ICMERE2011-PI-092

ACHIEVING STRATEGIC FIT OF SUPPLY CHAIN: A CASE STUDY APPROACH

Mohammad Mahmudur Rahman[1*], Md. Ahsan Habib[1], Md. Fashiar Rahman[2], S.M. Rejwan-Al-Nahian[2]

[1]Lecturer, [2]Former Students, Department of Industrial Engineering and Management,
Khulna University of Engineering and Technology, Khulna, Bangladesh
rochy.kuet@gmail.com[*], (shiplu04_ipe, frmukul2k6)@yahoo.com, rejwan.rsx@gmail.com

Abstract- *In this paper attempt has been made to develop a methodology to show a dynamic way of achieving strategic fit of supply chain. Actually it is very important to understand and achieve the strategic fit of supply chain. But so far there is no systematic, mathematical or graphical way to represent the condition of strategic fit of supply chain. All those that had been illustrated in the various books or other papers are all about theoretical statements for achieving strategic fit. In this paper it has been tried to develop a mathematical and graphical way to represent those theoretical statements for achieving strategic fit of supply chain. Different supply chain capabilities matrices have been identified and their targets have set to achieve the strategic fit. Analytical Hierarchy Process (AHP) has used to determine the relative weight among these capabilities. This will help the managerial personnel to understand the condition of supply chain with respect to their strategic target and give an easy approach to find out the weakness of the supply chain at each stage which will help them to take action to achieve the strategic fit. Ideas and information have been taken from different relevant sources to develop the methodology to determine the strategic fit of supply chain of an organization.*

Keywords: Strategic Fit, Supply Chain Capabilities, Supply Chain Strategy, Competitive Strategy, AHP

1. INTRODUCTION

For any organization supply chain management is a pivotal management topic as the objectives of any business firm mostly depend on it. For the supply chain department the main concern is to achieve strategic fit of the supply chain because this strategic fitness indicates how closely the company is maintaining the all the stage from the supplier to the end customer. Strategic fit may not depend only on one variable. This depends on the combined effect of the various stage of the supply chain and the targeted and exiting capability of supply chain. So an organization must have to achieve the strategic fit by indicating the perfect level of actual capability and targeted capability. For achieving strategic fit, so far there is no systematic, mathematical or graphical way to represent the condition of strategic fit of supply chain. All those that had been illustrated in the book or other papers are all about theoretical statements for achieving strategic fit. This traditional theory can't show or give any perfect level of strategic alignment. So a mathematical model is necessary to show and achieve strategic fitness. To develop the mathematical model the effective analysis of every stage of the supply chain has been done precisely and the factors influencing the strategic fitness have indentified.

2. LITERATUE REVIEW

A supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request. The supply chain not only includes the manufacturer and suppliers, but also transporters, warehouses, retailers, and customers themselves. Within each organization, such as manufacturer, the supply chain includes all functions involved in receiving and filling a customer request [1]. In sophisticated supply chain systems, used products may re-enter the supply chain at any point where residual value is recyclable. Supply chains link value chains [2]. A typical supply chain involves a variety of facilities as shown in following figure.
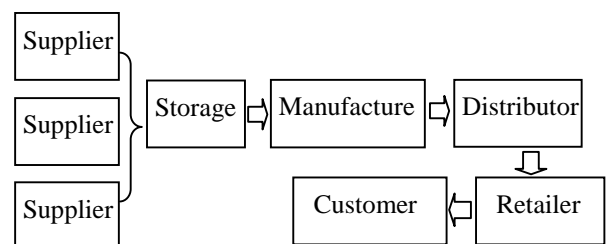

Fig. 1: A typical supply chain

Every business organization is part of at least one supply chain. It is not true that all stage must be present in every supply chain. Often the number and type of organizations in a supply chain are determined by whether the supply chain is manufacturing or service oriented [3].

