

AN EXPLORATORY STUDY OF MANUFACTURING STRATEGY OF PACKAGING PRODUCT-MANUFACTURING COMPANIES IN INDIA

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Abstract: This paper presents finding of a survey on manufacturing strategy implementation (MSI) adopted by the Indian packaging product manufacturing companies (IPPMC). Though the companies differ in terms of product types (shape, method, content and material of packaging), conversion system, sales volume and sophistication of machinery used, they share common purpose that are used for packaging the products. With growth in demand for consumer products, packaging forms basis of differentiating products from competitors. The survey shows emphasis on implementation of manufacturing strategy, key decision areas, identifies competitive priorities, order winners. To get insight, three companies are selected for detailed case studies.

Keywords: Manufacturing strategy implementation; decision areas; Competitive priorities; order winners; packaging product manufacturers

1. INTRODUCTION

Manufacturing is crucial for the robust growth of the economy, for exports and for generating substantial relevant employment. But manufacturing function is ignored by production group as a strategic function as shown by seminal article of Skinner (1969). Later on manufacturing function has passed through dramatic changes. It is influenced by manufacturing philosophies in the east like TQM, JIT whereas “World Class Manufacturing” in the west[2]. In academic research manufacturing function is studied by many authors from strategic point of view. Many authors studied and showed the strategic importance of manufacturing function (Skinner, 1969, Dangayach and Deshmukh, 2001, Chang et al. 2003, Rho et al. 2001, Miltenburg 2008).

The manufacturing sector is under tremendous pressure because of environment and market forces. Indian manufacturers are facing competition from new foreign entrants on cost, quality, flexibility and innovation. International competitors are continuously working on improving manufacturing, bringing new products and making manufacturing more proactive and responsive (Chandra & Shastri, 1998)[6]. This competitive environment forces Indian

manufacturers to understand the forces of driving industry competition stated by Porter (1980)[23]. The level of competition can be assessed by SWOT analysis of firm in the environment it operates. This can be source of understanding trade-off necessary to cope with market need and operating strength (Platts & Gregory, 1992)[25]. In a manufacturing competence survey, Chandra P. (2009) highlighted the need for Indian manufacturers to be competitive on supplier association, cluster initiative for joint raw material procurement which reduce cost, product quality, reduce delivery bottlenecks to reach to their customers, process enhancement leading to flexibility, create market innovation, lean practices enhancing productivity and promote R&D[7].

In order to mitigate competitive forces; firms need to prioritize the competitive factors-cost, quality, flexibility, delivery, innovation. In order to respond to market on competitive factors; firm needs a strategy. The contribution of Dangayach and Deshmukh, 2003. [9]; Skinner, 1974.[28] emphasizes requirement of manufacturing strategy. The need of manufacturing strategies and operations are environment fitness, strategic positioning, and operational efficiency.

It has been pointed out that the many failure stems from an inability to translate a competitive

strategy into specific implementation plan to gain competitive position (Porter, 1985)[24]. Manufacturing practices like TQM, JIT, and Continuous improvement yields favorable impact on the performance of the firm. Dangayach and Deshmukh (2008) assessed the prevalence of improvement activities termed as advanced management system in mutisector analysis. They found that machinery sector is improving on adoption of advanced manufacturing system as well as competitive capabilities[12]. Dangayach and Deshmukh (2004) found important issues of strategic planning, alignment of manufacturing and business strategy, communication of manufacturing strategy, business excellence. In a longitudinal study of process industry, they also found competitive priorities, investment in improvement activities and order winners of cement industry. This study proposed to find existence of MSI and assess the competitive priorities, order winners, pattern of manufacturing priorities based on strategic manufacturing groups in packaging industry[10].

Indian manufacturing firms need to focus on people issue such as conflict management, and resistance to change during adoption and implementation of addition of new machineries. Also it is required for managers to integrate the activities of the organization and communicate with the strategic requirements of the firm to all stakeholders concerned.

Indian packaging product manufacturing companies (IPPMC) meet the manufacturing requirements of a variety of sectors of the manufacturing industry especially the consumer product manufacturing companies[13]. The Indian packaging industry is growing at 14-15% annually (Indian Packaging Machinery Manufacturers of India (IPMMI), 2009)[18]. Indian Packaging industry is \$ 14 billion and wide range machinery is manufactured in India (Indo-Italian chamber of commerce report, 2008)[17]. Due to lower manufacturing costs, India is fast becoming a preferred hub for packaging production. A high degree of potential exists for almost all user segments which are expanding appreciably consisting of processed foods, hard and soft drinks, fruit and marine products, cosmetics and personal-care, office stationary and accessories, fabrics and garments, white goods and other durables, electrical appliances and equipment,

entertainment and other electronics, shoes and leather ware, gems and jewellery, toys and sports goods, chemicals and fertilizers. The market size of various materials is shown in Table 1. This formed motivation for understanding manufacturing strategy of IPPMC.

