

# The Development of the Critical Factor Index Method

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**Abstract** This paper introduces the development of the critical factor index (CFI) method. The CFI is a management tool to support strategic decisions which is based on real-life expectations and experiences. After a comprehensive description of the method the current pitfalls will be explained by comparing the CFI to the newly developed BCFI (balanced critical factor index) formula. The findings will present break through innovations in terms of validity and reliability. The execution of the BCFI in the first case study approved the good performances of the testing phase. The benefits of a fast, comprehensive and reliable method to gather important information in order to make strategic decisions on a low cost level are self-evident and will most probably lead to a further increase of interest about the BCFI method.

**Key words:** CFI Methodology, Management Tool, Strategic Decision, Business Performance, Process Measurement

## 1 Introduction

Many strategic decisions have to be made on daily bases. Therefore the management of an organisation need to have a profound overview about the current situation and future development possibilities. In order to make the right decision managers are using more and more, so called, decision supporting tools. Therefore the CFI (Critical Factor Index) has been developed to offer a comprehensive perspective on current performances of business processes.

The CFI method is a measurement tool to indicate which attribute of a business process is critical and which is not, based on the experience and expectations of the company's employees, customers or business partners [1]. The CFI was developed on the basis of the Gab analysis and the implementation index (IMPL). The IMPL was also invented by Josu Takala. The original idea, behind these measurement tools, was to develop a fast and reliable method for management purposes to sense and respond (to) customer satisfaction [2]. The method reveals which attributes are critical within the business process and therefore supports the management to make decisions concerning which attributes should be improved. However, the usage of IMPL and CFI in over 50 different case studies, comprising a big variety of processes as well as business environments, showed that the method can be used to measure basically all business processes, given that the attributes are well defined.

The use of a questionnaire is one of the most efficient approaches to gather the required information. Due to the fact that each process has its own attributes the questionnaire cannot be standardized but instead has to be created individually. Typically the method consists of three phases. During the first phase the current situation is explored, tools like personnel interviews, in depth interviews and observing are used. The second phase is the most crucial part; the right attributes have to be defined in order to reveal the relevant critical factors. To serve the overall goal, proposing

development needs for certain attributes, the choice for them should be in line with the company's own strategy, vision, mission and values. Therefore information from phase one is essential as well as internal information about the company's internal proceedings. In phase three all gathered information will be analysed and furthermore the CFI measurement tools will be applied [1] [2].

However, a frequently stated weakness of the CFI indicator is the high influence of the standard deviation. Antti Rajala proposed in his case study a further development of the CFI in order to increase the reliability of the findings [3]. In this paper the method will be explained in depth and furthermore the development from CFI to BCFI will be presented.

## 2 The development of the CFI

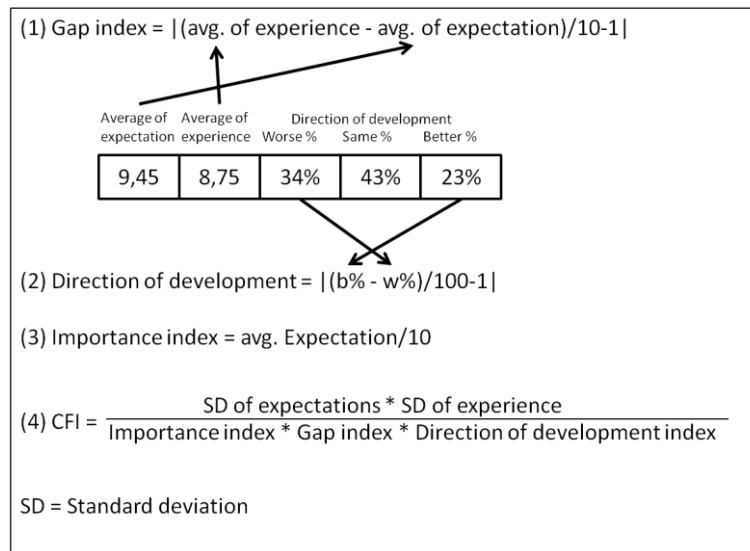
In this case study the method was used to measure the performance of the human resource allocation process. In total 20 attributes were chosen to describe the process of planning, allocating, monitoring and using software tools for the overall allocation process. The following table shows some examples, taken from the questionnaire.

