Management and Production Engineering Review
Volume 5 • Number 1 • March 2014 • pp. 74–86
DOI: 10.2478/mper-2014-0009

VALIDATING PERFORMANCE BASED CRITICAL ACTIONS IN A HIGH TECH START-UP

Veli-Pekka Vuoti[1], Josu Takala[1], Alexander Mäntylä[1], Yang Liu[1], Wenshan Yang[1], Nurul Aida Binti Abdul Malek[2], Patricia Kronman[1], Andreas Kreuzer[1], Afnan Zafar[1]

[1] *Department of Production, University of Vaasa, Vaasa, Finland*
[2] *Faculty of Technology Management and Business, University Tun Hussein Onn Malaysia (UTHM), Johor, Malaysia*

Corresponding author:
Veli-Pekka Vuoti and Josu Takala
University of Vaasa
Faculty of Technology
Department of Production
PL 700, FI-65101 Vaasa, Finland
phone: +358405592107, +358400564068
e-mail: veli-pekka.vuoti@student.uwasa.fi, jot@uva.fi

Received: 22 November 2013
Accepted: 4 February 2014

Abstract
The objective of this study is to analyze a Finnish manufacturing case company's operational competitiveness. A proposed analytical model based on analyses the corresponding angles of the strategic triangles (Prospector, Analyzer, and Defender). The model compares the angle differences between the strategy and resource triangles with opinions from different management groups of informants. It was found out that Normalized Scaled Critical Factor Index (NSCFI) model is more scientific comparing to formal ones through validation. Calculations based on the MSI questionnaire resulted in medium high values for the Prospector strategy both for past- and future orientation. S&R calculations regarding the past orientation resulted in low values for all strategy types, except P-NSCFI for Analyzer. Moreover this study covers a case, in where Balanced Critical Factor Index (BCFI) was used defining company annual strategy plan.

Keywords
sustainable competitive advantage, sense and respond, manufacturing strategy index, operations strategy, balanced critical factor index, operations start up, case study.

Introduction

As the rapid development of global economics, manufacturing enterprises are trying to find out a survival path to be stable in the competitive market and get benefit as much as it can be. It is undoubtedly recognized that quantitative analyzing will provide management more assistance with numerical data. The idea has been modified by changing both denominator and nominator with rational level values in previous SCFI formulas [1]. Takala draw out the idea of using triangles to comparing operations strategy and resource allocation. The Normalized Scaled Critical Factor Index (NSCFI) model was developed by Liu and the new model accurately the S&R theory and trend research into the study. This proposed model further improves the accuracy and stability of NSCFI modeling and evaluating business strategic decision-making process, based on feedback on case studies using NSCFI. Through analysis of this case study it can be find out that to some degree several Sense & Response models have similar results, however the NSCFI give managerial implication with high accuracy comparing to formal ones.

This paper analyses the corresponding angles of the strategic triangles (Prospector, Analyzer, and Defender) and compare the angle differences between the strategy and resource triangles with opinions from different management groups of informants. In addition, this study develops a new S&R model named NSCFI which based on formal models refers to CFI, BCFI and SCFI. It is critical for enterprise managers to evaluate whether the operations strategy supports their resource allocation then it is more

efficient to make decisions. The proposed analytical model created in this research provides benchmarking to BCFI and SCFI base on testing the hypothesis with the NSCFI model.

According to Takala [2], the case study from one Finnish manufacturing company provided validation of the NSCFI model is the best until now. However, it needs to be proved in a large number of case studies and this case company is just one of our study area. In this paper, our validation comes from different departments of one Finnish company which initially has been a smaller Finnish technology start-up developing a product for industrial material handling and management. The start-up has recently been acquired by a bigger Finnish manufacturing company that is the world's leading equipment and service provider in lifting and machine service business. The analyzing result has been taken from business area managers' operations feedback.

The structure of this paper is as follows. First paper introduces the study objectives and then the latest related studies are presented. After that the paper has review for methodologies used in this research. Two last sections draws findings of this study together and has summary about managerial implications, research limitations and also recommendations for future research.

Literature review

Johnson describes strategy as 'the direction and scope of an organization over the long-term, which achieves advantage in a changing environment through its configuration of resources with the aim of fulfilling stakeholder expectations' [3]. Mintzberg states that strategy is organization's future plan, a position in specific markets, a pattern of its performance and a tactic to left behind its competitors [4].

Companies construct their strategies in many ways. They can compete either on cost, quality of products or services, high levels of customer service or customizing their products and services to fit individual customer needs. The operations function therefore must respond to this by providing the capabilities needed to fulfill the market requirement. In some ways this is a 'translation' task because the techniques and language used by marketing managers to understand the requirements of markets are different to the language and techniques used by operations managers to manage their productive resources. Slack and Lewis [5] defined operations strategy as the pattern of decision which shape the long term capabilities of any type of operations and their contribution to overall strategy, through the reconciliation of market requirements with operations resources. The main vision of each company is to have an operational strategy that will keep the company growing. One of the key features of such strategy is the one that gives a way towards a unique strategic position in the market. According to Skinner [6], the new competitive environment forces manufacturing companies to have a quick response to market demands, deliver high quality products, and the industrial system have to be flexible to new materials and customer needs. Therefore, continuous innovations are needed if the company wants to continuously growing and remain profitable over time. A well formulated strategy would help companies to allocate their resources wisely according to their capabilities and shortcomings in a dynamic environment.

