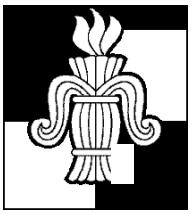

UNIVERSITY OF VAASA

FACULTY OF TECHNOLOGY

TUTA3080

OPERATIONS STRATEGY
Case Study: Bodycote Lämpökäsittely Oy

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1 INTRODUCTION

Bodycote was established in 1923 by Arthur Bodycote initially as a textile business under the name of G.R. Bodycote Ltd in Macclesfield, United Kingdom. It later moved into heat treatment and currently, it is the world's leading supplier of thermal processes.

The company operates in two business areas, Aerospace, Defense & Energy; and Automotive & General Industrial.

Bodycote is located in twenty seven (27) countries and with a hundred and ninety (190) operational plants. Some of its main customers are Boeing, VW, Man Diesel, Rolls-Royce and Mahindra and Mahindra. It is therefore prudent that management seek a sustainable competitive advantage (SCA) even during increased rapidity in economic recessions and changes in customer expectations. (Liu, 2010)[1] in order to stay at the herm of Business.

In Finland, Bodycote's core business is in thermal processing of all kinds of parts of machinery for many companies most of which finally arrive in the marine industry. Its main customers therefore are Wärtsilar, Componenta Pistons, Lapua Ketut and Mapromec that manufactures piston pins for Wärstilar, Scania and other giants in the heavy diesel engine business. With a global workforce of close to ten thousands and an annual turnover of £619 million pounds sterling (2013) its operations strategy naturally varies from country to country. (Bodycote, 2014)[2] This paper is written primarily to access the strategy Bodycote uses in its operations in Finland and suggest methods to equip it improve of its business by enhancing the capabilities it has while sustaining these advantages.

This team through the MSI and Sense and Respond (S&R) questionnaire module designed by Dr. Liu Yang & Professor Takala, at the University of Vaasa for Research on Global Manufacturing Strategies, that takes into consideration the core factors in industry (quality, cost and time of delivery), it has achieved this goal from the two questionnaires field by two managers from the Vaasa and Vantaa Plants of the company respectively. The success or otherwise of this exercise is based on the sincerity of the answers provided in the questionnaire. Fortunately enough, we received similar answers from both, although they manage different locations of the company. - A plant Manager at the Vantaa branch and a production manager at the Vaasa plant. We therefore deem it reliable and trust worthy. To this end, we have used the software provided which is also

designed by the Analytic hierarchy process (APH) to determine which path (defender, innovator or analyzer) the company is heading towards. (Liu, 2013)[3].

As a purely service providing company, this paper discusses at length by analyzing into details the Scaled Critical Factor Index (SCFI), the Balanced Critical Factor Index (BCFI) positions of the company. It also uses MSI to predict the future direction by analyzing and comparing the past, present and future preferences to cost, time of delivery, quality of services and the flexibility of this mix. Although it has been a tiresome and tedious exercise, we are confident it has served its intended purpose because of the interest these managers have shown in this report during our discussions with them (after our initial presentation in class). Howbeit, the total implementation of our suggestions cannot be guaranteed since most immediate managers within the service industry such as this manage a system whose control is beyond their jurisdiction.

2 MAIN OPERATIONS STRATEGY

We asked our informants to specify roughly the main operations strategy in the company by evaluating the priority weights of quality (Q), cost (C), time/delivery (T) and flexibility (F). Both of our informants gave the same estimations for Q, C, T and F for the past 3~5 years and for future estimations (3~5 years). The results are represented in the pie chart below:

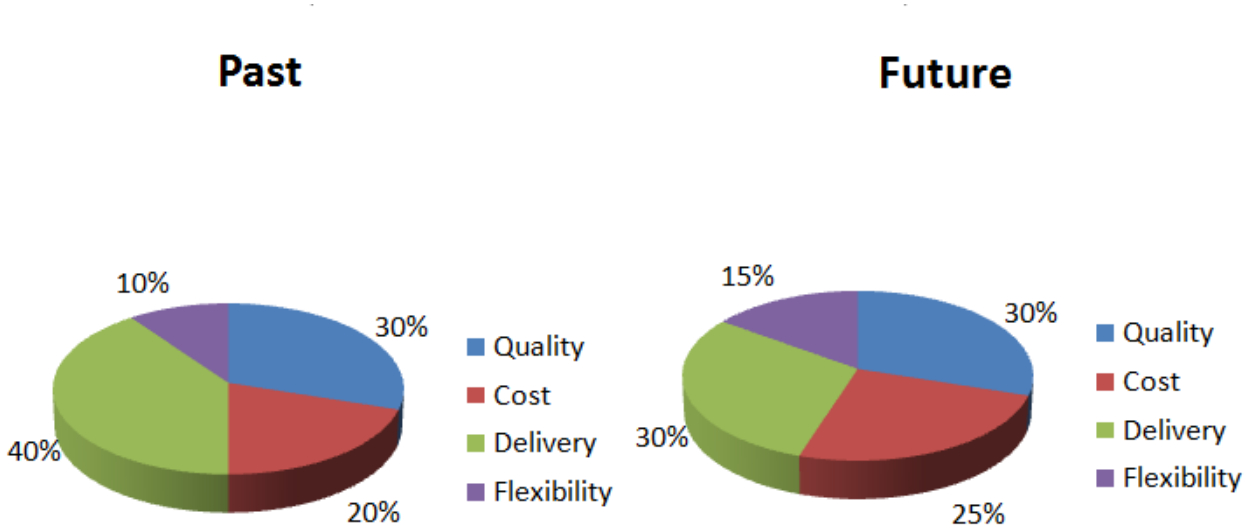


Figure 1: Pie chart illustrating the priority of weights on Q, C, T and F

2.1 Past operations strategy

According to the results from our informants, the company in the past has allocated 30% of its resources to ensuring that quality is achieved, 20% of the total weight goes into the cost of manufacturing and process, 40% into delivery both in time of completion of the required job and ensuring that the clients get the products on time and 10% of the weight goes into flexibility between the three main strategies of Q, C and T.

2.2 Future operations strategy

In future, the informants estimated that the weight on quality remains the same at 30%, this is so because, the company has no say on the quality of the product, it is the customer that gives the specifications and they produce according to those specifications. On the other hand, cost would increase from 20 to 25% in the future. Delivery would decrease from 40% to 30%. This means that

the company would able to complete the required task faster than they did in the past. Flexibility is expected to increase from 10% to 15% indicating that the company would be more flexible in the future than it did in the past.

3 STUDY OF COMPANY GLOBAL STRATEGY ACCORDING TO SCA

The objective of this part of the study is to understand the global strategy of the company based on the answers of different informants.

The calculations and figures presented were based on Sustainable Competitive Advantage (SCA) theory. To perform the calculations were used Manufacturing Strategy Index (MSI) questionnaire and also the Sense and Response questionnaire.

This study allows a comprehension of the company development direction and analyze if that development is the right one.

The validation is based on the following metrics:

- MSI – Manufacturing Strategy Index
- SCFI – Scaled Critical Factor Index
- NSCFI- Normalized Scaled Critical Factor Index

The metrics were evaluated using triangles, this triangles permit evaluate the answers according to three common behaviours of companies in the market (P – Prospector, A – Analyser, D – Defender).

3.1 MSI calculations

To calculate the values of MSI was used the MSI questionnaire and the answers were introduced in a webpage based on the program “expert choice”. The obtained results for each informant were the following ones:

Table 1: MSI results for past

PAST

	Informant1	Informant2	Average
Cost	0.2820	0.3090	0.2955
Quality	0.5730	0.5540	0.5635
Delivery	0.0810	0.0750	0.0780
Flexibility	0.0650	0.0610	0.0630
Inconsistency	0.1352	0.0755	0.1053

Table 2: MSI results for the future

FUTURE

	Informant1	Informant2	Average
Cost	0.3060	0.3420	0.3240
Quality	0.5230	0.4870	0.5050
Delivery	0.0870	0.1040	0.0955
Flexibility	0.0840	0.0680	0.0760
Inconsistency	0.0409	0.1537	0.0973

It was considered that all the values of inconsistency were close enough of 0.1 and for that reasons all results were considered valid.