2.1 Strategic Fit of Supply Chain

Strategic fit means the consistency between competitive strategy and supply chain capabilities. This means that is the company is able to satisfy their customers through their products or services as when the customers want. For achieving strategic fit there are two

basic steps. One is competitive strategy and the other one is supply chain strategy. A company's competitive strategy defines, relative to its competitors, the set of customer needs that it seeks to satisfy through its products and services. A supply chain strategy determines the nature of procurements of raw materials, transportation of raw materials to and from the company, manufacture of the product of operation to provide service and distribution of the product to customers [4]. In addition, strategic fit means the consistency above two. This depends on the company's decision whether they are going to be efficient or responsive. [5]

For achieving strategic fit the total supply chain is considered as three dimensions. They are: [4]

1. Understanding the customer and supply chain uncertainty
2. Understanding the supply chain capabilities
3. Achieving strategic fit.

2.2 Analytical Hierarchy Process

Saaty (1980) proposed AHP as a decision aid to help solve unstructured problems in economics, social and management sciences. AHP has been applied in a variety of contexts. Saaty (1980) proposed carrying out paired comparisons between the different elements because the human brain is perfectly designed to make comparisons between two elements, hence proposing the scale in Table 1 [6].

Table 1: Fundamental scale for paired comparison

Intensity of importance	Definition
1	Equal importance
3	Moderate importance
5	Strong importance
7	Very strong
9	Extreme importance
2,4,6,7	For compromise between the above values
Reciprocals of the above	If activity i has one of the above non zero numbers assigned to it when compared with activity j, then j has the reciprocal value when compared with i.

Using the scale in Table 1 the squared matrix A [n×n] is built using:

A= [a_{ij}], where, $1 \leq i, j \leq n$ (1)

Where, a_{ij} represents the comparison between element i and element j.

This matrix must have the following properties (Saaty, 1986):

- Reciprocity: If $a_{ij} = x$ then $a_{ji} = 1/x$, with $1/9 \leq x \leq 9$.
- Homogeneity: If the elements i and j are considered to be equally important then: $a_{ij} = a_{ji} = 1$ and $a_{ii} = 1$ for all i.
- Consistency: $a_{ik} * a_{kj} = a_{ij}$ is satisfied for all $1 \leq i, j, k \leq n$.

After building the squared matrix the consistency ratio (CR) [7] has been calculated to determine the trustworthy of the random judgment. That needs to be assessed against judgments made completely at random. A true Consistency Ratio is calculated by dividing the Consistency Index for the set of judgments by the Index for the corresponding random matrix. If that ratio exceeds 0.1 the set of judgments may be too inconsistent to be reliable. In practice, CRs of more than 0.1 sometimes have to be accepted. A CR of 0 means that the judgments' are perfectly consistent. A CR as high as, say, 0.9 would mean that the pair wise judgments are just about random and are completely untrustworthy [8].

3. METHODOLOGY

A systematic procedure has been followed to develop concept during research for achieving strategic fit. The procedure includes – visit to different industries to generate a concept about their supply chain management, collection of information from different sources, visit to respective customer and preparation of questionnaires for customers and supply and production managers to find out the actual condition in production and delivery the order in supply chain management. Based on this information a model has been developed, analytical hierarchy process (AHP) is used to determine the weight of the each supply chain metrics. To generalize of developing a method for achieving strategic fit the work has been carried out through a systematic approach as shown in table 2.

Table 2: Steps for determining strategic fit

Step 1	Case study observation
Step 2	Understanding the supply chain
Step 3	Defining SC metrics and the strategic target
Step 4	Calculating the weight of each SC metrics by AHP
Step 5	Data analysis to understand the actual SC capabilities
Step 6	Formulate analyzed data to show the strategic fit

3.1 Case Study Observation

For the implementation of our proposed methodology some information of Meghna Cement Mills Ltd (MCML) have been considered as case industry for information where two verities of products (here denoted by A and B) needs to made available to a large number of customer throughout the whole country through a good number of distributors. According to these information the methodology have developed by following next steps.

3.2 Understanding the Supply Chain (SC)

In this step, the organization for which we are supposed to show the condition of strategic fit must be observed. The production capacity, ordered received, distribution capacity, the flow of distribution, what technique they are using for managing customers everything are taken in consideration to understand the supply chain.

3.3 Defining SC Metrics and the Strategic Target

Based on the knowledge gathered through the visit in different department of the organization and conducting primary field survey in the research field, two set of questionnaires and from the answers of that queries seven supply chain metrics has been defined. To make an accurate and realistic analysis the key metrics are divided into two groups.

