

# SUSTAINABLE COMPETITIVE ADVANTAGE (SCA) ANALYSIS OF FURNITURE MANUFACTURERS IN MALAYSIA: NORMALIZED SCALED CRITICAL FACTOR INDEX (NSCFI) APPROACH

Rosmaini Tasmin<sup>1</sup>, Josu Takala<sup>2</sup>, Aliyu Alhaji Abu Bakr<sup>1</sup>, Daryna Shylyna<sup>2</sup>, Izabela Nizialek<sup>3</sup>, M.S. Che Rusuli<sup>4</sup>

<sup>1</sup> *Universiti Tun Hussein Onn Malaysia, Malaysia*

<sup>2</sup> *University of Vaasa, Faculty of Technology, Finland*

<sup>3</sup> *Warsaw University of Life Sciences, Faculty of Wood Technology, Poland*

<sup>4</sup> *Universiti Malaysia Kelantan, Malaysia*

## Corresponding author:

Rosmaini Tasmin

*Universiti Tun Hussein Onn Malaysia*

*Faculty of Technology Management, Business and Entrepreneurship*

*Beg Berkunci 101 Parit Raja Batu Pahat, Johor, Malaysia*

*phone: +607-453 7000/7025*

*e-mail: rosmaini@uthm.edu.my*

Received: 10 November 2015

Accepted: 11 May 2016

## ABSTRACT

The purpose of this paper is to investigate Malaysian furniture industry via Sustainable competitive advantages (SCA) approach. In this case study, sense and respond method and Normalized Scaled Critical Factor Index (NSCFI) are used to specify the distribution of companies' resources for different criteria and detect the attributes which are critical based on expectation and experience of companies' employs. Moreover, this study evaluates Malaysian furniture business strategy according to manufacturing strategy in terms of analyzer, prospector and defender. Finally, SCA risk levels are presented to show how much company's resource allocations support their business strategy.

This case study involved four furniture manufacturing companies, in the southern part of Peninsular Malaysia to provide the overall view of their strategies in the perspective of knowledge & technology management, processes & work flows, organizational, and information systems. Hence, the findings of this study presented the preliminary results from these furniture companies in Malaysia, which are involved in sustainable competitive advantage (SCA) studies in terms of expectation and experience, NSCFI, operational strategy triangle of prospector (P), defender (D), and analyzer (A). The result shows that almost all furniture companies are categorized into the Analyzer type strategy and planning to remain being Analyzer in future to come.

## KEYWORDS

sustainable competitive advantage (SCA) model, SCA risk level, critical factor indexes (CFIs) method, operation strategy index.

## Introduction

As the turbulence of business environments caused constantly shortening in product life cycle in today's business world, therefore the notion of sustainable competitive advantages has significant importance, meaning that the goal of establishing any business is to obtain sustainable competitive advantages (SCA) instead of temporary business advantages [1]. One of the approaches to SCA is Resource based view (RBV) of Firm. In RBV, firms are

different even within an industry and the differences among them come from their resource [2]. Several methods are used in order to conduct Sustainable competitive advantages approaches in business including: Sense and respond method, Critical factor index (CFIs) and manufacturing business strategy [3].

Critical factor index (CFI) was introduced by Ranta and Takala for the first time in 2007. This method supports decision makers by indicating which attributes of business process are critical based

expectation and experience of companies' employee, customer or business partners [4]. CFI method was developed later through BCFI, SCFI, NSCFI [5].

This paper first brings the theory and literature background behind SCA, then finding of the four case studies of Malaysian furniture industry is presented and at the end discussion and conclusion will be presented.

## Theory back ground

### Manufacturing business strategy

Strategy means "A pattern or plan that integrates an organization's major goals, policies and action sequences into a cohesive whole" [6]. One of the strategy topologies is Miles and Snow topology, which classifies business strategy in four groups: Prospector, Analyzer, Defender and Reactor as follow [7]:

1. Prospector: prospector strategy means that, those organizations that fall into this category tend to be keen in seeking new and better ways in doing things, such as new product development, venturing into new markets, creating new processes, new ways of organizing things and new sources of supply.
2. Analyzer: also, those organizations that belong to this category more often tend to balance between cost, quality and time. Hence, they are always busy at getting and sensing current data, information and knowledge. This means that, an analyzer firm is positioned between prospector and defender.
3. Defender: while on the contrary, companies that belong to this category are always trying to maintain the status quo by defending their market share as the cost leader. In other words, they are always championing the lowest cost agenda internally and more importantly externally.

Figure 1 shows different position of a firm considering operation strategy.

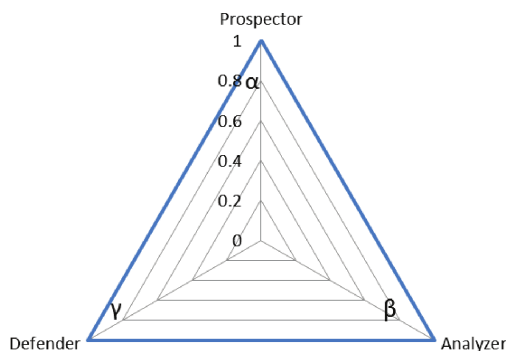


Fig. 1. Manufacturing business strategy.

### Sense and respond method

Sense and respond method supports decision makers by forming a picture of what might happen in the future. Using sense and respond method enables firms to collect data regarding expectations and experiences and understand how firms see themselves compared to competitors [4].

The following form is used to conduct Sense and Respond method [4]:

Performance attribute	Scale: 1=low, 10=high		Compared with competitors			Direction of development		
	Expectation (1-1)	Experience (1-10)	worse	same	better	worse	same	better
Performance 1								
Performance 2								

Fig. 2. Sense and Respond form.