Miles & Snow topology [7] is a dominant framework of the strategy types. They have developed a comprehensive framework which states that the strategy type can be detected depending on the fixed proportions between RAL Model elements (Quality, Cost, Time/Delivery, and Flexibility). According to this framework, there are four different groups; prospectors, defenders, analyzers and reactors. Prospector strategy is the one that always looking forward for opportunity to lead the industry through innovation. Defender strategy tries to maintain their current customer by taking advantage in cost to create a stable market. Analyzer strategy is an intermediate between defender and prospector strategy which tries to balance between quality, cost and time. Reactor strategy has no sense of aims or vision. Under this strategy, the decisions are taken in order to respond to immediate problem.

Methodology

Two methodologies apply in this case study: Manufacturing Strategy Index (MSI) and Sense and Respond (S&R). MSI refers to the operations strategy whereas S&R refers to resource allocation of a company. Both methodologies have a two-sided orientation: Past and future. Attributes are to be assessed for the situation during the past 3–5 years as well as the expectations for the future 3–5 years or equivalent dimensions. In this case study, informants were asked to assess the situation before and during the economic crisis of 2008/2009. Data was gathered by sending questionnaires to two white-collar employees of the case company. The first questionnaire covered the MSI criteria while the second set of questions asked for the attributes in Sense and Respond.

Sense and Respond (S&R)

The term 'Sense and Respond' as a business concept first appeared in the 1992 Management Review article by Stephan H. Haeckel. Originally a label describing a desirable type of organizational behavior, it evolved over the next six years into a post-industrial managerial paradigm, incorporating a set of concepts, principles, prescriptions and tools for creating and managing an adaptive enterprise [8].

According to Ivan Golovko [9], 'Sense and Respond' is a scalable managerial framework developing ability to adopt improvements. To further describe S&R, it's important to mention the current framework used by organizations, 'Make and Sell'. This lower level framework will not allow organizations to operate as competitive as possible nor will they compete in the fierce and constantly changing business environment. Mr. Golovko describes S&R as "converting threats into opportunities, drawbacks into strengths".

The Sense and Respond questionnaire is used to analyze dynamic business strategies. In the S&R questionnaire you deviate accordingly to the influence of an attribute on Quality, Cost, Time and Flexibility of the business performance process. The main criteria (Quality, Cost, Time and Flexibility) have their sub-criteria, which leads to better understanding of RAL Model (Fig. 1).

Competitive priorities of manufacturing strategy are as follows [10]:

- Quality
  - Low defect Rate
  - Product Performance
  - Reliability
  - Environmental Aspects
  - Certification
- Cost
  - Low Cost
  - Value Added
  - Quality Costs
  - Activity Based Measurement
  - Continuous Improvement
- Time
  - Fast Delivery
  - On Agreed Time
  - Right Amount
  - Right Quality
  - Dependable Promises
- Flexibility
  - Design Adjustment
  - Volume Change
  - Mix Changes
  - Broad Product Line

The S&R was utilized by Ranta and Takala [10] by introducing Critical Factor Index (CFI) to develop the operative management system. After introducing CFI, the S&R model has develop with three stages, which are called CFI, BCFI and SCFI model. The three models have common parts and the different parts are the numerator. The S&R model is used to analyze CFI of case companies.

In this research the S&R questionnaire [10] was customized to this company and had 32 attributes to value. Quality had 7 attributes, Cost had 10 attributes, Time had 7 attributes and Flexibility had attributes of 8.

Manufacturing Strategy Index (MSI)

MSI is described as the method of detection of the preferable strategy type. The method implies the key elements of RAL model and derives the proportions of importance between Quality, Cost, Time and Flexibility.

The MSI questionnaire uses pair wise comparison of criteria on a scale reaching from 9 on the left hand side to 9 on the right hand side, with a neutral choice of 1 in the between the two criteria. The full questionnaire consists of 6 top-level questions and 36 detailed questions. For this case study however the MSI survey was limited to the 6 top-level questions.

Cost	98765432123456789	Quality
Cost	98765432123456789	Delivery
Cost	98765432123456789	Flexibility
Quality	98765432123456789	Delivery
Quality	98765432123456789	Flexibility
Delivery	98765432123456789	Flexibility

Fig. 1. MSI top-level questions.

To evaluate the answered MSI questionnaires, a model was built using the Expert Choice software. With this model, the priority weights of the criteria were calculated depending on the answers given by the company informants. With the priority weights at hand it is then possible to detect a company's strategy type according to the typology by Ranta [7], which defines the Prospector, Analyzer, Defender and Reactor business strategy types. For example a high priority weight would be an indicator for a Prospector strategy.

Results and analysis

The Sense and Respond questionnaire included 32 attributes within Quality (Q), Cost (C), Time (T) and Flexibility (F). However, the attributes for operation strategies were not equal. Attributes were divided as follows: Q: ten, C: eight, T: eight and F: seven. Since the questionnaire was custom made in advance, no attributes were equally compiled. In other words, no attributes were left out of the calculations. Hence, this may affect the results.