Furthermore, it was considered that each informant should have the same weight in the following calculations. Due to that all the calculations presented in the rest of the document are average values.

SCFI and SCFI calculations

The calculations of SCFI and N-SCFI were based on Analytic Hierarchy Process (AHP) theory. It was also used the Sense and Response questionnaire.

The results obtained – for past and future – are shown in the following table:

Table 3: SCFI and N-SCFI results

P-SCFI	0.435635	0.4724931	0.0389815	0.0528903
F-SCFI	0.1725155	0.340203	0.1064624	0.3808191
P-NSCFI	0.3210691	0.3441134	0.1445669	0.1902506
F-NSCFI	0.2071043	0.3139114	0.1318786	0.3471056

3.2 Analysis of results

The results were analysed through triangles.

The triangles and results that permitted to draw it are shown in the next table and figures:

Table 4: Triangles values (all metrics)

	P	**A**	**D**	**α**	**β**	**γ**	**α Degree**	**β Degree**	**γ Degree**
P-MSI	0.9589	0.9109	0.9461	1.0285	1.0730	1.0401	58.9277	61.4769	59.5954
F-MSI	0.9520	0.8818	0.9424	1.0222	1.0885	1.0309	58.5658	62.3660	59.0683
P-SCFI	0.9546	0.8183	0.9562	1.0033	1.1364	1.0019	57.4868	65.1093	57.4039
F-SCFI	0.8926	0.9482	0.9169	1.0724	1.0201	1.0491	61.4448	58.4460	60.1092
P-NSCFI	0.9209	0.9126	0.9230	1.0452	1.0530	1.0433	59.8877	60.3350	59.7773
F-NSCFI	0.8963	0.9583	0.9110	1.0712	1.0133	1.0571	61.3753	58.0586	60.5661

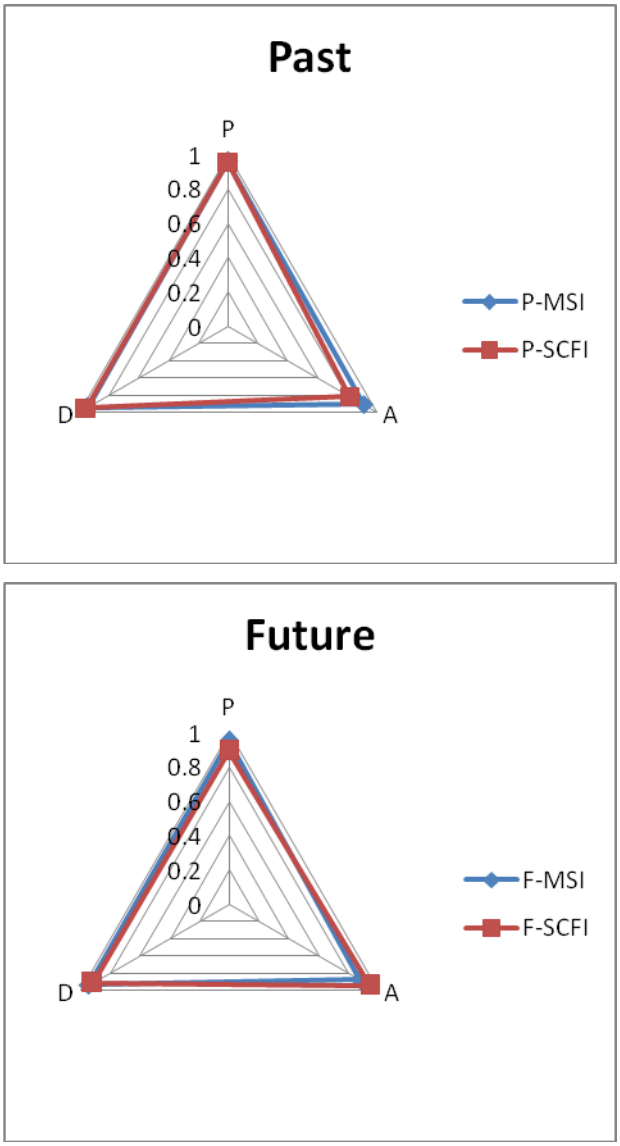
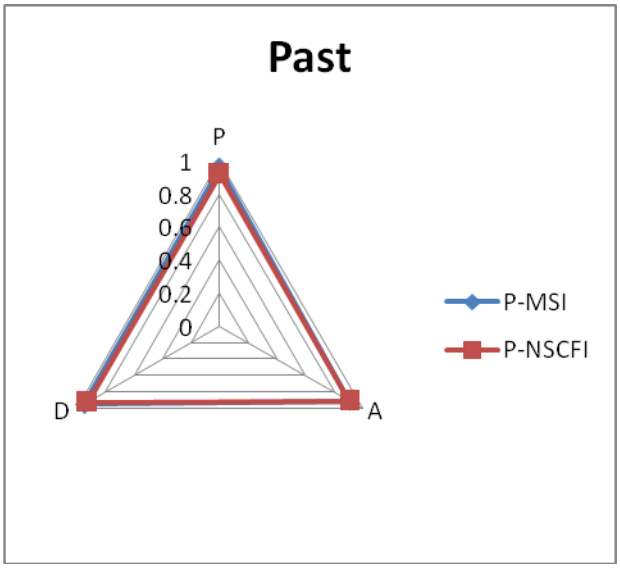