### The development of Critical Factor Index

In this case study, the last developed Critical Factor Index method which is NSCFI used to measure the business performance of four different selected furniture manufacturing industries in Malaysia. In total, 21 attributes (Appendix 1) were chosen to describe the process of knowledge & technology management, organizational systems and information systems in the manufacturing firms.

The respondents were asked to evaluate each attribute in terms of expectations and real life experiences (in Appendix 1). Essentially, the questionnaires give more emphasis on which way does the employees believe the attribute will develop within the next few years and how it has changed within the last few 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.

Based on the CFI formula, some changes have been made in order to lower the high influence of the Standard Deviation (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. According to (The Development of the Critical Factor Index Method), 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 [8, 9], and [10].

Later on, Critical Factor index were developed two more stages to SCFI and NSCFI (formula in Appendix 2) [5].

### Method of judgments in CFIs

Having calculated CFIs, the method of judgment for under resource, balanced and over resource attributes would be as follow: an attribute between

the range of 1/3 and 2/3 of average resource level is considered to be balanced and in CFIs charts is marked as green. An attribute above 2/3 of average resource is over resource and is marked as yellow and any attribute with the value less than 1/3 of average resource is under resources and will be marked as red in CFIs bar chart [11].

**SCA risk level**

As Sustainable competitive advantage (SCA) is the measurement of risk level for that the operation strategy so in this paper three indexes are used to measure the risk level of the operation strategy for sustainable competitive advantages. These three measures are: MAPE, RMSE and MAD (formulas Appendix 2) [3].

**Findings**

The following results are based on 15 responses out of 40 sent questionnaires. The response rate is not much higher than 40%, else big differences could have been identified. The following graph shows the deviation between the two approaches. From the shape of the Fig. 3 below, it can be seen that there is more ambiguity and unawareness of the various attributes than in the expectations for the future. The scale values in the figures are limited to 10, in order to keep the diagram readable.

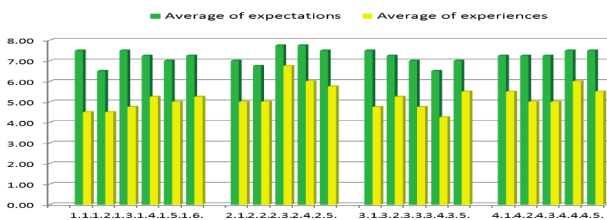


Fig. 3. Average of expectations vs. Average of experiences values for Company “A”.

Meanwhile, to determine the critical and balanced areas of business, the “traffic light” concept is used. This concept includes three indicators: red (area is critical and problematic and should be given more attention and resources), green (area is stable and resources are well allocated), yellow (area is scattered and disorganized; respondents do not have the same understanding and point of view concerning this area) [12] and [13]. The results of NSCFI method are displayed in figures below.

**Furniture Company “A”**

The attributes being measured are listed and showed in Appendix 1. The results confirmed that

in Company “A”, expectations (ideal) are higher than experience (real) in all 21 parameters being measured. Expectations on knowledge & technology management, organizational systems, and information systems are among the highest in Company “A”. Using the formulas for calculating CFI from the Fig. 1, the attributes namely 1.1 (Knowledge & Technology Management), 1.2 (Training and Development of the Company), 3.1 (Leadership and Management System of the Company), and 4.3 (Availability of Information in Information Systems) would have been identified to be most critical of Company “A”. Conversely, the BCFI shows that the attributes 1.2 (Training and Development of the Company), 2.2 (Reduction of Unprofitable Time in Process), and 3.4 (Utilizing Different Types of Organizing Systems) are considered the most critical ones in the company.

Furthermore, it was observed that extreme deviations can be monitored for the attribute numbers 1.1 (Knowledge & Technology Management), 1.3 (Innovativeness and Performance of Research and Development), and 3.1 (Leadership and Management System of the Company). Hence, attributes 1.1 (Knowledge & Technology Management), 1.2 (Training and Development of the Company), 3.1 (Leadership and Management System of the Company), and 4.3 (Availability of Information in Information Systems) are considered as being among the most critical attributes, whereas only 1.3 (Innovativeness and Performance of Research and Development) is considered as critical with the BCFI approach. Particularly, attributes 1.1 (Knowledge & Technology Management), and 3.1 (Leadership and Management System of the Company) reveal the pitfalls of the CFI equation. The company expectation is high; however, experience is also slightly rising. Firstly, this signifies a normal environment of many organizations in which employees are expecting better working environment in terms of knowledge & technology management, organizational systems and information systems [14]. Secondly, there has been a higher expectation of the organizational process and workflows, such as time delivery to customers and control and optimization of inventories in Company “A”. On the contrary, there has been slightly lower expectation on the innovativeness and performance of research and development in the company. Therefore, it is advised that the management of Company “A” to allocate more resources towards establishing a well-defined channel of distributions to their customers.

From Fig. 4 [Normalized Scaled Critical Factor Index (NSCFI)] some basic assumptions regarding the Company “A” are put out. First of all, it could

be stated that the situation of Company “A” was generally stable in the past, such as knowledge & technology management, organizational systems and information systems were balanced. However, the only concern (critical) of the company is that of leadership and management systems of the company. Furthermore, scattered areas that are indicated in “yellow” in Fig. 4 show that the management staff that respond to these questionnaires do not have a common opinion about a particular area of business, such as on-time deliveries to customers; control and optimization of all types of inventories; adapts of changes in demands and in order backlog; and Code of conduct and security of data and information.

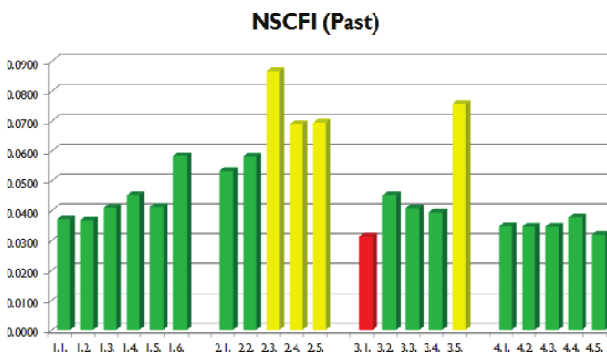


Fig. 4. NSCFI values for past period of time for Company “A”.