Table 3: Key matrices groups

Group 1	Group 2
Order fill rate (OF)	Service level (SL)
Delivery rate (DR)	Problem handling (PH)
Handle variety (HV)	Cost performance (CP)
Inventory (IL)	

For each defined supply chain metrics the strategic target will be set from the corporate level. A proposed strategic target for each defined SC metrics for MCML is shown below in table 4.

Table 4: Defining SC metrics and strategic target

SC Metrics	SC Capabilities	Strategic target
OF	Complete order fill rate	90 % for complete order fill rate
	Partial order fill rate (>75%)	
	Partial order fill rate (>50%)	
	Partial order fill rate (<40%)	
	Fail to delivery	
DR	Instant delivery	90 % delivery within lead time
	Within lead time	
	Late delivery	
HV	Availability of all varieties products	95 % availability for all products
	Not available of all parts	
SL	high	90 % high performance
	Moderate	
	poor	
PH	high	90 % problem solved with high performance
	Moderate	
	poor	
CP	high	95 % high for product A and moderate for product B
	Moderate	
	poor	
IL	High level	70 % availability for minimum safety stock
	Minimum safety stock	
	No inventory	

3.4 Calculating the Weight of Each Metrics

In this step, using AHP the relative weights of the each key metrics of the supply chain is determined. The key metrics of the supply chain are shown in table 3. So, we begin by writing down a 7×7 matrix which is known as pair wise comparison matrix A.

$$A = \begin{array}{c} \\ OF \\ DR \\ SL \\ PH \\ HV \\ CP \\ IL \end{array} \begin{array}{ccccccc} OF & DR & SL & PH & HV & CP & IL \\ \begin{pmatrix} 1 & 3 & 4 & 4 & 5 & 8 & 9 \\ 0.33 & 1 & 3 & 4 & 5 & 5 & 7 \\ 0.25 & 0.33 & 1 & 5 & 5 & 8 & 8 \\ 0.25 & 0.25 & 0.20 & 1 & 2 & 3 & 4 \\ 0.20 & 0.20 & 0.20 & 0.50 & 1 & 5 & 8 \\ 0.125 & 0.20 & 0.125 & 0.33 & 0.20 & 1 & 5 \\ 0.111 & 0.142 & 0.125 & 0.25 & 0.125 & 0.20 & 1 \end{pmatrix} \end{array}$$

Now from this pair wise comparison matrix the weight of each SC metrics will be calculated. The weight of the each SC metrics are $W_{OF} = 0.358$, $W_{DR} = 0.223$, $W_{SL} = 0.193$, $W_{PH} = 0.079$, $W_{HV} = 0.085$, $W_{CP} = 0.042$, $W_{IL} = 0.021$

4. DATA ACQISITION AND ANALYSIS

This step includes the details analysis of data to understand the actual supply chain capability with respect to the strategic target. In this step details analysis will be performed for all of the key supply chain metrics in table 3 and for their capabilities.

4.1 Data Sheet Development and Analysis for Metrics Group 1

The detail information and data for group 1 will be served from in-house distribution details. For group 1 a distribution details have been recorded for a month based on the case study already observed above. From this distribution detail, a summary of the month march, 2011 has been shown below:

Table 4: Summary of the distribution details, March 2011

Order fill rate	Completely filled	224 order
	Partially filled (>75%)	10 order
	Partially filled (>50%)	4 order
	Partially filled (<40%)	2 order
Delivery rate	Instant delivery	132 time
	Within lead time	108 time
	Late delivery	11 time
Handle variety	Availability of all varieties products	109 time
	Not available of all parts	11 time
Inventory level	High level	8 time
	Minimum safety stock	14 time
	No inventory	26 time

Now by using the information from table 4 the strategic point and the actual capability point will be calculated in the following way:

Strategic target = 90 % for complete order fill rate

Total delivery made = 240

Strategic point = strategic target * total delivery made
$$= 0.90 * 240 = 216$$

Achieved % for complete delivery
$$= [(224/240) * 0.90] \% = 84\%$$

Similarly,

Achieved % for partially filled delivery (≥75) = 3.75 %

Achieved % for partially filled delivery (≥50) = 1.5 %

Achieved % for partially filled delivery (≤40) = 0.75 %

Now,

Achieved point = $\sum$ no. of order fill rate* achieved % for each SC capabilities

n = no. of supply chain capability for each metrics.