Figure 2: Evaluation of MSI and SCFI (for past and future)



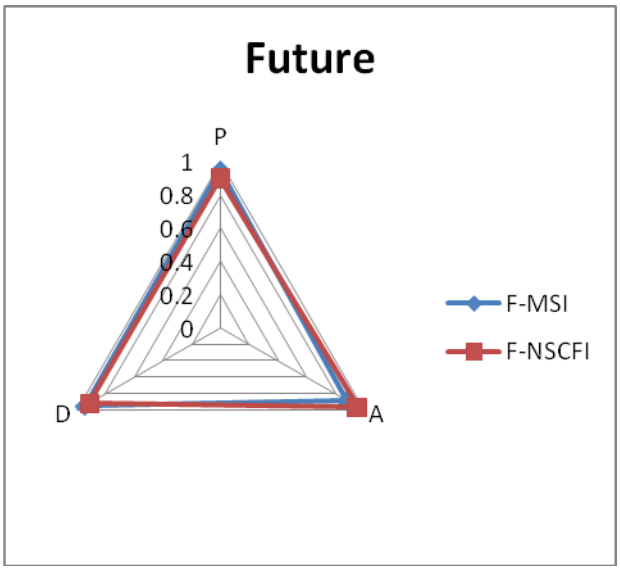


Figure 3: Evaluation of MSI and N-SCFI (for past and future)

It is possible realize that the results of that calculations – for all metrics – point for a past behavior where is difficult to distinguish clearly what was the behavior of the company as a prospector, analyzer or defender. Although, all of them present a higher value for past behavior as prospector. That information is enough to point that prospector was the main direction of the company in the past.

As future behavior, the metric MSI still point to prospector as the main behavior for the future of the company. However, that fact is contradicted by the other two metrics.

SCFI and N-SCFI point in very clear way for analyzer as the main behavior for the future. This results show that the most probable behavior of the company is a change in a gradual way from is past prospector behavior for a more analyzer behavior in the future.

4 SCFI VERSUS NSCFI

Table 1 shows the SCFI and NSCFI value of sub-criteria both for past and future. For being able to analyze these values we need to normalize them. To do so, first we obtain the sum of all attributes for each index and then divide the value of each attribute by the total sum. This gives us the percentage or normalized value of attributes. Table 2 shows the result of normalization.