While on the contrary, Fig. 5 (NSCFI future) shows that the company is balanced and stable on Knowledge and Technology Management and Information Systems. Conversely, some of the attributes areas (as indicated in red) are considered as very critical for the company survival in the near future. Attributes of innovativeness and performance of research and development; leadership and management systems of the company; and well defined responsibilities and tasks for each operation are found to be critically important for the Company “A” management to pay attention and take necessary corrective

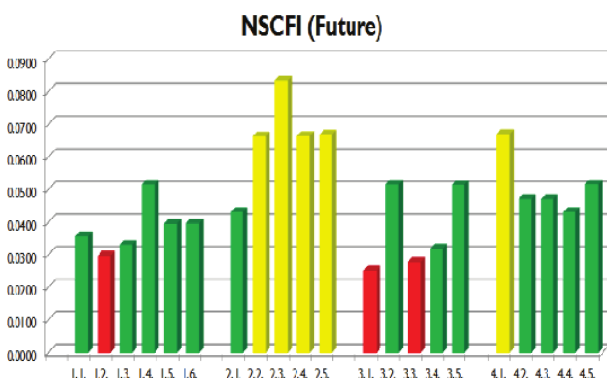


Fig. 5. NSCFI values for future period of time for Company “A”.

strategic measures. This also means that in the near future Company “A” situation will become critical, in which a lot of scattered areas (yellow) will appear, such as in process & work flows area (reduction of unprofitable time in processes; on-time deliveries to customers; control and optimization of all types of inventories; addictiveness of changes in demands and in order backlog).

Another key area of concern for Company “A” is the operations strategy of the company (Figs. 6 and 7).

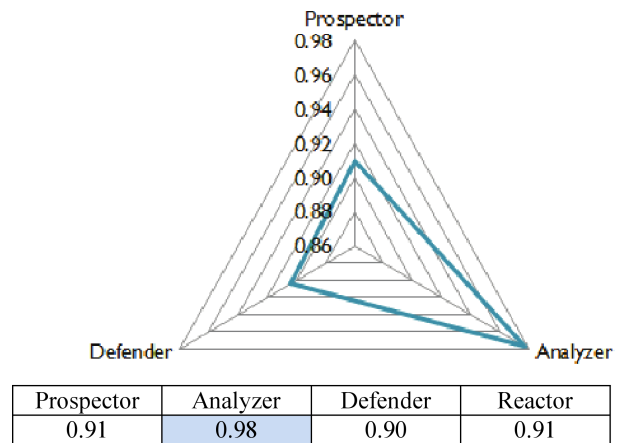


Fig. 6. Operations strategy of Company “A”: Past.

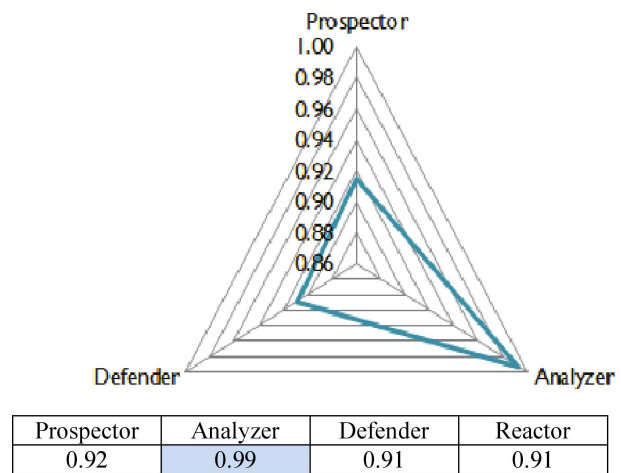


Fig. 7. Operations strategy of Company “A”: Future.

Moreover, Takala [15] embraced the RAL model to support the Business strategy related to manufacturing strategy. The RAL model (Fig. 8) contains factors’ responsiveness, agility and leanness. Essentially, the model contains the supporting resources for operational strategy, using four main criteria, such as quality, cost, time and flexibility. According to [12], the transferability of RAL model has proven to be excellent. Thus, operational strategies have been developed over the course of 100 case com-

pany studies in over 10 countries worldwide. Case companies' sizes have varied from very large to very small, and they all have competed in turbulent business environments in different industries.



Fig. 8. RAL model (Heikkilä, 2013 and Takala et al., 2007).

The RAL model demonstrated in the Fig. 8 uses a pyramid shape to review the manufacturing strategy. The pyramid is formed from the normalized weights of cost, quality, time and flexibility. The lengths of the pyramid's sides are the values for responsiveness, agility and leanness. With these values it is possible to form an image which indicates the operations strategy of the company and the competitive group the company belongs to. The shape of the pyramid depends on the lengths of the sides and the angles of the corners. Angles and lengths are defined by the normalized weights of cost, quality, time and flexibility.

Hence, Fig. 6, shows that in the past period of time due to two types of product the company is producing in the market domains, the management are relatively stable on one product, while the other is changing. For example, Company "A" operates routinely and efficiently through the use of formalized structures and processes in their stable areas. At the same time, top managers watch their competitors closely for new ideas in more turbulent areas and then they rapidly adopt those changes which appear to be the most promising.

Consequently, as shown in Fig. 7, the operations strategy of Company "A" in the future is inclined to be analyzer. Meaning that Company "A" tends to balance between cost, quality, and time. Hence, they are always busy at getting and sensing current data, information, and knowledge. This finding reveals that, as the company is relatively stable on its two types of product-market domains in the past, the company will also continue to operate routinely and efficiently through the use of formalized structures and processes.