**Table 1. Examples of attributes from the internal questionnaire**

| ATTRIBUTES  | Expectations | Experiences | Direction of Development |      |        | Compared to past |      |        |
|---|--------------|-------------|--------------------------|------|--------|------------------|------|--------|
|   | (1-10)       | (1-10)      | Worse                    | Same | Better | Worse            | Same | Better |
| Resource planning process                         |              |             |                          |      |        |                  |      |        |
| Structure and clarity of project schedules        |              |             |                          |      |        |                  |      |        |
| Reliability of time schedules                     |              |             |                          |      |        |                  |      |        |
| Reliability of workload estimations               |              |             |                          |      |        |                  |      |        |
| Information flow throughout the project team      |              |             |                          |      |        |                  |      |        |
| Planning process in general                       |              |             |                          |      |        |                  |      |        |
| Resource allocation process                       |              |             |                          |      |        |                  |      |        |
| Communication between management and project team |              |             |                          |      |        |                  |      |        |
| Distribution of projects                          |              |             |                          |      |        |                  |      |        |

The respondents were asked to evaluate each attribute in terms of expectations and real life experiences. In this case study it was also asked in which way the employees believe the attribute will develop within the next two years and how it has changed within the last two years. The scale from 1 to 10 has been chosen to evaluate the different attributes. The relatively wide range makes it easier to point out inconsistencies between expectations and experiences [1]. The following figure will present all necessary formulas for calculating the CFI.

**Figure 1. The CFI method**



Based on the CFI formula some changes have been made in order to lower the high influence of the SD and furthermore to higher the weight of the experiences. In addition to these features the earlier SD problem, by appearance of SD = 0, has been solved. The new formula is called BCFI (Balanced Critical Factor Index) and has been approved in terms of functionality by the inventor of the CFI method, Professor Josu Takala and the statistic Professor of Vaasa University, Dr. Bernd Pape.

$$BCFI = \frac{SD \text{ expectation index} \cdot SD \text{ experience index} \cdot \text{Performance index}}{\text{Important index} \cdot \text{Gap index} \cdot \text{Direction of development index}} \quad (1)$$

$$SD \text{ expectation index} = \left( \left( \frac{SD \text{ of expectation}}{10} \right) + 1 \right) \quad (2)$$

$$SD \text{ experience index} = \left( \left( \frac{SD \text{ of experience}}{10} \right) + 1 \right) \quad (3)$$

$$\text{Performance index} = \text{Average of experience}/10 \quad (4)$$

With the BCFI the critical factors can easily be identified. All attributes with a value below one are considered to be critical. As more the values of the attributes are going in the direction of zero as more critical they are. The value one represents an optimal attribute whereas all attributes with values above one are considered to be “high performers”. However, the expression of high performer could lead to a misinterpretation. High performer does not necessarily mean that the attribute has a high performance it only indicates, for example, that the expectations are met by the experience and the direction of development is higher than one (positive direction), if the experience exceed the level of expectations or similar combinations.

In addition to the standard formula the BCFI method offers two variables which can be emphasized. The following formulas will show how the Gap index and the Direction of development index can be modified.

Influence of Gap index increased by 0,3:

$$\text{Gap index} = |(\text{avg. of experience} - \text{avg. of expectation}) * 1,3 / 10 - 1| \quad (5)$$

Influence of Direction of development decreased by 0,1:

$$\text{Direction of development} = |(b\% - w\%) * 0,9 / 100 - 1| \quad (6)$$

The results change accordingly to the adjustments that have been made and therefore different factors can be reflected stronger or weaker than the others. This is important, for example, if the management feels that the employees might have a too positive attitude concerning the direction of development. In that case the management can lower the influence of this factor by reducing its weighting as stated in formula 6.

As mentioned earlier the respondents were also asked to answer in which direction an attribute has changed compared to the past. Therefore the BCFI has to be calculated with the past development index. As this factor should have the reverse influence on the value of the attribute, compared to the direction of development index, following formula has to be applied.

$$\text{Past development index} = |(w\% - b\%) / 100 - 1| \quad (7)$$

Otherwise the BFCI formula remains the same. After the BFCI with direction of development index and the BFCI with past development index have been calculated, the development of the attributes can be monitored simply by comparing the two calculations. This approach gives valuable information for the management to see how past development efforts have been affecting the attributes.

The following table shows the feasible values for each factor and furthermore explains the logic behind the value.

