

Managing Supply Chain at High Technology Companies

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Abstract- There is an expectation that high technology companies use unique and leading edge technology, and invest heavily in supply chain management. This research uses multiple case study methodology to determine factors affecting the supply chain management at high technology companies. The research benchmarks the supply chain performance of these high technology companies with supply chain of other supply chains at both strategic at tactical levels. The results indicate that at the strategic level the high technology companies and benchmark companies have a similar approach to supply chain management. However at the tactical, or critical, supply chain factor level, the analysis suggests that the benchmark companies (which happen to be companies dealing in commodity-type products) have a different approach to supply chain management.

Keywords- Critical success factors, high technology, supply chain management.

I. INTRODUCTION

One of the earliest approaches to competitive advantage is the microeconomic approach, or the idea of perfect competition [12]. In perfect competition products are homogenous, consumers and producers have perfect information, prices will reach equilibrium, and as a result profits are negligible or low in the long run. However, such a perfect economy is an abstraction, because there are monopolies, oligopolies, and perfect competition [6]. However, perfect competition provides a benchmark against which the behaviour of other markets is judged [2].

Porter [9] argues that competitive advantage comes from the many discrete activities a firm performs in designing, producing, marketing, delivering, and supporting its product. Porter proposes a framework for analyzing industries and competitors and describes three generic strategies – cost leadership, differentiation, and focus. He postulates that if a firm is able to do well in any of these strategies, it will gain competitive advantage. Based on Porter's arguments, firms were constrained by their customers' or suppliers' lack of collaboration and unresponsiveness. These attributes prevented firms from responding quickly to changes in the market or to customers' requirements [1].

Lambert and Copper [7] point out that one of the most significant paradigm shifts of modern business management has been that individual businesses no longer compete as autonomous entities, but rather as supply chains. As a result, the supply chain approach to gaining competitive advantage has moved into the mainstream of business strategies.

Managing the supply chain has become a means of improving competitiveness [3, 8]. Proactive supply chain managers begin to view the supply chain as a whole, and promote customer-focus, supplier partnership, co-operation and information sharing [5]. Three major developments in global markets and technologies have brought the emerging supply chain management (SCM) to the forefront of management's attention [4]:

1. The information revolution;
2. Customer demands in areas of product and service cost, quality, delivery, technology, and cycle time brought about by increased global competition; and;
3. The emergence of new forms of interorganisational relationships.

Although it is clear that the supply chain must be integrated from supplier (or upstream activities) to internal processes, to downstream activities, and to customers, there seem to be few examples of truly integrated supply chains [4]. Hence, the synchronized supply chain seems to be more aspiration than reality. Furthermore, according to Siekman [10], quoting Sandor Boyson, co-director of Supply Chain Management Center at the University of Maryland, only a fourth of 117 companies in an e-commerce association claim to have extended trading via e-commerce. Evidently, as companies work towards better coordination and integration of the various supply chain activities into SCM systems, they are faced with many barriers, such as lack of internal support, short-term performance focus, misaligned measures and rewards, poor use of technology, and lack of trust [11].

This research concentrates on studying the supply chain management in high technology industries. These are companies that produce and deliver computer and electronic products, such as computers, computer systems and networks, electronic measurement systems, and other electronic products. There is an expectation that these high technology companies will use unique and leading edge technology, and invest heavily in supply chain management. Hence, it will be beneficial to understand how such companies manage their supply chain in comparison with other supply chains at both strategic and tactical levels. The research employs a multiple case study research methodology. Five high technology companies based in California, USA have been selected. To benchmark the supply chain performance of these high technology companies with supply chain of other supply chains, four benchmark manufacturing companies were selected from the membership roster of the Council of Logistics Management, USA. At strategic supply chain

management, nine general areas are identified while at tactical level, the questionnaire comprises 52 supply chain management factors.

II. RESEARCH METHODOLOGY

This research adopts multiple case study approach for the following reasons:

- The focus of this research is on high technology companies operating in California, USA, there is a concern that there will be a small number of companies willing to participate in a large (sample size) quantitative survey.
- Supply chain management is a vast collection of techniques. Hence, selection of supply chain factors and strategies can be a complex process. In such a dynamic setting it is best to use case studies to understand the situation.
- Face-to-face meetings with respondents can help provide understanding and information on several qualitative areas, such as: reasons for implementing specific supply chain factors (or

strategies), customer needs data, and discussions and feedback on the questionnaire.