### Furniture Company "B"

The results of Company "B" for both future and past are displayed in Fig. 9, whereby the scale values are fixed to 10 in order to keep the diagram reader

friendly. Although for such attributes as 1.1 (Knowledge & Technology Management), 2.1 (Short and Prompt Lead Time in Order – Fulfillment Process), 2.2 (Reduction of Unprofitable Time in Process), 2.3 (On-Time Delivery to Customer), 2.4 (Control and Optimization all Types of Inventories), and 2.5 (Adaptiveness of Changes in Demands and in order Backlog), the values for the past BCFI are significantly bigger than others. The BCFI method yielded results for both the future and past development separately. From the shape of the Fig. 9, it can be deduced that there are more uncertainties on most of the attributes with bigger gaps when comparing between experience and the expectations for the future.

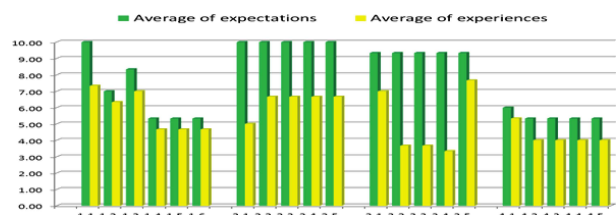


Fig. 9. Average of expectations vs. Average of experiences values for Company "B".

From Fig. 9, it is observed that the values for attributes 3.2 (Quality Control of Products, Process and Operations), 3.3 (Well-Define Responsibility and Tasks for each Operation), and 3.4 (Utilizing Different Types of Organizing Systems) are the most critical focus for the future development for Company "B".

The peak values of attributes 1.1 (Training and Development of the Company), 2.1 (Short and Prompt Lead Time in order – Fulfillment Process), 2.2 (Reduction of Unprofitable Time in Process), 2.3 (On-Time Delivery to Customer), 2.4 (Control and Optimization all Types of Inventories), and 2.5 (Adaptiveness of Changes in Demands and in order Backlog) showed that these particular attributes are considered less critical. Therefore, there is less priority and need for development. The nature of these attributes suggests that with any development to other (critical) attributes, the ones in question will also be improved.

Consequently, the past BCFI values show 1.1 (Knowledge & Technology management), 1.3 (Innovativeness and Performance of Research and development), 3.1 (Leadership and Management System of the Company), and 3.5 (Code of Conduct and Security of Data and Information) attributes are either non-critical or otherwise there has not been a common view on them between the respondents, by and large this will explain the ambiguity of those at-



tributes to the Company “B” around them in the near future.

Comparing Fig. 10 and Fig. 11, figures demonstrate that in the past Company “B” are relatively stable on the attributes of knowledge and technology and Information system whereas processes & work flows and organizational systems attributes are considered imbalanced and critical. Essentially, the major concern (critical) of the company is that of process & work flows attributes and partially some attributes of organizational system. Hence, it’s recommended that in future, the situation of process & work flows will be considerably improved; however, in other area’s situation will remain the same with slight changes.

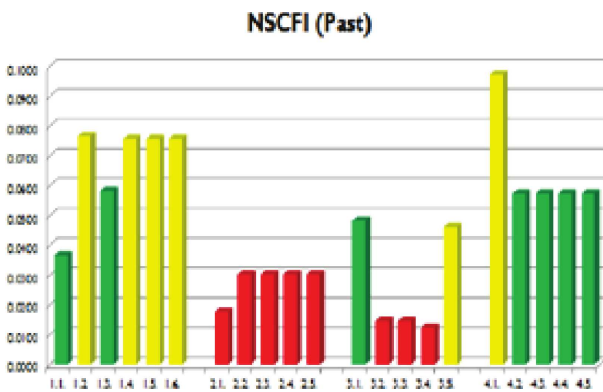


Fig. 10. NSCFI values for past period of time for Company “B”.

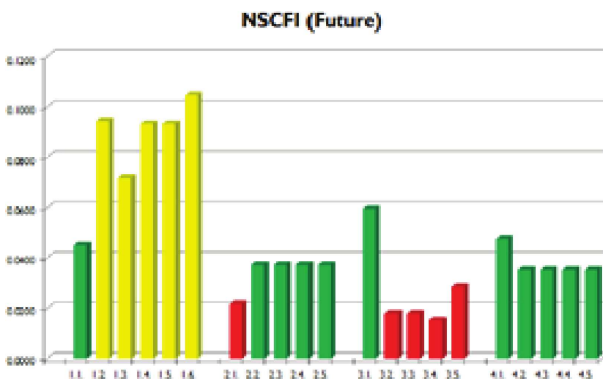


Fig. 11. NSCFI values for future period of time for Company “B”.

Company “B” has few areas of concern in relation to the operation strategy of the company, as shown in Fig. 12 and Fig. 13. Reference [14] stated that operational strategy in most organizations has different sustainable index and is classified into three different groups, namely prospector, analyzer and defender. Hence, it can generally be said that the interpretation and triangle position of the Company “B” strategies vary between the past and the

future. Figures 12 and 13 present the differences in the images respondents have regarding the company’s strategy. From the respondents’ point of view, analyzer-type strategy has been the main strategy in the past. However, the employees of Company “B” expect and predict that, in the future, both analyzer and defender strategy types are considered to be the main way forward in the future.

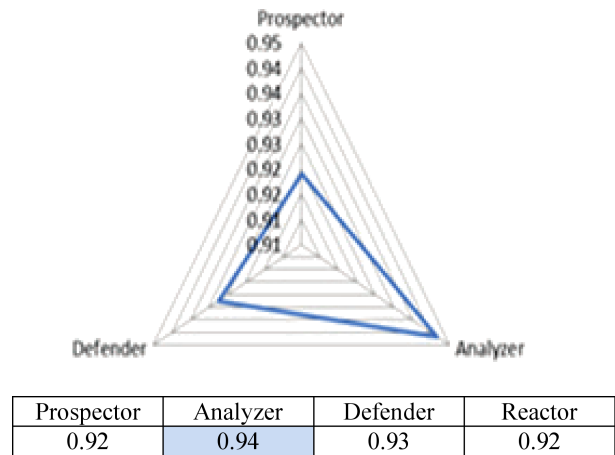


Fig. 12. Operations strategy of Company “B”: Past.