The specific objectives of this study are to:

- find extent manufacturing strategy implementation followed by IPPMC
- assess competitive priorities of an organization,
- identify order winners for IPPMC,
- identify key decision areas of improvements,
- to establish relation between manufacturing strategy implementation and manufacturing priorities

In this research, we conducted a survey of IPPMC to assess emphasis placed on manufacturing strategy implementation and mapped as per Thun' (2008)[30] three constructs, key decisions and priorities are mapped as per Miltenburg's (2008) manufacturing levers or subsystem and output. Miltenburg coined manufacturing levers or subsystems in terms of Human resources, Organization structure and controls, production planning and control, sourcing, process technology, facilities, and manufacturing output or priorities in terms of cost, quality, delivery, performance, flexibility, innovativeness[19]. However Order winners differentiate firm from competing firms and are key criteria for customer preference. In addition to survey, detailed case study of three firms has been conducted and relationship between manufacturing strategy implementation and manufacturing priorities are established[5].

The paper is structured as follows. Section 2 presents the literature review on manufacturing strategy. Section 3 describes the research methodology used. Survey findings are presented in Section 4. Case study of the three companies is given in Section 5. Section 6 deals with relationship between MSI and manufacturing of the output/priorities. Conclusions and limitations of the study are given in Section 7.

2. MANUFACTURING STRATEGY

In a path breaking article on missing link in manufacturing, Skinner (1969) pointed out the

role manufacturing operation, a common understanding as support activity in company. Production operations are designed to fulfill strategic plans and strategic plans are designed based on production competence. Skinner puts forward the cause and effect relationship between manufacturing decisions and corporate strategy and recognizes the need for looking manufacturing as strategic function. Skinner stated in 1969:

In a strategic sense, manufacturing's task was to maximize output to satisfy large, key customers[27].

Manufacturing objectives are derived from strategic plans, and then manufacturing policies developed to address these objectives. Manufacturing objectives include; cost, quality, delivery and flexibility, innovation. Since then, lot of research has been carried out in the area of manufacturing strategy. One of the definition coined by Hayes and Wheelwright (1984) is as: A manufacturing strategy is defined by a pattern of decisions, both structural and infrastructural, which determine the capability of a manufacturing system and specify how it will operate to meet a set of manufacturing objectives which are consistent with overall business objectives and take into account market needs, competitor performance, and internal strength and weaknesses. In their 1984 book, Hayes and Wheelwright define four stages of progression toward attainment of a truly competitive manufacturing strategy. Stage 1 (internally neutral) is a fire-fighting, reactive form of decision making where top-management is not concerned with manufacturing. In stage 2 (externally neutral), the rationale for manufacturing strategy is to keep up with industry, in a sense of industry parity. In stage 3 (internally supportive), manufacturing is closely linked to the business strategy of the corporation and becomes a force in supporting the business. Finally, in stage 4 (externally supportive), all of the functions are closely linked together, and manufacturing is a basis for competitive advantage[14].

It is evident that firms implementing manufacturing strategy improve the infrastructural and structural subsystems (Skinner, 1969, Hayes and Wheelwright, 1985). The structural decision areas include following decisions (Avella et al.,

2001):

- a. *Capacity*; which deals with reconfiguration of factory layout, factory reconditioning and/or reorganization, investments in plants, equipment and R&D, expanding factory capacity, reducing factory size.
- b. *Location*; which deals with factory location and relocation.
- c. *Technology management*; which deals with computer-aided design (CAD), computer-aided manufacturing (CAM), robots, flexible manufacturing system (FMS), group technology.
- d. Vertical integration/relation with suppliers; which deals with subcontracting part of the current manufacturing process, cooperation with suppliers, integration of information system with suppliers.