- Since all the selected companies are high technology companies, they are expected to be facing similar business and external issues. Therefore a smaller number of cases can be deemed sufficient and appropriate to compare and contrast findings and establish replication [13]. Further, case study approach can provide a robust insight and thus achieve a higher level of external validity and reliability.

This research considers five high technology companies. Products of two of these companies have short product life cycles of one to two years. The others are companies that produce products with longer life cycles of 2 to 5 years. Table 1 illustrates the type of companies and number of interviewed respondents at each company.

TABLE 1
CASE SELECTION AND INTERVIEW MATRIX

| | Companies with short product life cycles of about 1-2 years. | | Companies with longer product life cycles of 2 to 5 years. | | |
|---------------------------------------|--|------------------------------------|--|--------------------------------------|-------------------|
| | X | H | A | P | C |
| Line of Business | Documentation equipment | Global Provider of Printers and PC | Analytical and measurement instruments | Radio frequency and power amplifiers | Network equipment |
| Number of employees | 67,000 | 140,000 | 32,000 | 1,000 | 36,000 |
| Annual Revenue US \$ @ 2002 | \$15B | \$70B | \$6B | \$330M | \$19 |
| Respondent Profile | | | | | |
| General. Sales, or operations Manager | 1 (X1) | 1 (H4) | 1 (A4) | 1 (P3) | 1 (C2) |
| Supply Chain or Material Manager | 2 (X2, X3) | 3 (H1, H2, H3) | 3 (A1, A2, A3) | 2 (P1, P2) | 2 (C1,C3) |
| Number of respondents | 3 | 4 | 4 | 3 | 3 |

To benchmark the supply chain performance of the high technology companies with supply chain of other companies, four benchmark manufacturing companies were selected from the membership roster of the Council of Logistics Management, USA, and were approached to participate in the case study. These four companies, with a total of four respondents are commodity type companies.

The profiles of the selected companies are shown in Table 2. The benchmark companies are either the market leader or among the market leaders in their product categories. Four respondents were interviewed: two respondents were business managers and the others are supply chain or material managers.

TABLE 2
PROFILE OF BENCHMARK COMPANIES

| Company | Lines of Business | Revenue, latest quarter of 2002 |
|-----------|---|---------------------------------|
| Company J | A company dealing in up-market mineral water and other beverages – a market leader | US\$ 2.8B |
| Company K | A company dealing in sugar manufacturing and distribution – among the market leaders | No comparable data available |
| Company L | A company dealing in tools & appliances – among the market leaders | US\$ 1.2B |
| Company M | A company dealing windows, window frames, & other home items – among the market leaders | No comparable data available |

III. THE QUESTIONNAIRE

The questionnaire comprises 52 questions which pertain to supply chain factors that will have specific influence on supply chain management. These questions are classified into 10 supply chain categories as shown in

Table 3. Interested researchers can obtain directly from the authors the list of the supply chain management factors or a copy of the questionnaire.

TABLE 3
CATEGORIES OF THE QUESTIONS

| Supply chain category | Covered by questions numbers |
|--|------------------------------|
| Logistics | 1 to 4 |
| Procurement | 5-8 |
| Inventory Management | 9-14 |
| Manufacturing | 15-24 |
| Partnership & Collaboration | 25-27 |
| Customer Relationship Management | 28-32 |
| Information Systems & Technology | 33-39 |
| Supply Chain Agility | 40-42 |
| Decision Making & Organization Factors | 43-47 |
| Employee Performance | 48-52 |

In addition to the questions on supply chain management factors, there is a question that requires the respondents are asked to choose the top six categories mentioned in Table 3 and rank them from 1 to 6. Any category that receives one vote or less in each company is discarded. The purpose of this forced ranking exercise is to understand overall priorities and important areas in supply chain management at the case study companies.