Figure 2 shows the collected Sense and Respond data from the case company. This is an illustration of the trend for how critical factors change and develop directions. The Figure shows the calculated S&R results of past and future values using BCFI, SCFI and NSCFI models. The range of the attributes are divided into three parts; over resourced, balanced and under resourced. Therefore, if an attribute falls between the range of 1/3 and 2/3 of the average resource level, it is considered balanced. An attribute that is in the range lower than 1/3, is considered under resourced. In this case, average level is 100%/32 = 3.125%, which means that the judging values are 2.083% and 4.167%. This means, that any attribute lower than 2.083% is under resourced and any attribute higher than 4.167% is over resourced. The resource levels are marked with black lines in Fig. 2.

A comparison of past and future BCFI, SCFI and NSCFI with one by one analyze can be seen in Table 1.

Table 1 shows how the attributes change from before economic crisis to during economic crisis. There is comparison of results of past and future values using three different S&R models (CFI, BCFI and SCFI) which are based on analysis of 32 attributes one by one. The trend clearly shows how any specific attribute alters from past to future. When the value of an attribute in both before and during are good, the trend is considered to be unchanged and marked with "-". Values, which change from good to other, will show that the trend is worse. However, if values change from other to good, the trend is better. When values are either lower or higher, it is still recognizable to determine their direction. For instance, if two values are over resourced and the latter value is lower, then the direction is better and vice versa.

When comparing the results, a summary can be made that all values are valid. Looking at the trends for BCFI and SCFI, most of the attributes are marked as "Better" while NSCFI have almost the same amount of attributes marked with "Better" and "Same". The trend for before and during NSCFI is showing good results. Many attributes have shown 0 index values the reason behind this is zero standard deviation in the collected data, which is expected commonly. So from the 0 index value no real situation can be analyzed. But still the original CFI model is considered to be a benchmark to interpret the critical factors.

The BCFI and SCFI proved to be helpful for solving above mentioned problem and more interpretations can be made from the results. For SCFI using root mean square to avoid zero standard deviation is enough. These formulas are shown below [10].

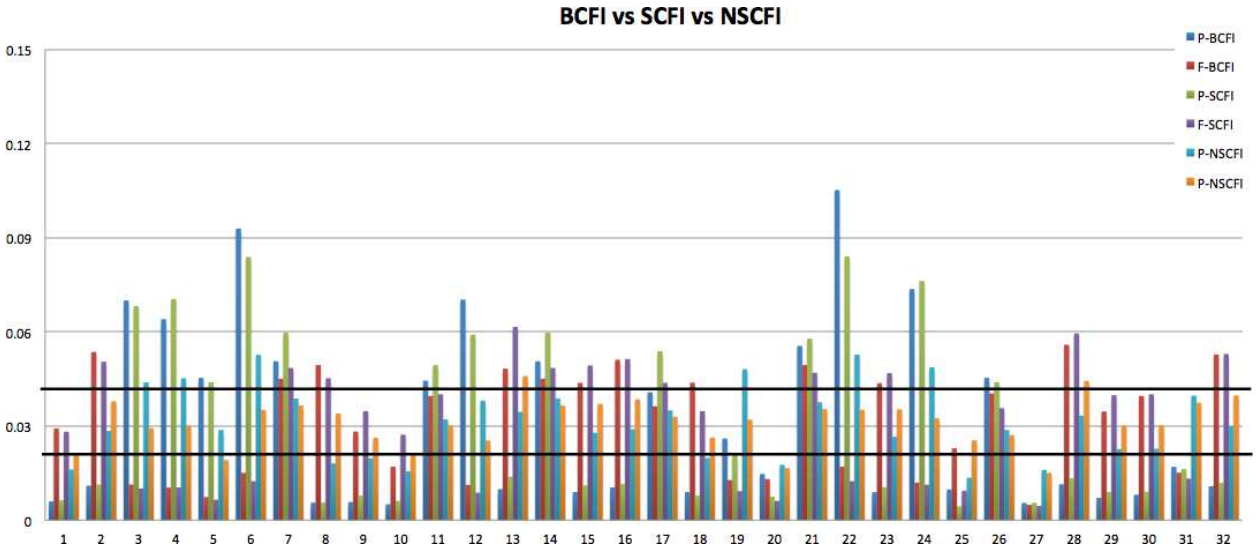

Fig. 2. Results of BCFI, SCFI and NSCFI.

Table 1
Comparison of Past and Future BCFI, SCFI and NSCFI.