Infrastructural decisions enables firm to carry out operations which increase the manufacturing competitiveness. The infrastructural decisions include:

- a. *Workforce management*; which deals with job enlargement/enrichment (increase variety of tasks to be carried out by workers), workers empowerment (increase workers' responsibility), team work, worker training, management trains.
- b. *Quality control and guarantee systems*; which deals with total quality management(TQM), zero defect programs, quality circles, statistical quality control, preventive maintenance, continuous improvement of the current manufacturing processes.
- c. *Production and inventory and control systems*; which deals with definition of manufacturing strategy, improvement in production and inventory control system, reduction in machine set-up time, reduction in manufacturing lead-time, *just in time* purchase management.
- d. *New product development*; which deals with value analysis and product redesign, competitive engineering, development of new products, development of new processes for new products.
- e. *Organizational structure*; reducing workforce size, decision decentralization, improving management-worker relation, improving

quality of working condition, interfunctional team work[3].

Hill (1989) put forth the manufacturing capability which concern customer in market place and termed as market qualifying and winning output. Market qualifying outputs qualify company for acceptable level for existing customers. Order winning outputs are the critical characteristic of particular market. This could lead to source of manufacturing investment decision. Hill also pointed out that manufacturing strategy was function of manufacturing and corporate decisions. The issues involved in corporate decision involve-corporate objectives, marketing strategy, order winner outputs, process choice and infrastructure and trade-off in these functions which provide order winning outputs[15]. Miltenburg (2008) has shown the capabilities in terms of manufacturing output which affected the measurement of the performance. The manufacturing output varies as per level of analysis-entire factory or single production system. He reduced the outputs in terms of cost, quality, delivery time and delivery time reliability, performance, flexibility and innovativeness. The firm can exploit the capabilities to enhance the performance and help on strategically to position firm in market-place (Rosenzweig E.D. et al., 2003). Boyer & Lewis (2002) found that operating decision are important while making trade-off among competitive priorities-cost, flexibility, delivery, quality[26, 4].

Kim and Lee (1993) provide typology of manufacturing system and generic manufacturing strategies. This approach is helpful for identifying factors influencing strategic choice and performance (e.g. cost, quality, flexibility). In a survey of 164 American manufacturing units, Miller and Roth (1994) classified manufacturing units into three clusters; caretakers, marketers, innovators. In classifying, they found differences among group in terms of action programs to improve the effectiveness of operations over following two years. The action programs include; labor/management relationships, zero defects, manufacturing lead time reduction, CAD, new process/product, closing plants, SPS(process), new product introductions, reducing workforce size. Arnoud De Mayer (1998) provided trend in implementation of action programs over 1986-96. Some of the significant action programs, which

lead to higher competitive priorities for European manufacturers are giving work to broaden range of tasks, closing and relocating plants, functional team work, value analysis, computer aided design, reconditioning physical plants, developing new process for existing products, flexible manufacturing systems, robots, production and inventory control[1].

Boyer and Lewis (2002) stressed the importance consistency among plant's practices (e.g. technological investments, human resource systems, inventory control) to its competitive priorities to develop operation as a competitive advantage. Miltenburg (2008) defined manufacturing subsystems in terms of Human resources, Organization structure and controls, production planning and control, sourcing, process technology, facilities. However, Dangayach and Deshmukh (2004) found evidence of manufacturing strategy implementation in process industry. In longitudinal study they found competitive priorities and order winners for cement industry.

It seems that no study has been reported to the best of our knowledge in packaging product manufacturing industry. We have administered a structured questionnaire to these companies spread all over the country. This work focuses on assessing extent of implementation of manufacturing strategy, extent of decisions in manufacturing levers and competitive priorities in IPPMC.

3. RESEARCH METHODOLOGY

Research on manufacturing strategy planning and implementation has received attention all over the world for manufacturing performance improvement. In one of the study carried out by Thun (2008), on general implementation of manufacturing strategy and its alignment with resource and market based view of manufacturing strategy, they found significant difference among high, medium and low strategy group. The MSI factors are adopted from Thun (2008) and Dangayach and Deshmukh (2004). In order to assess emphasis on key decision areas we operationalized the subsystem using the literature (Avella et al., 2001; Miltenburg, 2008; Dangayach and Deshmukh, 2006). We have adopted the

constructs for assessing existence of manufacturing strategy among IPPMC. However, to find detailed explanation of some findings case study method is adopted[11]. Dangayach and Deshmukh (2004) adopted case study methodology along with comprehensive survey of Machinery industry of India.

Fig. 1 reflects the methodology adopted for

this research. This is cross-sectional and prospective study. The objective of the study is to find emphasis on MSI, key decision areas, order winner and manufacturing capabilities through survey and information. The methodology was based on a questionnaire survey and personal interviews.