So, Achieved point = 224*0.84 + 10*0.0375 + 4*0.015 + 2*0.0075 = 188.61 ≈ 189

Thus the strategic and achieved point for the remaining metrics of group 1 shown below:

Table 5: Strategic and achieved points of group 2 matrices

	OF	DR	HV	IL
Strategic point	216	226	114	34
Achieved point	189	207	95	17

4.2 Data Sheet Development and Analysis for Metrics Group 2

In this step of the data analysis, a direct customer survey has been done to get the actual feedback about the metrics of group 2. Here a customer survey has performed to 20 different customers for both of the product A and B. Each of the metrics has been defined as high, moderate and poor performance level and put value on the survey sheet as they got feedback from their customer such as 3 for high, 2 for moderate and 1 for poor performance. The summary of the developed data sheet are showed in the following tables.

Table 6: Summary of the customer survey

SC metrics	SC capabilities	Achieved capabilities	Achieved total
SL	High	57	84
	Moderate	22	
	Poor	5	
PH	High	60	95
	Moderate	30	
	Poor	5	
CP	High	60	100
	Moderate	40	
	Poor	0	

Now by the same procedure, using the information from table 6 the strategic point and the actual capability point calculated and followings are found for group 2:

Table 7: Strategic and achieved points of group 2 matrices

	SL	PH	CP
Strategic point	108	108	95
Achieved point	76	86	95

4.3 Formulation of Analyzed Data to Show the Strategic Fit

Table 8 shows the determination of the actual SC capabilities and the strategic target. In this step the above analyzed data will be formulated to determine the level of strategic fit. Here the weight of the each key supply chain metrics obtained by using AHP is multiplied with the both of achieved point and the strategic point.
Then the value of each of each respective row will be added to determine the actual capability of all the key metrics of supply chain. At the same time we will also determine the strategic targeted value for all of the metrics by the similar process.
For example for Order Fill Rate (OF) the achieved value with relative weight is found as:

Achieved value= Achieved point X Weight
= 189 X 0.358
~ 68

Now, Achieved total value for actual capability
= 68+46+15+7+8+4+0.36
= 148.36

And, Achieved total value for strategic target
= 77+50+21+9+10+4+0.71
= 171.71

Table 8: Determining actual SC capability and strategic target

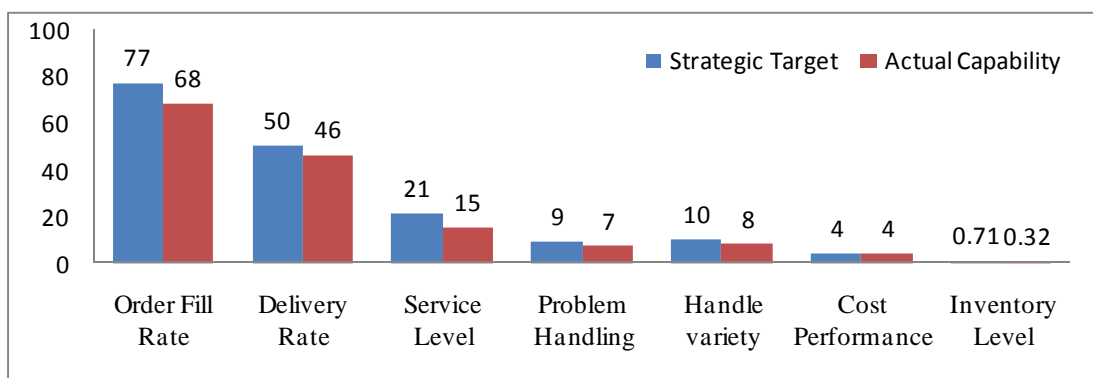| Understanding the SC capability	Supply chain capability metrics						
	Order fill rate	Delivery rate	Service level required	Problem Handling	Handle variety	Cost Performance	Inventory Level
Weight	0.358	0.223	0.193	0.079	0.085	0.042	0.021
Achieved point	189	207	76	86	95	95	17
Achieved value	68	46	15	7	8	4	0.36
Strategic point	216	226	108	108	114	95	34
Strategic Value	77	50	21	9	10	4	0.71