IV. CASE STUDY RESULTS

Looking at Table 4, it can be observed that five of the top six categories are the same for benchmark and high technology companies. These categories are manufacturing, decision-making & organisation, partnership & collaboration, customer relationship, and

inventory management. Hence it can be concluded that high level is similar at both the benchmark and high technology companies. However, the high technology companies put the highest priorities to partnership & collaboration and customer relationship categories while the benchmark companies emphasise manufacturing and

the focus of supply chain management at the decision-making & organisation. All companies have similar ranking for inventory management category. Benchmark companies showed interest in logistics while high technology companies expressed interest in procurement.

TABLE 4
IMPORTANT SUPPLY CHAIN CATEGORIES AT BENCHMARK COMPANIES & HIGH TECHNOLOGY COMPANIES

| Supply Chain <i>Categories</i> prioritized by Rank | | | |
|--|------|--|------|
| BENCHMARK COMPANIES | | HIGH TECHNOLOGY COMPANIES | |
| Supply Chain Category | Rank | Supply Chain Category | Rank |
| Manufacturing | 1 | Partnership & Collaboration | 1 |
| Decision Making & Organization Factors | 2 | Customer Relationship | 2 |
| Partnership & Collaboration | 3 | Decision Making & Organization Factors | 3 |
| Customer Relationship | 4 | Procurement | 4 |
| Logistics | 5 | Manufacturing | 5 |
| Inventory Management | 6 | Inventory Management | 6 |

At a tactical or actual area of supply chain factor implementation, there are some similarities but major differences. 'On-time delivery' factor is very important at all companies reviewed in this study. 'Superior product quality' is another factor emphasised by companies, but beyond that the high technology companies put a strong focus on partnerships and outsourcing which directly related to its relationships with various entities of the supply chain. The benchmark companies emphasise on supply chain factors that improve or manage customer satisfaction and product quality (Table 5). This different approach is, possibly, due to the fact that the short life cycle of the high technology company's products enforces these companies on issues that enhance the quick response to the market demands. The benchmark companies deal in commodity type products and hence they have to focus on differentiating themselves through implementing supply chain factors that provide strong customer services.

V. CONCLUSION

The analysis of high technology companies and benchmark companies suggest that at the high level, or supply chain category, management of all companies have a similar approach to supply chain management. However at the tactical, or critical, supply chain factor level, the analysis suggests that the benchmark companies (which happen to be companies dealing in commodity-type products) have a different approach to supply chain management. The benchmark companies are externally focused and put a strong focus on critical supply chain factors that improve or manage customer satisfaction. In addition just like the high technology companies they also emphasize product quality.

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TABLE 5
SUMMARY OF IMPORTANT SUPPLY CHAIN FACTORS AT BENCHMARK COMPANIES & HIGH TECHNOLOGY COMPANIES

| Supply Chain Factors prioritized by Importance | | | |
|--|---------|--|---------|
| BENCHMARK COMPANIES | | HIGH TECHNOLOGY COMPANIES | |
| Supply Chain Factor | Average | Supply Chain Factor | Average |
| 2. Provide on-time delivery to customers | 4.75 | 2. Provide on-time delivery to customers | 4.71 |
| 24. Superior product quality compared to competitors | 4.50 | 5. Partnership with suppliers | 4.65 |
| 28. Monitoring and measuring customer service level | 4.50 | 16. Effective use of ERP & MRP systems | 4.65 |
| 43. Top management commitment | 4.50 | 20. Outsourcing of non-core manufacturing activities | 4.65 |
| 29. Effective management of customer complaints | 4.25 | 47. Teamwork and inter-organizational coordination | 4.56 |
| 30. A process to manage customer dissatisfaction returns | 4.25 | 24. Superior product quality compared to competitors | 4.53 |
| 49. There is high employee productivity | 4.25 | 43. Top management commitment | 4.50 |
| 51. High utilization of employee's skills and abilities | 4.25 | 42. Responding to high market fluctuations | 4.47 |
| 5. Partnership with suppliers | 4.00 | 17. Responsiveness to meet engineering changes | 4.44 |
| 8. Company-wide purchasing contracts for best pricing | 4.00 | 41. Responding to unexpected demand from customers | 4.41 |

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