance index} \cdot \text{Gap index} \cdot \text{Development index}} ]</td>
</tr>
<tr>
<td></td>
<td>[ \frac{1}{n} \sum_{i=1}^{n} \left( \text{experience}(i) - 1 \right)^2 \cdot \frac{1}{n} \sum_{i=1}^{n} \left( \text{expectation}(i) - 10 \right)^2 \cdot \text{Performance index} ]</td>
</tr>
<tr>
<td>SCFI</td>
<td>SCFI = [ \frac{1}{n} \cdot \sum_{i=1}^{n} \left( \text{experience}(i) - 1 \right)^2 \cdot \frac{1}{n} \cdot \sum_{i=1}^{n} \left( \text{expectation}(i) - 10 \right)^2 \cdot \text{Performance index} ]</td>
</tr>
<tr>
<td></td>
<td>[ \text{Importance index} \cdot \text{Gap index} \cdot \text{Development index} ]</td>
</tr>
</tbody>
</table>

Source: Liu et al. 2011.

Table 2: The common parts of three mentioned model

| Importance index | \[ \frac{\text{Average of expectation}}{10} \] |
| Performance index | \[ \frac{\text{Average of experience}}{10} \] |
| Gap index | \[ \frac{(\text{avg. of experience} - \text{avg. of expectation})}{10} \cdot 1 \] |
| Development index | \[ |\text{better} - \text{worse}| \cdot 0.9 - 1 | \] |

Source: Liu et al. 2011.
CASE STUDY AND DATA COLLECTION METHOD

The case study of this paper is one of the most famous automobile parts manufacturing companies of Iran, called EKS stands for ELECTRIC KHODRO SHARGH The main products of the company are different types of wire harnesses for different types of cars which are manufactured in Iran and in some other European countries as well.

EKS Company is a sub company of Iran Auto Parts Industrial Group (IAP) in which founded on May 07, 1997 in order to comply independency policy and granting legal entity with companies affiliated with IAP.

Data collection and data analysis methods

Data for doing this research is gathered by the questionnaires filed out care of strategic planning manager, R&D manager and IT manager of EKS. These managers have more than 10 years’ experience in EKS. The conclusion of research will be reflected to the respondents in order to discuss about it and confirm the reliabilities of the data further.

To study the S&R models, the value of each index in the models from (1)-(12) can be obtained by the questionnaire (Table 3) and the value of each attribute in the Figure 1 can be calculated by the models. The smaller the value, the more critical the attribute is. In the Table 1, direction of development refers to the prediction of development trend in the next three years according to the enterprise performance during two years ago, and development experience is defined as the brief of pass two years business development.
In the sense and respond approach after calculating above mentioned indices, the most attributes can be found among 21 items.

**Results**

The following method is utilized for judging about under resourced and over resourced attributes. Each attribute which falls between the range of 1/3 and 2/3 of average resource level will be considered as a balanced attribute, i.e. If an attribute falls lower than 1/3 of average resource level, therefore, it will be considered as an under resourced, and if an attribute is higher than 2/3 of average resource level consequently it will be considered to be over resourced. In this case the average of resource level of attribute is 100% divided by 21.
which is equal to 4.76%, so the values that we judged about attributes are 3.17% and 6.35%.

![Figure 2: Results of CFI, BCFI and SCFI](image)

Table 4 illustrate the comparative consequences of past and future values which obtain from different S&R methods CFI, BCFI and SCFI, in which all 21 attributes are analyzed one by one. The trend column demonstrate how each attribute changes from past to future. “Same” represent that both past and future values of attributes are good. The term “Worse” denote changing of values from good to other. In contrast, if the values of attribute change from other to good, the trend shows to become better. In case the values of past and future are either over or under, the trend display their direction is going better or worse as well.
By comparing the finding, the following results can be summarized:
First of all, the original CFI model’s disadvantage is completely clear. Some attributes have resulted 0 index values since during collecting data the zero standard deviation can occur commonly and in this method the 0 index will not be able to show anything.

Secondly, as in new equation 6 and 7 of BCFI (standard deviation of experience and expectation) were added 1 manually, using the BCFI and SCFI such problem would not be occurred. Based on these modifications the minimal values will force to be 1 instead of 0, hence, more interpretation can be obtained through the finding. SCFI (Eq. 9) does not have similar problem but instead using root mean square to avoid zero standard deviation and also increase the sensitivity. In theory, in BCFI approach the mathematical property of CFI was destroyed, and some BCFI leads to converse results in some situation. It refers to that one of these approaches leads toward wrong results.
Discussions

The analysis of results cannot be verified without the feedback from the company. Therefore in order to validate which S&R model best reflects the real situation of the company, the top managers have been interviewed again to discuss their opinions towards the analysis results.

Based on the feedback from the enterprise, the managers believe that the results obtained from SCFI are more adequate than others, besides there is a wide gap between CFI results and the reality. The mentioned difference is illustrated in Table 5.

Table 5: The analysis result compared with feedback from the case company

<table>
<thead>
<tr>
<th>Attribute</th>
<th>P-BCFI</th>
<th>F-BCFI</th>
<th>Trend</th>
<th>P-SCFI</th>
<th>F-SCFI</th>
<th>Trend</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Over</td>
<td>Good</td>
<td>Better</td>
<td>under</td>
<td>under</td>
<td>worse</td>
<td>worse</td>
</tr>
<tr>
<td>5</td>
<td>Over</td>
<td>Good</td>
<td>Better</td>
<td>Under</td>
<td>Under</td>
<td>Worse</td>
<td>Worse</td>
</tr>
<tr>
<td>15</td>
<td>Good</td>
<td>Good</td>
<td>Same</td>
<td>Under</td>
<td>Under</td>
<td>Worse</td>
<td>Worse</td>
</tr>
<tr>
<td>21</td>
<td>Good</td>
<td>Good</td>
<td>Same</td>
<td>Under</td>
<td>Under</td>
<td>Worse</td>
<td>Worse</td>
</tr>
</tbody>
</table>

As illustrated on Table 4, the results which are yielded by SCFI are closer to the feedback from case company in comparison with BCFI model. To sum up, SCFI approach can be taken into account as the best method of analysis to demonstrate the reality.

According to the report from company SCFI method is more reliable than others, but finding of BCFI and CFI were not valid.

CONCLUSION

This paper aim to introduce several developed sense and respond (S&R) models CFI, BCFI and SCFI to help decision makers to make adaptive adjustments on operations strategy in dynamic business environments such as dealing with different markets and crisis. In addition, the case study in this paper shows the difference among the three S&R models and the advantages of SCFI model. Inappropriate models may lead to wrong or sometimes even opposite opinion in decision-making and therefore in order to make S&R methodology useful a decent model must be well established. The analysis showed that well-developed S&R
models have contribution to making adaptive operations strategy adjustment based on clear objectives in dynamic and turbulent business environment which can be verified from the top management of the studied case company.

REFERENCES