**Table 2. Values and meaning of factors**

| Factor                   | Range of value | Meaning   |
|--------------------------|----------------|---|
| Standard deviation index | 1 – 1,5        | 1= high (critical)<br>1,5= low (not critical)   |
| Performance index        | 0,1 – 1        | 0,1= high (critical)<br>1= low (not critical)   |
| Important index          | 0,1 – 1        | 0,1= low (not critical)<br>1= high (critical)   |
| Gap index                | 0,1 – 1,9      | 0,1= low (not critical)<br>1,9= high (critical) |
| Direction of development | 0 – 2          | 0= low (not critical)<br>2= high (critical)     |

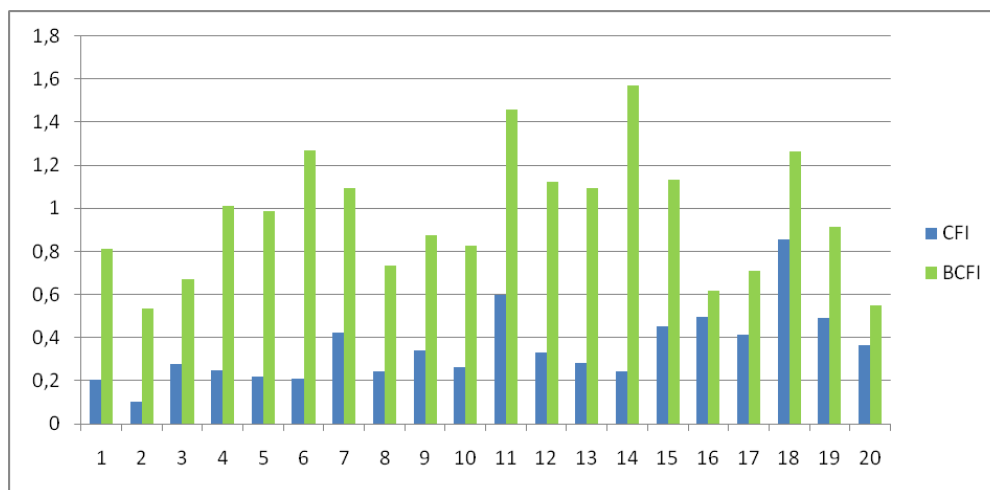
The standard deviation, for example, indicates the agreement between the participants of a certain attribute, a low value indicates that people agree with each other and therefore the attribute is defined with a higher trustworthiness. If the value is high the significance for the attribute is decreasing as the participants have quite different opinions about it. The performance and importance index are self-explanatory and representing simply the level of performance or expectation of the attribute. If there is no gap between the expectations and experiences of an attribute the index is one, otherwise the Gap

index can give positive or negative direction to the CFI according to the relation of difference. The last index follows the same principle as the Gap index, if the direction of development is 100 percent same (no direction) the value is one otherwise it will influence the CFI in the same manner as the Gap index

### 3 Findings

The following comparison between the old CFI and new BCFI are based on 18 responses out of 33 send questionnaires. Also the response rate is not much higher than 50% big differences could have been identified. The following graph will show the deviation between the two approaches.

**Figure 2. Comparison between CFI and BCFI values**



(The CFI values have been divided by ten in order to plot a chart for a good visible comparison.)

By analysing the CFI method the attributes 1, 2, 5 and 6 would have been identified to be most critical, the BCFI on the other hand shows the attributes 2, 3, 16 and 20 as the most critical ones. Furthermore high deviations can be monitored on the attributes 6 and 14 which result from the values of the standard deviations. According to the CFI approach, attribute number 6 has been considered as being among the most critical attributes, whereas it is not considered as critical with the BCFI approach. The following table will show the exact results for the different attributes.