Fig. 2: Strategic target Vs actual capabilities

Therefore, Achieved strategic fit

$$= [(148.36/171.71)*100]\%$$
$$= 86.4\%$$

5. RESULT AND DISCUSSION

A comparison bar chart showing the actual capability and strategic target for each of the supply chain capability metrics is illustrated in Figure 2. From this bar chart, it is clearly depicted about the actual condition of supply chain in terms of strategic target. A company now can understand and to track the diversion of the metrics from their strategic target. As when the strategic target point will be achieved by the existing capability of supply chain, a new target will be set from the corporate level and the company will try to achieve the strategic fit for all metrics. Here, the achieved strategic fit, which is the ratio of achieved total strategic value to the strategic target value, is 86.4%. The achieved strategic target is with reference to the strategic target which had been set accordingly. Any organization should always try to achieve 100% strategic fitness with the target value. When the company will achieve 100% achieve fitness with the strategic target, we can say this as a strategically fit organization, which is maintaining a good strategy and combination for managing supply chain.

From the above calculation and discussion we have seen that the strategic fitness depends only on the matrices but not in their relative weights. But from the relative weight analysis the actual impact of the supply chain key matrices on the supply chain strategy has been clearly comes out which help decision maker to emphasis on certain factor to maintain a good strategic fitness.

6. CONCLUTION

Achieving strategic fit is an important criterion for managing supply chain. A lack of strategic fit between competitive and supply chain strategy causes the failure to sustaining in the competitive market. To achieve the strategic fit a company first identifies the problem. According to the problem the step should be taken. If we can't identify the problem we can't take any effective measurement. This job is done in this paper. Here the key identifier of the supply chain has been identified. Then their relative Wight has been measured using AHP method. Then a systematic data sheet has been developed and analyzed. A customer survey has been conducted. By combining the entire step finally a comparison bar has been developed showing the strategic target and achieved capability. Now the company will be able to easily track where the problem is and according to the measurement the company can take action. This method and procedure will surely help a company to manage their supply chain and to reach to the top of expectation.

7. ACKNOWLEDGEMENT

8. REFERENCE

[1] Chopra, Sunil and Peter Meindl. *Supply Chain Management*. 2 ed. Upper Saddle River: Pearson Prentice Hall, 2004.

[2] Anna Nagurney*: Supply Chain Network Economics: Dynamics of Prices, Flows, and Profits,* Edward Elgar Publishing, 2006, ISBN 1-84542-916-8

[3] J.Stevenson William. *Operation Management.* 8th editions. International Edition ISBN 0-07-111218-9

[4] Chopra, Sunil and Peter Meindl. *Supply Chain Management*. 3 ed. Upper Saddle River: Pearson Prentice Hall, 2004.

[5] J. O'Brien William, T. Formoso Carlos, A. London Kerry, *Construction Supply Chain Management Handbook,* CRC Press 2008, ISBN 978-1-4200-4745-5

[6] Marufuzzaman, M.,Ahsan, K.B. and Xing, K. (2009) *'Supplier selection and evaluation method using Analytical Hierarchy Process (AHP): a case study on an apparel manufacturing organization'*, Int. J. Value Chain Management, Vol. 3, No. 2, pp.224–240.

[7] González-Panchón, J. and Romero, C. (2004) *'A method for dealing with inconsistencies in pair wise comparisons'*, European Journal of Operational Research, Vol. 158, pp.351– 361.

[8] Coyle R G (1989) *'A Mission-orientated Approach to Defense Planning',* Defense Planning, Vol. 5, No.4. pp 353-367.

[9] Saaty, Y. (1980) *The Analytic Hierarchy Process*, New York: McGraw Hill.

9. NOMENCLATURE

SCM	Supply Chain Management
SC	Supply Chain
AHP	Analytical Hierarchy Process
OF	Order Fill Rate
DR	Delivery rate
SL	Service Level
PH	Problem Handling
CP	Cost Performance
IL	Inventory Level
HV	Handle Variety
CR	Consistency Ratio
CI	Consistency Index