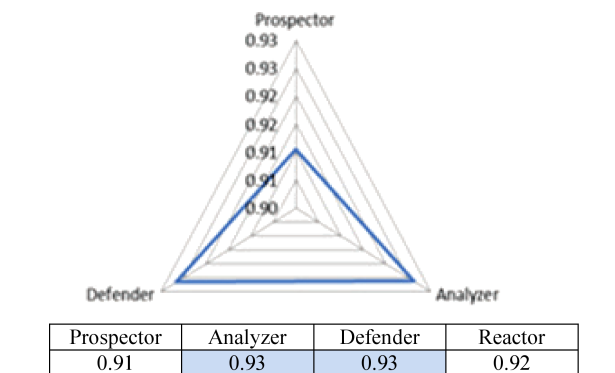


Fig. 13. Operations strategy of Company “B”: Future.

This implies that operations strategy of Company “B” (refer to Figs. 12 and 13) in the past, the company management is relatively stable on their production, because of formalized structures and process system, while making some limited changes by observing their competitors’ strategy. At the same time, the company is taking benefits from each operations strategy. Hence, the operational strategy of the company in the future will be fully supported, because the company will tend to maintain the status quo by defending their market share as the cost leader, while balancing between cost, quality, and time.

**Furniture Company “C”**

The findings of Company “C” (Fig. 14) revealed that all respondents had very high expected values, which are equated and sometimes partially exceeded almost invariably themselves for the success of the company. The general impression was that the survey questions given in different respondents’ groups’ had very similar feedback. All respondents and groups deliver almost the same results, when results were compared to each other. Questions 1.1 (Knowledge & Technology management), 1.3 (Innovativeness and Performance of Research and Development) and 4.5 (Usability and Functionality of Information in Information Systems) of BCFI values are clearly higher than the values for the rest of the questions. Besides, there are areas where experience is higher than expectations: leadership and management systems of the company; quality control of products, processes, and operations; well defined responsibilities and tasks for each operation.

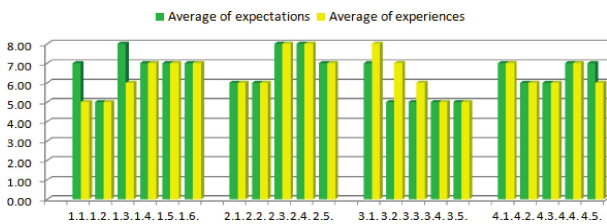


Fig. 14. Average of expectations vs. Average of experiences values for Company “C”.

This means that respondent does not expect any significant changes in knowledge & technology management; in process & work flows, and in information systems areas. However, considerable changes are expected in the near future on training and development of the company’s personnel; communication between different departments and hierarchy levels; usability and functionality of information systems.

One other key area of concern for Company “C” is the operations strategy of the company (Figs. 15 and 16).

According to [14], operational strategy in most organizations has a different sustainable index and is classified into three different groups, namely prospector, analyzer, and defender.

According to the Company “C” respondents, the image of the company tends to be analyzer-type strategy in the past and the analyzer-type strategy will become even more obvious in the future. Essentially, the findings of operational strategy for Company “C” (Figs. 15 and 16) is almost similar to that of Company “A” (Figs. 6 and 7), which show that in

the past period of time due to the two types of product the company is producing in the market domains, the management are relatively stable on one product, while the other is changing. For example, Company “C” operate routinely and efficiently through the use of formalized structures and processes in their stable areas, while in their more turbulent areas, top managers watch their competitors closely for new ideas, and then they rapidly adopt those which appear to be the most promising.

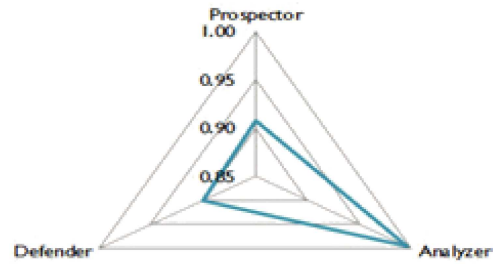


Fig. 15. Operations strategy of Company “C”: Past.

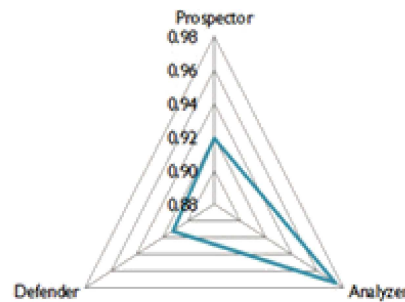


Fig. 16. Operations strategy of Company “C”: Future.

This means that since the company inclines towards balancing between cost, quality, and time in the past; hence, the company will continue to be relatively stable on its two types of product-market domains, so also is expected in the near future.

**Furniture Company “D”**

The results confirmed that expectations (ideal) are higher than experience (real) in all 21 parameters being measured in the company. Expectations on knowledge & technology management, organizational systems and information systems are among the highest in Company “D”. Figure 17 shows that attributes 3.2 (Quality Control of Products, Process, and Operations), 3.3 (Well-Define Responsibility and Tasks for Each Operation), and 3.4 (Utilizing Differ-

ent Types of Organizing Systems) would have been identified to be most critical in Company “D”. Conversely, the BCFI shows that attribute 3.4 (Utilizing Different Types of Organizing Systems) is considered the most critical in the company (Fig. 17).