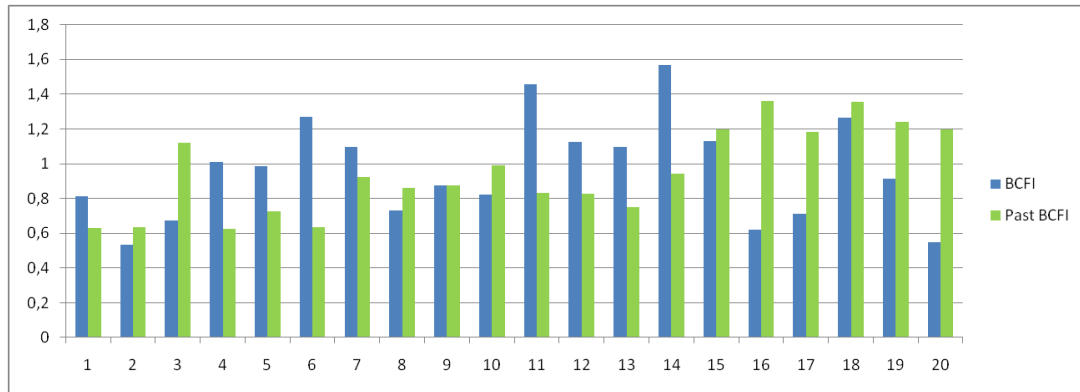
**Table 3. Internal questionnaire results of HRM case study**

| Attribute  | Avg. Expectation | SD Expect. | Avg. Experience | SD Experi. | Direction of development |       |        |
|------------|------------------|------------|-----------------|------------|--------------------------|-------|--------|
|            |                  |            |                 |            | Worse                    | Same  | Better |
| 1          | 8,28             | 0,93       | 5,26            | 1,83       | 11,11                    | 55,56 | 33,33  |
| 2          | 8,28             | 0,80       | 5,00            | 1,50       | 27,78                    | 50,00 | 22,22  |
| 3          | 7,33             | 1,37       | 4,95            | 2,04       | 27,78                    | 55,56 | 16,67  |
| 4          | 8,89             | 1,20       | 6,26            | 1,67       | 16,67                    | 38,89 | 44,44  |
| 5          | 8,33             | 1,25       | 6,11            | 1,38       | 16,67                    | 44,44 | 38,89  |
| 6          | 8,72             | 0,80       | 6,53            | 1,71       | 5,56                     | 50,00 | 44,44  |
| 7          | 7,61             | 1,95       | 6,11            | 1,68       | 5,56                     | 77,78 | 16,67  |
| 8          | 8,00             | 1,37       | 5,84            | 1,91       | 22,22                    | 66,67 | 11,11  |
| 9          | 8,06             | 1,72       | 5,84            | 1,86       | 16,67                    | 61,11 | 22,22  |
| 10         | 7,83             | 1,38       | 5,79            | 1,80       | 16,67                    | 66,67 | 16,67  |
| 11         | 7,67             | 1,76       | 6,11            | 2,01       | 0,00                     | 66,67 | 33,33  |
| 12         | 7,72             | 1,19       | 5,95            | 1,95       | 11,11                    | 55,56 | 33,33  |
| 13         | 7,61             | 1,11       | 5,58            | 1,67       | 5,56                     | 61,11 | 33,33  |
| 14         | 8,56             | 0,96       | 7,68            | 1,56       | 5,56                     | 55,56 | 38,89  |
| 15         | 7,22             | 1,87       | 6,32            | 1,89       | 11,11                    | 77,78 | 11,11  |
| 16         | 7,72             | 2,28       | 4,84            | 2,64       | 50,00                    | 22,22 | 27,78  |
| 17         | 7,67             | 1,86       | 5,16            | 2,39       | 38,89                    | 33,33 | 27,78  |
| 18         | 7,44             | 2,34       | 5,84            | 2,63       | 27,78                    | 27,78 | 44,44  |
| 19         | 8,11             | 2,02       | 6,21            | 2,48       | 27,78                    | 50,00 | 22,22  |
| 20         | 8,22             | 1,87       | 5,16            | 2,81       | 50,00                    | 33,33 | 16,67  |
| CFI        |                  |            |                 |            |                          |       |        |
| BCFI       |                  |            |                 |            |                          |       |        |
| CFI & BCFI |                  |            |                 |            |                          |       |        |

Especially attribute number 14 reveals the pitfall of the CFI equation. The expectations are high but so is the experience and furthermore are the participants quite in line with each other (relatively low standard deviation). In addition only 5,56% are expecting the attribute to get worse within the next two years which in summary should present a quite good performed attribute. Another example is attribute number 16 which is considered among the four best attributes according to CFI and one of the most critical according to BCFI. Although the gap index already indicates a high deviation between the expectations and experiences on attribute 16 and furthermore 50% expect the attribute to get worse, the CFI, based on the high standard deviation, ranks the attribute still as high. The BCFI in contrast considers also the low performance of the attribute and takes weight of the high standard deviation. The SD can become logically higher as closer the value of an attribute is to the median of the overall weighting scale. Therefore the SD should not have a too big impact on the output. The main problem of the SD usage in the CFI is that if the standard deviation of either expectations or experiences is below one the results are negatively influenced. In case both standard deviations are below zero the effect is even stronger. As a result the BCFI gives a more reliable indication of the critical factors and offers a more comprehensive analyse tool.