Table 5: The primary value of attributes

Attribute	P-SCFI	F-SCFI	P-NSCFI	F-NSCFI
Q1. Defect rate	25.36977	46.12686	31.0867	43.96324
Q2. Product performance	28.33623	28.33623	34.22048	34.22048
Q3. Reliability	21.78662	21.78662	27.20312	27.20312
Q4. Environmental impacts	25.90987	259.0987	31.92884	63.85768
Q5. Certification	25.90987	25.90987	31.92884	31.92884
C1. Production costs	179.4267	179.4267	45.32726	45.32726
C2. Value added costs	17.94267	17.94267	22.66363	22.66363
C3. Quality costs	20.20671	36.73947	25.31748	35.80432
C4. Activity based costs	22.66397	22.66397	28.11384	28.11384
C5. Continuous improvement costs	18.71851	187.1851	23.51494	47.02988
T1. Lead time	20.20671	202.0671	25.31748	50.63495
T2. On agreed time	15.86561	158.6561	20.16399	40.32798
T3. On agreed quality	22.66397	226.6397	28.11384	56.22768
T4. On agreed quantity	19.46338	35.38797	24.29027	34.35164
T5. Dependable promises	23.73778	23.73778	29.16988	29.16988
F1. Design adjustments	24.78969	24.78969	30.13167	30.13167
F2. Changes in product volume	24.78969	24.78969	30.13167	30.13167
F3. Changes in product mix	23.73778	23.73778	29.16988	29.16988
F4. Changes in product lifecycle	24.78969	24.78969	30.13167	30.13167
F5. Broad product line	24.78969	24.78969	30.13167	30.13167
Sum	611.105	1594.601	578.0571	740.5209

Now we can analyze these attributes to see whether they are over resourced or under resourced. According to Liu et al. (2011) those attributes that are located between 1/3 and 2/3 of average resource level are considered as balanced or normal attributes. Those attributes which are below the 1/3 of the average resource level are under resourced, and those which are above the 2/3 of average resource level are over resourced. So, first we need to calculate the average resource value. We have 20 attributes, therefore the average resource value for our case is 1/20=0.05 or 5%. The upper

and lower levels are 0.05 - (1/3*0.05) = 0.033 and 0.05 + (1/3*0.05) = 0.067, respectively. Figure 2 illustrates the values of our attributes for both methods and also these two lines.

Table 6: Normalized value of attributes

Attribute	P-SCFI %	F-SCFI %	P-NSCFI %	F-NSCFI %
Q1. Defect rate	0.041515	0.028927	0.0537779	0.059368
Q2. Product performance	0.046369	0.01777	0.0591991	0.0462114
Q3. Reliability	0.035651	0.013663	0.0470596	0.0367351
Q4. Environmental impacts	0.042398	0.162485	0.0552347	0.0862335
Q5. Certification	0.042398	0.016248	0.0552347	0.0431167
C1. Production costs	0.29361	0.112521	0.0784131	0.06121
C2. Value added costs	0.029361	0.011252	0.0392066	0.030605
C3. Quality costs	0.033066	0.02304	0.0437975	0.0483502
C4. Activity based costs	0.037087	0.014213	0.0486351	0.0379649
C5. Continuous improvement costs	0.030631	0.117387	0.0406793	0.0635092
T1. Lead time	0.033066	0.126719	0.0437975	0.0683775
T2. On agreed time	0.025962	0.099496	0.0348823	0.0544589
T3. On agreed quality	0.037087	0.142129	0.0486351	0.0759299
T4. On agreed quantity	0.031849	0.022192	0.0420205	0.0463885
T5. Dependable promises	0.038844	0.014886	0.0504619	0.039391
F1. Design adjustments	0.040565	0.015546	0.0521258	0.0406898
F2. Changes in product volume	0.040565	0.015546	0.0521258	0.0406898
F3. Changes in product mix	0.038844	0.014886	0.0504619	0.039391
F4. Changes in product lifecycle	0.040565	0.015546	0.0521258	0.0406898
F5. Broad product line	0.040565	0.015546	0.0521258	0.0406898

Now we can compare the value of each attribute with these two lines to see if they are balanced, over resourced, or under resourced. Table 3 shows the result of this comparison. Those attributes which are between two lines are in the good condition and are indicated in the green boxes. Attributes that are above the upper line are over resources and shown with the red boxes. Finally, attributes below the lower line are under resourced and shown in the yellow boxes. As it can be seen in the table 3, there are two other columns named as trend. The trend shows the change in an attribute from past to future. If both past and future values are good, the trend is considered without change and marked with "-". If the values change from good to over or under, the trend is worse, and if the values change from over or under to good, the trend is better. In the case that both values for the past and future are either over or under, the trend still can show the direction. It means that if both values are over and the future value is less than the past value, the trend is better, otherwise is

worse; and if both values are under and the future value is bigger than the past value the trend is better, otherwise is worse (Liu et al. (2011).