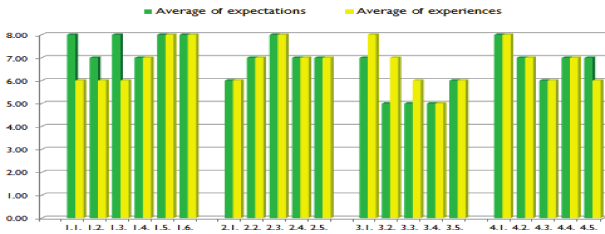


Fig. 17. Average of expectations vs. Average of experiences values for Company “D”.

Furthermore, by comparing both the CFI and BCFI results, it was observed that extreme deviations can be monitored on the attributes number 1.1 (Knowledge & Technology Management), and 1.3 (Innovativeness and Performance of Research and Development). Hence, attributes 3.2 (Quality Control of Products, Process, and Operations), 3.3 (Well-Define Responsibility and Tasks for Each Operation), and 3.4 (Utilizing different Types of Organizing Systems) are considered as being among the most critical attributes, whereas only 1.1 (Knowledge & Technology Management) and 1.3 (Innovativeness and Performance of Research and Development) are considered as critical with the BCFI approach. Particularly, attributes 1.1 (Knowledge & Technology Management), 1.3 (Innovativeness and Performance of Research and Development), and 3.2 (Quality Control of Products, Process, and Operations) reveal the pitfalls of the CFI equation. Though, both expectation and experience of the company are relatively ranked high. However, this signifies a normal environment of many organizations in which employees are expecting better working environment in terms of knowledge & technology management, organizational systems, and information systems. On the contrary, there has been a slightly lower expectation on quality control of products, process and operation, on time delivery to customers, and utilization of different types of organizing systems, such as project, team, and process.

Hence, it’s advised that the management of Company “D” allocates more resources towards establishing well-defined channels of distributions to their customers among others.

Largely, the situation of Company “D” was relatively stable in the past, as shown in Fig. 18. Meanwhile, there are a lot of mixed reactions regarding the past and the future attributes of the company

in the long run. For example, those attributes that are considered as very critical in the past, such as training and development of the company’s personnel, innovativeness, and performance of research and development, communication between different departments and hierarchy levels, reduction of unprofitable time in processes, utilizing different types of organizing systems, information systems support the business processes, visibility of information in information systems, quality & reliability of information in information systems, usability and functionality of information systems may turn out to improve the situation in the near future, as more “yellow” attributes appears (Fig. 19).

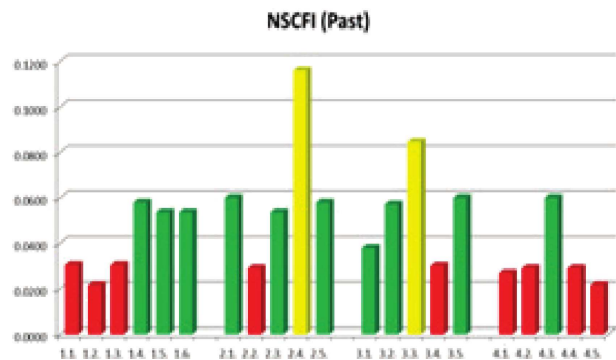


Fig. 18. NSCFI values for past period of time for Company “D”.

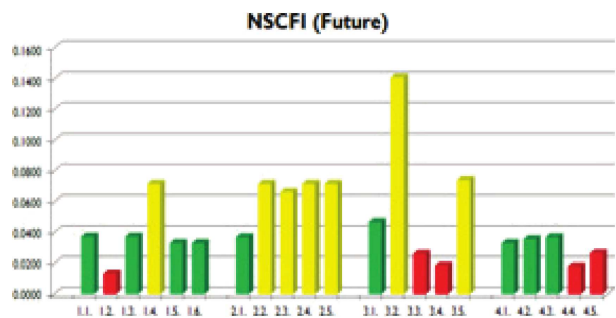
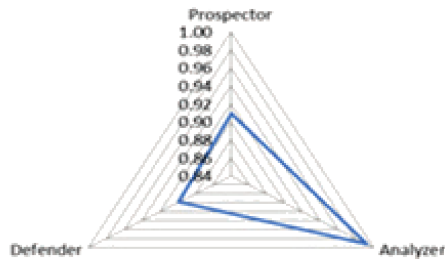


Fig. 19. NSCFI values for future period of time for Company “D”.

This means that due to the rapid increase of scattered areas on those attributes (adaptation to knowledge and technology, reduction of unprofitable time in processes, on-time deliveries to customer; control and optimization of all types of inventories, adaptiveness of changes in demands and in order backlog, quality control of products, processes and operations, code of conduct, and security of data and information) the management of Company “D” has to take a very drastic decision, so as to rescue the company in the near future or else the future situation will worsen as critical areas will appear.

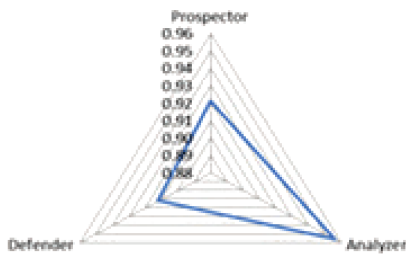


One other key area of concern for Company “D” is the operations strategy of the company (Figs. 20 and 21). According to [14], operational strategies in most organizations have a different sustainable index and are classified into three different groups, namely prospector, analyzer, and defender.



Prospector	Analyzer	Defender	Reactor
0.91	0.99	0.90	0.90

Fig. 20. Operations strategy of Company “D”: Past.



Prospector	Analyzer	Defender	Reactor
0.92	0.96	0.91	0.92

Fig. 21. Operations strategy of Company “D”: Future.

Figures 20 and 21 present similar results on the respondents’ perception regarding the company “D” strategy. From the respondents’ point of view, analyzer-type strategy has been the main strategy for the Company “D” in the past. Also analyzer-type strategy is considered to be the main strategy for the Company “D” in the future, while balancing between cost, quality, and time. This means that in the past the company was relatively stable on its two types of product-market domains. This, also, shows that the company will continue to operate routinely and efficiently through the use of formalized structures and processes, while in their more turbulent areas, the top managers watch their competitors closely for new ideas, and then they rapidly adopt those which appear to be the most promising.