In addition to the critical factors the development over the last two years can be monitored. This feature is especially interesting if a company had development efforts over the period in question. The following figure will show the findings of this case study.

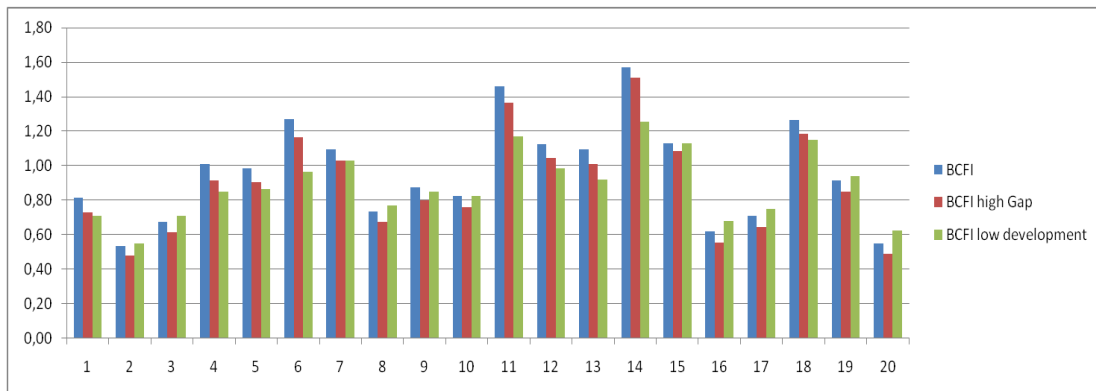
**Figure 3. Comparison between BCFI and Past BCFI**



As the development direction of both BCFI values are based on expectations and experiences the reliability of the difference is greatly influenced by recent events and impressions, therefore this comparison should only give a rough idea in which direction one attribute has developed. For continuous analyses the past development index can be left out after the first investigation and be replaced by the BCFI of the previous survey.

In case that several factors occur equally critical the management has the option with the BCFI to higher or lower the influence of certain factors. The following figure shows for example the BCFI high Gap with a 50% higher influence of the gap index and the BCFI low development with a 50% reduced influence of the development index, compared to the standard BCFI.

**Figure 4. Comparison between different weighting modifications**



In this case study the critical factors could be identified easily due to big variations and no significant changes occurred when changing the influence factors. However, the feature can still be monitored and will help especially when differences between several attributes are not as distinct as in this case study.

## 4 Conclusions

The new BCFI method performed well in the first real-life execution phase and reflected the current HR- allocation process of the case study very precisely. The management of the case company was convinced of the usability and reliability of the new method. Furthermore the testing phase with extreme values showed the high sensitivity, high scalability and the advantages of modifying certain factors of the new method. Also the identification of critical factors is now defined exactly and can easily be recognized. As more the value of an attribute is going in the direction of zero as more critical it is, on the other hand if its performance exceed the value one it can go to infinity. In the test phase the only error occurred when an attribute had equal values for expectations and experiences, the SD of both factors were zero and the direction of development was rated with 100% better. Than the equation leads to an error message and cannot be solved. However in such a case the attribute would not be considered as critical and therefore can be influenced by setting the direction of development for example to 99,99999.

The comparison of the BCFI with the earlier CFI method revealed the pitfalls of the CFI method. Especially the usage of the SD caused major errors and therefore influenced the reliability of the results negatively. Another advantage of the BCFI method is that it is based on the same data as the CFI and no further data has to be collected. That means that all data which have been collected for testing the CFI method can now be used to test the BCFI method as well.

The benefits of a fast, comprehensive and reliable method to gather important information in order to make strategic decisions on a low cost level are self-evident and will most probably lead to a further increase of interest about the BCFI. However as stated above there is still the need of further development and therefore should be tested in future case studies. Last but not least it has to be stated that the BCFI can be utilized to test internal as well as external processes, based either on expectations and experiences of employees, customers or business partners.

## References

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