Atribute	P-BCFI	F-BCFI	Trend	P-SCFI	F-SCFI	Trend	P-NSCFIE	F-NSCFIE	Trend
1	Under	Good	Better	Under	Good	Better	Under	Good	Better
2	Under	Over	Worse	Under	Over	Worse	Good	Good	–
3	Over	Under	Worse	Over	Under	Worse	Over	Good	Better
4	Over	Under	Worse	Over	Under	Worse	Over	Good	Better
5	Over	Under	Worse	Over	Under	Worse	Good	Under	Worse
6	Over	Under	Worse	Over	Under	Worse	Over	Good	Better
7	Over	Over	Better	Over	Over	Better	Good	Good	–
8	Under	Over	Better	Under	Over	Better	Under	Good	Better
9	Under	Good	Better	Under	Good	Better	Under	Good	Better
10	Under	Under	Better	Under	Good	Better	Under	Under	Better
11	Over	Good	Better	Over	Good	Better	Good	Good	–
12	Over	Under	Worse	Over	Under	Worse	Good	Good	–
13	Under	Over	Better	Under	Over	Better	Good	Over	Worse
14	Over	Over	Better	Over	Over	Better	Good	Good	–
15	Under	Over	Better	Under	Over	Better	Good	Good	–
16	Under	Over	Better	Under	Over	Better	Good	Good	–
17	Good	Good	–	Over	Over	Better	Good	Good	–
18	Under	Over	Better	Under	Good	Better	Under	Good	Better
19	Good	Under	Worse	Under	Under	Worse	Over	Good	Better
20	Under	Under	Worse	Under	Under	Worse	Under	Under	Worse
21	Over	Over	Better	Over	Over	Better	Good	Good	–
22	Over	Under	Worse	Over	Under	Worse	Over	Good	Better
23	Under	Over	Better	Under	Over	Better	Good	Good	–
24	Over	Under	Worse	Over	Under	Worse	Over	Good	Better
25	Under	Good	Better	Under	Under	Better	Under	Good	Better
26	Over	Good	Better	Over	Good	Better	Good	Good	–
27	Under	Under	Worse	Under	Under	Worse	Under	Under	Worse
28	Under	Good	Better	Under	Over	Better	Good	Over	Worse
29	Under	Good	Better	Under	Good	Better	Good	Good	–
30	Under	Good	Better	Under	Good	Better	Good	Good	–
31	Under	Under	Worse	Under	Under	Worse	Good	Good	–
32	Under	Over	Better	Under	Over	Better	Good	Good	–

CFI is calculated as follows:

$$CFI = \frac{Std\,(experience) - Std(expectation)}{Importance\ index - Gap\ index - Development\ index},$$

$$SD\ Expectation\ index = \frac{SD(expectation)}{10} + 1,$$

$$SD\ Experience\ index = \frac{Std(expectation)}{10} + 1.$$

BCFI is calculated as follows:

$$BCFI = \frac{SD\ Expectation\ index - SD\ Experience\ index - Performance\ index}{Importance\ index - Gap\ index - Development\ index}.$$

SCFI is calculated as follows:

$$SCI = \frac{\sqrt{\frac{1}{n}\sum_{1}^{n}\left(Experience\,(i) - 1\right)^2} * \sqrt{\frac{1}{n}\sum_{1}^{n}\left(Expctation\,(i) - 10\right)^2} * Performance\ index}{Importance\ index * Gap\ Index * Development\ Index}.$$

The inconsistent results in CFI than BCFI and SCFI shows that critical factor index as the benchmark cannot be considered correct in real case study analysis. So, the derived formulas such as BCFI and SCFI are alternative options. This case study analysis also showed that the results of BCFI and SCFI are more consistent than the CFIs. From discussion with the case company inconsistent results can be verified which one is right and which one is wrong.

The feedback and discussion from the case company can verify if one is evaluating right. However, in this case the feedback from the case company is confidential.

Manufacturing Strategy Index (MSI)

Two informants from the case company answered the two questionnaires for MSI. When answering the questionnaire, the informants have marked the situations before the economic crisis of 2008/2009 with a grey color. The situation during the crisis is marked with a bolded font.

Informant number one did not provide answers concerning the situation before the crisis, due to the fact that his employment in the case company started after the crisis. Hence, informant number one had not been working there long enough to access the situation before crisis.

Table 2
MSI answered by Informant 1.

Cost	98765432123456789	Quality
Cost	98765432123456789	Delivery
Cost	98765432123456789	Flexibility
Quality	98765432123456789	Delivery
Quality	98765432123456789	Flexibility
Delivery	98765432123456789	Flexibility

Table 3
MSI answered by Informant 2.

Cost	98765432123456789	Quality
Cost	98765432123456789	Delivery
Cost	98765432123456789	Flexibility
Quality	98765432123456789	Delivery
Quality	98765432123456789	Flexibility
Delivery	98765432123456789	Flexibility

As the tables show, there can be seen which strategy types the case company has been focusing on before and during economic crisis. The strategy type derives the proportions of importance between Quality, Cost, Delivery and Flexibility. The answers of the informants are quite similar when comparing the answers during the economic crisis. Since only informant number two could state the importance of Q, C, D and F before economic crisis, there is no other answer that could be compared with it. Each result displays a high priority on Quality, followed by Delivery and Flexibility while putting little value on Cost. This order is consistent in between both Informants and in case of Informant 2 it even remains the same for the assessment before and during the economic crisis.

The MSI results shows, that the case company, both before and during economic crisis, focused on the importance of Quality as their main strategy type. When calculating the integrated values, a weight of 1/3 was given to Informant 1 and 2/3 was given to Informant 2. It was decided to put more weight on Informant 2 due to the facts that he provided a full set of data and had more working experience in the case company compared to Informant 1. In the case of Informant 1, who was not able to assess the situation before the economic crisis, missing data was left blank and calculations for integration were adapted. Therefore, there is a 100% weight on Informant 2 for integrated P-MSI values.

Table 4 shows the integrated values of the MSI results. Past Manufacturing Index for Q, C, D, and F, should have a value equal to one and Future Manufacturing Index for the same proportions should as well have a value equal to one. As can be seen in Table 5, both P-MSI and F-MSI have the same importance for the proportions, only some small changes in the values.