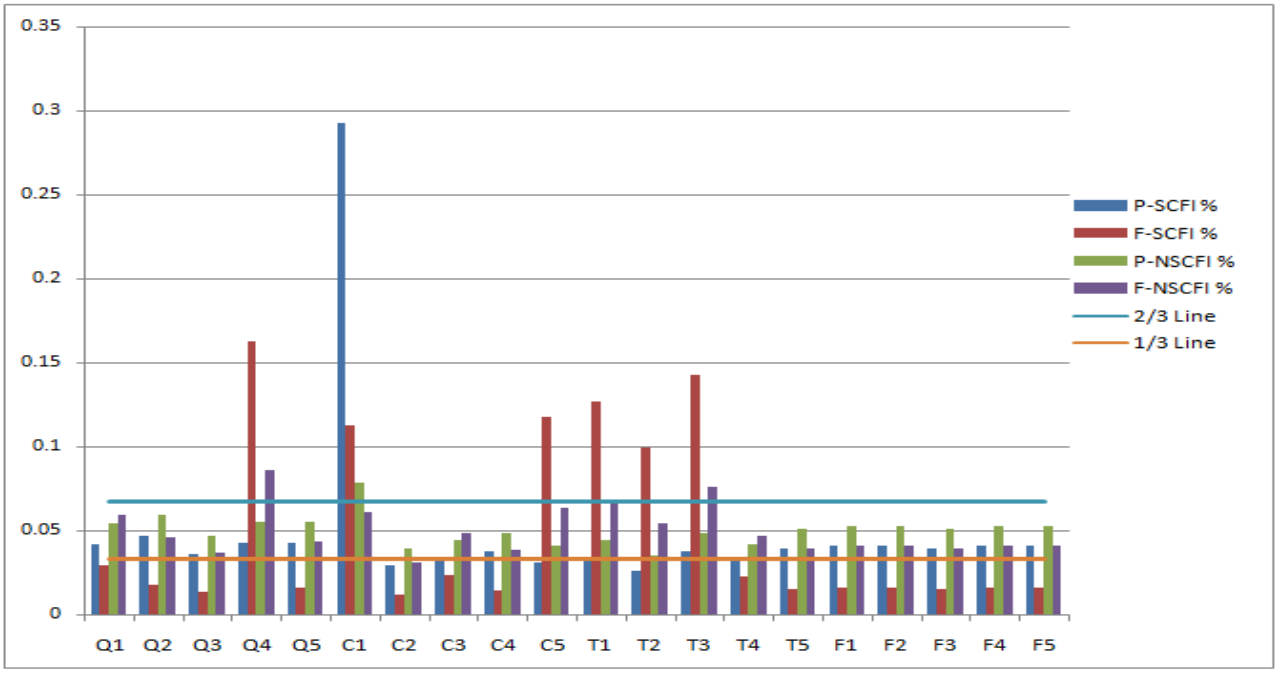


Figure 4: The graph of the SCFI and NSCFI

Table 8 also enables us to make a comparison between SCFI and NSCFI methods. The results are as follows:

- According to SCFI method, in the past four attributes out of five attributes of cost are either under or over resourced. Also three attributes of time are under resourced. Other attributes are in the good situation. However, for the future the situation is totally different. As it is obvious from the table 3, in the future all of the attributes are either over or under resourced. Regarding trend, all of the attributes except one (production cost) are getting worse. This attribute drops dramatically from 30% to almost 10%.
- Based on the NSFI, in the past there is only one attribute that is over resourced- which is again production cost- and all the others are in the good situation, which means they receive enough resource. In the future, we have three attribute (i.e. environmental impacts, lead time, and on agreed quality) that are over resources and one (value added costs) that is under resourced. Regarding the trend, for these four attributes the trend is worse and for production cost is better.
- When comparing these two methods -SCFI and NSCFI, one can easily see the difference between their results. However, there are still some similar results. For Q4 (environmental impacts) and T3 (on agreed quality), the result of both methods are the same, i.e. their resource allocation changes from good to over and the trend is worse. For production costs, although the past situation is over and the trend is better, in SCFI it still is over resourced in

the future, and in NSCFI it is in a good situation. For C2 (value added costs) and T1 (lead time), the result of both methods for the future is the same (under resourced for C2 and over resourced for T1), but SCFI indicates that both of these attributes were under resourced in the past, while in NSCFI they both were good in the past. However, the trend for both methods is worse.

Table 7: comparison between SCFI and NSCFI

Attribute	P-SCFI	F-SCFI	Trend	P-NSCFI	F-NSCFI	Trend
Q1. Defect rate	good	under	worse	good	good	-
Q2. Product performance	good	under	worse	good	good	-
Q3. Reliability	good	under	worse	good	good	-
Q4. Environmental impacts	*good*	*over*	*worse*	*good*	*over*	*worse*
Q5. Certification	good	under	worse	good	good	-
C1. Production costs	*over*	*over*	*better*	*over*	*good*	*better*
C2. Value added costs	under	under	worse	good	under	worse
C3. Quality costs	under	under	worse	good	good	-
C4. Activity based costs	good	under	worse	good	good	-
C5. Continuous improvement costs	under	over	worse	good	good	-
T1. Lead time	*under*	*over*	*worse*	*good*	*over*	*worse*
T2. On agreed time	under	over	worse	good	good	-
T3. On agreed quality	*good*	*over*	*worse*	*good*	*over*	*worse*
T4. On agreed quantity	under	under	worse	good	good	-
T5. Dependable promises	good	under	worse	good	good	-
F1. Design adjustments	good	under	worse	good	good	-
F2. Changes in product volume	good	under	worse	good	good	-
F3. Changes in product mix	good	under	worse	good	good	-
F4. Changes in product lifecycle	good	under	worse	good	good	-
F5. Broad product line	good	under	worse	good	good	-

Therefore, it can be said that Q4 (environmental impacts), C2 (value added costs), T1 (lead time), and T3 (on agreed quality) are critical for this company and need urgent attention. For C1 (Production costs) the trend in both methods shows that it is getting better, so it is not as critical as those above mentioned attributes, but it still needs attention.

5 CONCLUSION AND RECOMMENDATION

Bodycote as a company works based on customer requirements and it is there for very difficult for them to choose the set quality for the output. However, they have to put measures in place to ensure that they meet the quality demand from the customer. This clearly explains why the weight priority for quality remained at 30% for both past and future.

According to figures 2 and 3, it is possible to realize that the results of that calculations – for all metrics – point for a past behavior where is difficult to distinguish clearly what was the behavior of the company as a prospector, analyzer or defender although all of them present a higher value for past behavior as prospector. As future behavior, the metric MSI still point to prospector as the main behavior for the future of the company. However, that fact is contradicted by the other two metrics.

SCFI and N-SCFI point in very clear way for analyzer as the main behavior for the future. This results show that the most probable behavior of the company is a change in a gradual way from is past prospector behavior for a more analyzer behavior in the future.

According to figure 4,, we clearly see some sectors that are over resourced for example production cost (C1) and those that are under resourced example product performance (Q2), it is therefore very crucial for the company to try to analyze what went wrong and try to fix the problem in order to stay ahead of its competitors.

Table 8 which is so critical to the study actual shows the performance patent of the various strategic sections and gives a clear indication of the direction of performance. Therefore, it can be said that Q4 (environmental impacts), C2 (value added costs), T1 (lead time), and T3 (on agreed quality) are critical for this company and need urgent attention. For C1 (Production costs) the trend in both methods shows that it is getting better, so it is not as critical as those above mentioned attributes, but it still needs attention.

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