From the summary of Sustainable Competitive Advantage (SCA) risk level (Table 1), the risk level of each company can be analyzed by comparing the risk level in the past and that of the anticipated risk level in the near future. First of all, the risk levels of

the Company “A” in the past and the future were the same. For that a conclusion can be made that the overall situation of the Company “A” is balanced without high risk level.

Table 1  
Summary of SCA Risk Level.

	Technique	Past	Future
Company “A”	BCFI	0.94	0.94
	SCFI	0.94	0.94
	NSCFI	0.94	0.94
Company “B”	BCFI	0.94	0.94
	SCFI	0.93	0.93
	NSCFI	0.93	0.93
Company “C”	BCFI	0.93	0.93
	SCFI	0.93	0.93
	NSCFI	0.94	0.94
Company “D”	BCFI	0.93	0.93
	SCFI	0.93	0.93
	NSCFI	0.94	0.94

Secondly, the risk level of the Company “B” in the future remains relatively the same. Meaning that, the strategies of the Company “B” are fully supporting the system in the Company “B”. Also, the risk level of the Company “C” strategies compared to other similar companies, the risk level is not high and is acceptable. This shows that, risk level in the Company “C” will remain the same in the near future. Finally, from the table below the risk level of the Company “D” is considered as not high. Meaning that, all the available resources are allocated in a proper way.

### Findings from Malaysian furniture industries

Generally, it is quite known for a newly developing country like Malaysia that its manufacturing firms are much more focused on production (market and export-based) than on research, innovation and training. Malaysian furniture industries are putting more attention and time to meet customer orders and its respective delivery, for sales and profit achievement. The complementing activities to production and delivery, such as enhancing knowledge and technology, streamlining organizational process and effective information systems, are seemingly less crucial and receiving lower attention. This implies that there is less attention given on R&D activity, meantime there are big market and customers to take care of. In addition, Tasmin and Woods [16] affirmed the fact that Malaysian manufacturing firms are more production and quantity

based, than incorporating leverages on new technology, research and innovation. Hazri and Vega [17] contended that Malaysia is going to be staying in “middle-income trap” economy. This implies that the country seems to be relatively comfortable at the moderate level of income, and finding it surmountable to attain into developed nation status. At low income level, it is relatively easy to take advantage of cheap labor for low-skilled manufacturing exports that already help to expedite the transition from low to middle income. However, moving upward to be high-income nation is much more challenging.

Hence, Malaysian furniture firms have to acquire foresight towards looking into the future. They must move one step ahead in areas of innovativeness and R&D, leadership and management systems plus well-defined responsibilities and tasks. Manufacturing firms need to take actions on investing towards empowering creative and design performance, such as exploring into new potential wood-based products as hybrid papers and high-tech wood as their new competitive advantage. This provides new horizontal product integration into the existing business operation, which is currently yielding good sales and commendable profit. It is quite obvious that the leadership and management systems are urgently needed to be addressed effectively. This could be achieved by organizational restructuring or streamlining the workforce and perhaps, implementing environmentally friendly manufacturing system, such as ISO 14000. Most furniture firms in Malaysia have attained the ISO 9001 quality assurance system. For future furniture industry direction, Malaysia’s firms need to rejuvenate on product processes, workflows, work-in-progress (WIP), inventory control and more visible and available type of information systems. Perhaps, the management may consider implementing a MRP or ERP system, as competitive advantage and effective means for future growth.

## Future directions

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Generally, it can be summed up that Malaysian furniture industry requires to significantly increase on innovativeness and performance of research and development. This can be achieved partially through introduction of more automation, digital processing, high-tech equipment and software solutions. Application of more advanced machinery contributes to reduction of unprofitable time in process and subsequently eliminating low-skilled manpower. Leadership and management systems within the fur-

niture firms are suggested to be less hierarchical, more streamlined and implementing wider information systems in strategic manufacturing points, so as to enhance information visibility and accessibility.

In Finland industries have more and more global trade with local features in design etc. In many countries huge efforts are taken to export more with complete furnishing designs at home and in offices. Results from materials development will be taken into use, and new technologies like 3D scanning and printing, automation especially with the increasing number of robots in Finnish manufacturing, and even cloud manufacturing will make it more and more possible to operate competitively globally. And, at the same time environmentally, economically and strategically more sustainable operations strategies are under great interest all over the world.

For the Global Manufacturing Strategy to fully optimize world’s resources, Finland could export its furniture-based advanced technology to Malaysian furniture firms to have a win-win impact on the global scale. Since Finnish furniture firms are relatively local-oriented and having limited market, they need to embark into operating in areas with potential expanding market and be in that growing region, as business proverb says “produce where there is market”. Finnish companies may opt to use Malaysia as a base for ASEAN region and the stepping stone, prior moving into the China’s vast market. At macro and national economic level, Malaysia must move progressively to make the leap from middle to high income nation. This partly could be achieved by internal production of furniture parts, hence reducing furniture components’ import. Thus, Malaysia could export a more competitive and much higher local furniture contents to attain higher export values. When incomes increase, costs will also increase, which means Malaysia has to “move up the value chain” [18]. Hence at micro economic level, this signifies that Malaysia’s furniture firms must move into enhanced new product research then export more technologically advanced products, such as high-end office furniture, hybrid paper and highly engineered veneer, to newly expanding market such as the Middle East, India and Brazil.