Table 4
Integrated values of MSI.

	Q	C	D	F
P-MSI	0.529	0.068	0.254	0.150
F-MSI	0.550	0.068	0.247	0.136

Table 5
Strategy type Prospector, Analyzer and Defender.

	Prospector	Analyzer	Defender
P-MSI	(y) 0.947	(g) 0.961	(r) 0.902
F-MSI	(y) 0.950	(r) 0.916	(r) 0.906

Considering the strategy type regarding to MSI-results, there can be seen that Analyzer is the strongest strategy type before economic crisis. However, the strategy type changes during the economic crisis from Analyzer to Prospector.

SCA calculation

The integrated MSI- and S&R-results were put into the SCA calculation. The sum check was true for each variable. SCA values shall be between 0 and 1. Values close to or greater than 0.97 can be

considered as high. Values reaching from 0.93–0.97 are further referred to as "medium high" and values < 0.93 as "low" values. SCA calculations derived from the MSI questionnaire (indicated with green background color) resulted in medium high values for the Prospector strategy and low values for the other groups, both for past- and future-orientation. The tendency in the MSI-based SCA values towards the Prospector group is supported by the MSI priority weights, which have a high emphasis on quality. High priority weights on quality are typical for a Prospector strategy with quality being a crucial point for this type of strategy [9].

Calculations based on the S&R questionnaire regarding the past orientation resulted in low values for all strategy types, except P-NSCFI for Analyzer. Concerning the future orientation, we find high values for Analyzer and medium high to low values for the Analyzer and Defender groups. These results would indicate that our case company has turned from a former strategy that was not clearly defined towards a highly Analyzer characterized business strategy.

These angles more correctly reflect the way of business strategy implementation. The sum check was true for all angles. Calculations may have the outcome that the company has to change its operations strategy. Using SCA-method can bring stability, flexibility, and sustainability for the organization and enlarges its performance and competitiveness. With the result from this research the case company can forecast their future strategy and business performance.

Using BCFI in defining operational strategy

In one part of the research BCFI method was used to find critical attributes for the start up business under research. The purpose was to identify critical attributes in the organization and to recognize the development actions needed. The second goal was to find attributes with unclear goal setting and to emphasize the need for these to be clarified by the management.

The organization in focus is under change from R&D project to business process. The goal of the study was to collect expectations of different organizational groups and to highlight attributes that are considered as critical for the business development. These findings are taken into account when making decisions for strategic actions to follow.

Table 6
Sum check and P, A, D results for SCA.

	Q	C	T	F	P	A	D
P-MSI	0.484	0.071	0.283	0.162	(y) 0.941	(r) 0.896	(r) 0.898
F-MSI	0.550	0.068	0.247	0.136	(y) 0.950	(r) 0.916	(r) 0.906
P-BCFI	0.275	0.275	0.055	0.394	(r) 0.908	(r) 0.902	(r) 0.908
F-BCFI	0.298	0.298	0.326	0.078	(y) 0.935	(g) 0.973	(y) 0.935
P-SCFI	0.314	0.297	0.067	0.322	(r) 0.914	(r) 0.893	(r) 0.912
F-SCFI	0.303	0.286	0.354	0.056	(y) 0.942	(g) 0.984	(y) 0.941
P-NSCFI	0.264	0.250	0.217	0.268	(r) 0.906	(g) 0.986	(r) 0.904
F-NSCFI	0.261	0.247	0.304	0.188	(r) 0.913	(g) 0.985	(r) 0.912

Table 7
Angle results and MAPE, RMSE and MAD values.

A	β	Γ	α angle	β angle	γ angle	MAPE	RMSE	MAD
1.037	1.025	1.079	59.444	58.714	61.842			
1.023	1.055	1.064	58.615	60.430	60.955			
1.045	1.051	1.045	59.881	60.240	59.879	0.935	0.958	0.968
1.059	1.024	1.059	60.657	58.687	60.656	0.931	0.95	0.965
1.040	1.060	1.042	59.577	60.737	59.686	0.928	0.951	0.965
1.060	1.021	1.061	60.712	58.521	60.767	0.930	0.952	0.964
1.071	0.998	1.073	61.369	57.165	61.466	0.935	0.958	0.968
1.069	1.003	1.070	61.226	57.465	61.309	0.901	0.933	0.951

In the core of the business is a material handling service which is executed by delivering a special tailor-made automated storage device for the customer company. Device is at the customer's disposal against fixed monthly fee that includes the storage system, support for the service and software development. The research covered supply department that manages platform, procurement, production and delivery activities.

BCFI findings

The questionnaire included 32 questions covering all supply activities and management attributes. Moreover some of the questions aimed to show up expectations about how the supply organization should support research and development. In this case the supply team cannot focus only on process development, but has a role to support R&D activities as well. The attributes and activities are presented in further in this chapter.

Nine questionnaires were sent and eight of them were responded. The data was handled in three groups, based on the organizational position of the respondent. Three answers were received from the board members, two from supply management and three from team leaders of other activities inside the business. When estimating the final actions results from all the three groups were taken into account.

Attributes were rated inside different groups of respondents basing on BCFI values. Low value indicates that an attribute is considered critical and the members of group have common understanding of actions needed. High attribute value shows that the issue is unclear within the group thus indicating the need of creating a common goal. Significant variation in ratings between the groups indicates lack of communication between them and highlights the need to improve for example management system and reporting. Values and the ratings with critical level statement are presented later in this article (see Table 9).

Attributes used in questionnaire were as follows:

1. Risks concerning stock and assets within material flow are under good control
2. Assembling functions are effective with minimized waste in the process
3. Quality of assembling is homogenous and modules are compatible
4. Asset risk of the material flow is being controlled and reported regularly
5. The supply chain is quickly able to react on changes in market demand
6. The needs of R&D are well considered within the production process
7. Current receivables are on an optimized level when compared to deliveries
8. There is always available reliable cost information about the product
9. New features developed by the R&D are utilized rapidly
10. The product cost structure and it's development are transparent
11. Including new features to the manufactured product is cost-effective
12. Production version and R&D version are clearly separated when sustaining delivery ability
13. Ability to deliver the system for test run within one working day is the target
14. System deliveries are carried out precisely on the day confirmed for the customer
15. Delivery process is budgeted and the budget is controlled in order to ensure cost efficiency
16. The company brand is visible during each delivery process
17. Mounting a system is managed in accordance with the company brand
18. Delivery ability of systems covers also export markets
19. Supply actively joins developing the system
20. Assembly applies the system in production
21. Company's own production is used as a reference and a tool for sales activity
22. Supply takes part in developing process control tools for system
23. Information security is taken into account within the scope of all operations
24. Safety at work is strongly emphasized and kept in mind at all levels of production
25. Communication between R&D and production works well
26. Information about future deliveries is actively spread in order to maintain operational readiness
27. Activities are well organized with clear definitions about employee responsibilities and authorities.
28. The organization values process discipline, only serious causes justify violating the process structure
29. The information produced is reliable
30. Professional skills of the employees are maintained and improved actively in accordance to job descriptions
31. The company's ERP guarantees good support for the process
32. Customer needs and wishes are thoroughly taken into consideration throughout the delivery

Questions one to seven were related to production and material flow, eight to twelve product plat-

form activities, thirteen to eighteen delivery and mounting process, nineteen to twenty three support for product development and the rest ending question number thirty two supply management.

Critical attributes

The main findings of the research is related to cost and asset control. When starting a new business, the big challenge is how to make the right structural decisions to enable the expected growth. Three top critical attributes concerned risk management in stock and asset control. BCFI indicated these issues critical in both board and supply management results. In the results of the team leaders' group the status was more unclear, but in overall results these attributes were considered critical.

In the results it can be seen that the board pictures the startup already in a bigger size. Expectations to grow are on a high level. With the current low volumes asset risks are not significant and there is a risk that the operating strategy does not focus on the process structure as closely as required. In this case growth is most likely to happen and the scale can be altered in a very short time. Quick change with low functionality of process operations might block the growth. Practically this sets a need to build consumption based material flow and process with good tools for parameter control to direct activities effectively.

Table 8
BCFI results.

	BCFI –idex			Qualification inside the group		
Attribute Nuber	Supply Management	Board	Team Leaders	Supply Management	Board	Team Leaders
1	1.110	1.175	1.509	5	4	27
2	1.508	1.823	1.498	30	29	25
3	0.985	1.150	1.234	2	3	6
4	1.220	1.782	1.350	16	26	17
5	1.343	1.195	1.585	24	5	30
6	1.178	1.121	1.240	10	2	7
7	1.141	1.102	1.266	9	1	9
8	1.332	1.821	1.183	23	28	4
9	1.072	1.798	1.293	3	27	11
10	1.074	1.469	1.306	4	19	13
11	1.195	1.316	1.481	14	11	24
12	1.327	2.102	1.311	22	32	14
13	1.528	1.280	1.895	31	8	32
14	1.179	1.852	1.796	11	30	31
15	0.976	1.319	1.173	1	12	3
16	1.110	1.458	1.464	7	16	22
17	1.429	1.672	1.128	28	24	2
18	1.185	1.652	0.781	12	22	1
19	1.236	1.252	1.260	18	7	8
20	1.110	1.407	1.320	6	15	16
21	1.402	1.715	1.439	27	25	21
22	1.399	1.198	1.551	26	6	29
23	1.192	1.550	1.371	13	21	18
24	1.437	1.397	1.214	29	13	5
25	1.231	1.481	1.536	17	20	28
26	1.272	1.910	1.297	20	31	12
27	1.211	1.467	1.409	15	18	19
28	1.284	1.299	1.465	21	10	23
29	1.389	1.652	1.414	25	23	20
30	1.240	1,405	1.266	19	14	10
31	1.124	1.463	1.315	8	17	15
32	1.631	1.292	1.501	32	9	26

Table 9
Attribute critical levels inside organization groups.