## Conclusions

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The comparison of the Balanced Critical Factor Index (BCFI) with the earlier Critical Factor Index (CFI) methods revealed the pitfalls of the CFI method. For example, the BCFI method specifically

showed that there were definite targets for development, according to the respondent experiences and expectations. Hence, this study had produced important information about the current state of idle and critical attributes for the company in the past and the future. Therefore, based on the findings and the results, the management of the furniture industry under review, will be able to focus attention to the critical areas, as well as perpetual improvement on the idle and stable attributes. So that in the long run, the companies could screen their ideas for feasibility in the early stages, in order keep their dominant market share and to pick the winning ideas for further development into world-class innovations. Consequentially, 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.

On the final note, the benefits of fast, comprehensive, and reliable method to gather important information in order to make sustainable decisions on a low cost level are self-evident and will most probably lead to a further increase of interest about the BCFI method in the future. However, as stated above, there is still the need for further development of BC-

FI method and therefore should be tested in future case studies. Last but not least it has to be stated that the BCFI method can be utilized to test internal as well as external processes, based either on expectations and experiences of employees, customers or business partners.

The Malaysian firm statistical finding shows that they have higher sense of Time (T), being highly responsive towards adaptation to knowledge and technology and quality control of the manufacturing operations. This suggests that these firms are highly flexible with customer requests and focusing on delivery on-time, hence attaining Responsiveness (R). The RAL model categorizes the Malaysian furniture firms as “Analyzer” in future. This suggests that the furniture firms are always conscious with acquiring current data, information and knowledge. In addition, this signifies that the firms prefers for balancing quality-cost-time (QCT) operational strategy, hence striving to be more technologically adaptive in attaining high satisfaction on on-time delivery, sales achievement and market dominance.

### Appendix 1. Example of Attributes from the Internal Questionnaire

	Expectation (1-10)	Experience (1-10)	Direction of Development			Compared to Past		
			Worse	Same	Better	Worse	Same	Better
<b>1. ATTRIBUTES</b>								
1.1 Knowledge & Technology Management								
1.2 Training and development of the company								
1.3 Innovativeness and performance of research and development								
1.4 Communication between different departments and hierarchy								
1.5 Adaptation to knowledge and technology								
1.6 Design and planning of the process and product								
<b>2. Processes &amp; work Flows</b>								
2.1 Short and prompt lead time in order — fulfilment process								
2.2 Reduction of unprofitable time in process								
2.3 On time delivery to customer								
2.4 Control and optimisation all types of inventories								
2.5 Adaptiveness of changes in demands and in order backlog								
<b>3. Organizational Systems</b>								
3.1 Leadership and management system of the company								
3.2 Quality control of products, process and operations								
3.3 Well define responsibility and tasks for each operation								
3.4 Utilising different types of organizing systems (project, teams)								
3.5 Code of conduct and security of data and information								
<b>4. Information Systems</b>								
4.1 Information systems support the business process								
4.2 Visibility of information in information systems								
4.3 Availability of information in information systems								
4.4 Quality and reliability of information in information systems								
4.5 Usability and functionality of information in information systems								

## Appendix 2

The Calculation of CFI, BCFI and SCFI:

$$CFI = \frac{Std(experience) * Std(expectation)}{Gap\ Index * Direction\ of\ development\ Index * Importance\ Index}, \quad (1)$$

$$BCFI = \frac{Std(experience) * Std(expectation) * Performance\ Index}{Importance\ Index * Gap\ Index * Direction\ of\ development\ Index}, \quad (2)$$

$$SCFI = \frac{\sqrt{\frac{1}{n} * \sum_1^n (experience(i) - 1)^2} * \sqrt{\frac{1}{n} * \sum_1^n (expectation(i) - 10)^2} * Performance\ Index}{Importance\ Index * Gap\ Index * Development\ Index}. \quad (3)$$

The parameters are:

$$Gap\ index = \left| \frac{Avg(experience) - Avg(expectation)}{10} - 1 \right|, \quad (4)$$

$$Direction\ of\ development\ index = \left| \frac{Better\% - Worse\%}{100} - 1 \right|, \quad (5)$$

$$Importance\ index = \frac{Avg(expectation)}{10}, \quad (6)$$

$$Performance\ index = \frac{Avg(experience)}{10}, \quad (7)$$

$$SD\ expectation\ index = \frac{Std(expectation)}{10} + 1, \quad (8)$$

$$SD\ experience\ index = \frac{Std(experience)}{10} + 1. \quad (9)$$

Calculation of MSI factors:

$$Q' = \frac{Q}{Q + C + T}, \quad (10)$$

$$C' = \frac{C}{Q + C + T}, \quad (11)$$

$$T' = \frac{T}{Q + C + T}, \quad (12)$$

$$F' = \frac{F}{Q + C + T + F}. \quad (13)$$

The MSI model for prospector group:

$$MSI_p = 1 - [(1 - Q'^{1/3}) * (1 - 0.9 * T') * (1 - 0.9 * C') * F'^{1/3}]. \quad (14)$$

The MSI model for analyzer group:

$$MSI_A = 1 - (1 - F' * [abs[(0.095 * Q' - 0.285) * (0.95 * T' - 0.285) * (0.95 * C' - 0.285)])]^{1/3}. \quad (15)$$

The MSI model for defender group:

$$MSI_D = 1 - (1 - C'^{1/3}) * (1 - 0.0 * T') * (1 - 0.9 * Q') * F'^{1/3}. \quad (16)$$

Calculation of risk level: Models of MAPE, RMSE and MAD:

$$MAPE\ (absolute\ percentage\ error) = SCA = 1 - \sum_{\alpha, \beta, \gamma} \left| \frac{BS - BR}{BS} \right|, \quad (17)$$

$$RMSE\ (root-mean-square\ error) = SCA = 1 - \sqrt{\sum_{\alpha, \beta, \gamma} \left( \frac{BS - BR}{BS} \right)^2}, \quad (18)$$

$$MAD\ (maximum\ deviation) = SCA = 1 - \max_{\alpha, \beta, \gamma} \left| \frac{BS - BR}{BS} \right|. \quad (19)$$

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