Attribute Number	Attribute	Supply Management	Board	Team Leaders
1	Risks concerning stock and assets within material flow are under good control	Rather critical	Rather critical	Unclear
2	Assembling functions are effective with minimized waste in the process	Very unclear	Unclear	Rather unclear
3	Quality of assembling is homogenous and modules are compatible	Critical	Critical	More critical than unclear
4	Asset risk of the material flow is being controlled and reported regularly	Neutral	Rather unclear	Neutral
5	The supply chain is quickly able to react on changes in market demand	Rather unlcear	Rather critical	Very unclear
6	The needs of R&D are well considered within the production process	Quite OK	Critical	Rather critical
7	Current receivables are on an optimized level when compared to deliveries	More critical than unclear	Critical	More critical than unclear
8	There is always available reliable cost information about the product	More unlear than clear	Unclear	Rather critical
9	New features developed by the R&D are utilized rapidly	Critical	Unclear	Quite OK
10	The product cost structure and it's development are transparent	Rather critical	Neutral	Neutral
11	Including new features to the manufactured product is cost-effective	Neutral	Quite OK	Rather unclear
12	Production version and R&D version are clearly separated when sustaining delivery ability	More unlear than clear	Very unclear	Neutral
13	Ability to deliver the system for test run within one working day is the target	Very unclear	More critical than unclear	Very unclear
14	System deliveries are carried out precisely on the day confirmed for the customer	Quite OK	Very unclear	Very unclear
15	Delivery process is budgeted and the budget is controlled in order to ensure cost efficiency	Critical	Quite OK	Critical
16	The company brand is visible during each delivery process	More critical than unclear	Neutral	More unclear than clear
17	Mounting a system is managed in accordance with the Company brand	Unclear	Rather unclear	Critical
18	Delivery ability of the systems covers also export markets	Quite OK	More unclear than clear	Critical
19	Supply actively joins developing the system	Neutral	Rather critical	More critical than unclear
20	Assembly applies the system in production	Rather critical	Neutral	Neutral
21	Company's own production is used as a reference and a tool for sales activity	Unclear	Rather unclear	More unclear than clear
22	Supply takes part in developing process control tools for the system	Rather unclear	More critical than unclear	Unclear
23	Information security is taken into account within the scope of all operations	Neutral	More unclear than clear	Neutral
24	Safety at work is strongly emphasized and kept in mind at all levels of production	Unclear	Neutral	Rather critical
25	Communication between R&D and production works well	Neutral	Neutral	Unclear
26	Information about future deliveries is actively spread in order to maintain operational readiness	Neutral	Very unclear	Quite OK
27	Activities are well organized with clear definitions about employee responsibilities and authorities.	Neutral	Neutral	Neutral
28	The organization values process discipline, only serious causes justify violating the process structure	More unlear than clear	Quite OK	More unclear than clear
29	The information produced is reliable	Rather unclear	More unclear than clear	Neutral
30	Professional skills of the employees are maintained and improved actively in accordance to job descriptions	Neutral	Neutral	Quite OK
31	The company's ERP guarantees good support for the process	More critical than unclear	Neutral	Neutral
32	Customer needs and wishes are thoroughly taken into consideration throughout the delivery	Very unclear	More critical than unclear	Rather unclear

Table 10
Action categories for attributes.

Attribute Number	Attribute	Action category
1	Risks concerning stock and assets within material flow are under good control	Make a plan about needed actions
2	Assembling functions are effective with minimized waste in the process	Clarify needed actions
3	Quality of assembling is homogenous and modules are compatible	Make a plan about needed actions
4	Asset risk of the material flow is being controlled and reported regularly	No actions needed
5	The supply chain is quickly able to react on changes in market demand	Describe needed actions
6	The needs of R&D are well considered within the production process	Make a plan about needed actions
7	Current receivables are on an optimized level when compared to deliveries	Make a plan about needed actions
8	There is always available reliable cost information about the product	Clarify needed actions
9	New features developed by the R&D are utilized rapidly	Describe needed actions
10	The product cost structure and it's development are transparent	No actions needed
11	Including new features to the manufactured product is cost-effective	No actions needed
12	Production version and R&D version are clearly separated when sustaining delivery ability	Clarify needed actions
13	Ability to deliver the product for test run within one working day is the target	Describe needed actions
14	System deliveries are carried out precisely on the day confirmed for the customer	Clarify needed actions
15	Delivery process is budgeted and the budget is controlled in order to ensure cost efficiency	Make a plan about needed actions
16	The Company brand is visible during each delivery process	No actions needed
17	Mounting a system is managed in accordance with the Company brand	Describe needed actions
18	Delivery ability of systems covers also export markets	Describe needed actions
19	Supply actively joins developing the system	Describe needed actions
20	Assembly applies the system in production	No actions needed
21	Company's own production is used as a reference and a tool for sales activity	Clarify needed actions
22	Supply takes part in developing process control tools for system	Describe needed actions
23	Information security is taken into account within the scope of all operations	No actions needed
24	Safety at work is strongly emphasized and kept in mind at all levels of production	No actions needed
25	Communication between R&D and production works well	No actions needed
26	Information about future deliveries is actively spread in order to maintain operational readiness	Clarify needed actions
27	Activities are well organized with clear definitions about employee responsibilities and authorities.	No actions needed
28	The organization values process discipline, only serious causes justify violating the process structure	No actions needed
29	The information produced is reliable	No actions needed
30	Professional skills of the employees are maintained and improved actively in accordance to job descriptions	No actions needed
31	The company's ERP guarantees good support for the process	No actions needed
32	Customer needs and wishes are thoroughly taken into consideration throughout the delivery	Describe needed actions

Unclear attributes

When BCFI shows high value, it indicates that attribute does not have common understanding inside the group. Most significant finding within unclear attributes was that the organization did not have a unified vision about the schedule of making the business ready for export markets Issue rose up in the discussion when the results were presented to board. This can be seen in Table 9 when looking attribute 18 results. Board value gives unclear result but inside team leader group this attribute is ranked the most critical. In results the most critical attribute in team leaders group is unclear in board members answers.

Other issues within unclear findings where related to product lifecycle and process parameter management activities. This means that the organization needs to clarify its' methods and processes concerning goal communication and production version management. When ramping up a business it is important to keep the product and the process updated matching the goal while simultaneously ready to support the changes needed. Table 9 shows BCFI value and critical ranking for attributes within each group.

If an attribute has been indicated critical in all three groups, it can be assumed that the need of immediate actions concerning this issue is recognized throughout the entire organization. Significant differences for one attribute in critical rankings show lack of communication within the various organizational groups. As mentioned earlier attribute no 18 "Delivery ability for the product covers also export markets" is showing critical level in team leaders group but is "More unclear than clear" within board member group. Board did not have yet clear vision when and how export is started, but for team leaders this has been the most critical goal in decision making. Table 10 is presenting critical levels for attributes inside the organization groups.

Conclusions

Results were used for strategic planning for the year 2013. The main focus now is to prepare processes for profitable growth to be ready for the expected period of growing fast. Actions are taken to improve process control tools and accuracy of asset management. The target is to create consumption based material flow with an agile parameter control. As shown in table 10, certain actions for each attribute were determined basing on this research and BCFI-model.

Other important finding was the need of common understanding about the right timing when to start piloting export cases. Before starting to prepare going abroad maturity of operating processes and device have to be developed to a good level. If maturity is too low, the risk of lose control of costs begins to grow too high. Basing on this study, the board has now generated a strategic plan and a realistic schedule about when to aim towards the export markets.

This study has shown the value of BCFI method in investigating the status of an organization. With this method it is possible to produce numeric information about how well communication functions within organizational hierarchy or between teams. Also the level of understanding strategic communication and the way the different actions are linked to it in order to achieve the common goal can be measured.

Discussion

This study examined a case company's behavior towards operational strategy before and during the economic crisis in 2008–2009. The study was analyzed by the corresponding angles of the strategic triangles. Along with the study, a new S&R model, named NSCFI, was developed based on previous models. To verify a case study of this character, it is essential to acquire proper feedback from the case company in order to ensure the results.

It is vital for managers to have knowledge of their company's operational strategy. By understanding operational strategy, companies will allow themselves to make correct decisions that will have a positive influence on the companies' long term capabilities [5]. The method presented in this paper will help organization leaders to gain control over the strategic focus. Research shows, that this study has given the best validation yet known for NSCFI model. Hence, it is significant to prove this model in a larger scale of case studies.

The results indicate that the case company went from having a somewhat diffuse approach on strategy to a clear and profitable approach. If companies do not have a common vision for strategy, it might mean that resources are misspent. Before the economic crisis, the company's strategy was scattered between Prospector, Defender and Analyzer types of strategy. However, the Analyzer strategy type had the strongest numerical values both before and during the economic crisis. On the other hand, towards the crisis the Analyzer strategy type emerged clearer than any other. In other words, the company changed its strategy focus into one unified orientation where a balance between quality, cost and time was achieved [7].

It is important to remember the fact that one of the informants was only able to give insight on the situation during the economic crisis. Furthermore, the Sense and Respond questionnaire consisted of an uneven amount of attributes for each proportion. A last limitation is the relatively high inconsistency ratio for one of the informants' answers in the MSI questionnaire. All these factors, along with a larger number of informants could have an impact on the result of this case study.

References

[1] Liu Y., Wu Q., Zhao S., Takala J., *Operations Strategy Optimization Based on Developed Sense and Respond Methodology*, Kitakyushu, Japan, Proceedings of the 8th International Conference on Innovation & Management, 2011.

[2] Takala J., Liu Y., Feng B., Yang W.S., *Analytical Evaluation of Sustainable Competitive Advantage*, Moscow, Russia, IFAC Conference on Manufacturing Modelling, Management and Control Methodology, Vaasa, University of Vaasa, 2013.

[3] Johnson G., Scholes K., Whittington R., *Exploring Corporate Strategy*, Prentice Hall, Harlow, UK, 2005.

[4] Mintzberg H., Ahlstrand B.W., Lampel J., *"Strategy safari: A guided tour through the wilds of strategic management"*, http://cws.cengage.co.uk/barnes/students/sample_ch/ch2.pdf (accessed 10 January 2013), 1998.

[5] Slack N., Lewis M., *Operations Strategy*, Prentice-Hall, Edinburgh, 2002.

[6] Skinner W., *The productivity paradox*, Harvard Business Review, 64, 4, 55–59, 1986.

[7] Miles R., Snow C., *Organizational strategy, structure, and process*, McGraw-Hill, New York, NY, 1978.

[8] Haeckel S.H., *Adaptive enterprise: creating and leading sense-and-respond organizations*, Boston, Harvard Business School Press, 1999.

[9] Golovko Ivan, *Directions of a Company's Preferable Strategy Type by Sense & Respond Methodology*, Vaasa, University of Vaasa, 2012.

[10] Ranta J.M., Takala J., *A Holistic Method for Finding out Critical Feature of Industry Maintenance Services [J]*, International Journal of Services and Standards, 3 (3), 312–325, 2007.