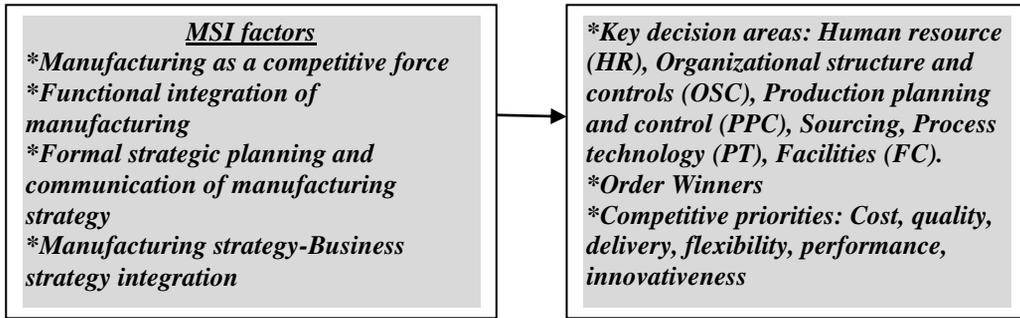


Figure 1: Research methodology

3.1 Selection of industry and database

Table 1: Market size of packaging materials (Source: IPMMI, 2009)[13]

Material	Size (%)
Food, pharmaceuticals, cosmetics, toiletries, Ind. products, textiles, handicrafts	4
Rigid & semi-rigid plastic containers	9
Tin containers	10
Glass containers	10
Corrugated board & boxes	23
Paper & paper board	36
Other ancillary materials like tapes straps, labels, adhesives, etc	8

Table 2: Region wise data

Region	No. of questionnaire sent (%)	No. of companies responded (%)
East	5(8.9)	1(4.1)
West	30(53.5)	12(50)
North	10(17.)	4(16.6)
South	11(19.6)	7(29.1)
Total	56(100)	24(100)

Due to lower manufacturing costs, India is fast becoming a preferred hub for packaging production. As per World Trade Organization, it is imperative for India to upgrade its packaging standards through innovative technologies in order to be on a par with the world’s best practices. A survey methodology is carried out using sampling technique. A database of 56 packaging production companies has been created based on packaging product manufacturing industries from all over the country. Selection criteria were based on number of employees and sales turnover of the company. An attempt was made to select such companies in which numbers of employees were more than 50 and an annual sale was more than `50 lakh. Table 2 shows region wise data of companies and response rate.

3.2 Constructing an instrument for data collection

Based on the literature (Thun, 2008; Dangayach and Deshmukh, 2004) a questionnaire on manufacturing strategy implementation (MSI) is designed. Questionnaire include factors- Manufacturing as competitive force (MCF), Functional integration of manufacturing (FIM) and Formal strategic planning and communication of manufacturing strategy (SPC).

Table 3: Profile of the respondent IPPMC

Parameter	Number of companies	Percentage
<i>Number of employees</i>		
1. <100	8	33.3
2. 100–250	9	37.5
3. 250-500	2	8.3
4. 500-1000	4	16.6
5. >1000	1	4.1
Total	24	100
<i>Sales turnover (` Crores)</i>		
1. 0.5-1	4	16.6
2. 1-2	2	8.3
3. 2-5	7	29.1
4. 5-10	6	25
5. >10	5	20.8
Total	24	100
<i>Company by type of material</i>		
1. Rigid packaging (Bottle, Metal Can, Wooden Box, Metal Box)	9	37.5
2. Semi-rigid (Carton Box, Plastic Bottle)	8	33.3
3. Flexible (Paper, Plastic ,Film, Aluminum foil, Cellophane)	7	29.1
Total	24	100
<i>Company by type of content</i>		
1. Food Packaging	5	20.8
2. Cosmetics Packaging	5	20.8
3. Powder Packaging	3	12.5
4. Toiletry Packaging	1	4.1
5. Drug Packaging	2	8.3
6. Liquid Packaging	7	29.1
7. Dangerous Packaging	1	4.1
Total	24	100
<i>Industry in which products are supplied</i>		
1. Pharmaceuticals/Chemicals	10	41.6
2. Healthcare/Medical Devices	6	25
3. Food/Beverages	8	33.3
Total	24	100
<i>Respondent</i>		
1. CEO/GM/President/Vice President/Executive Director (with 21 years and above experience)	14	58.33
2. Divisional Manager/Production Manager/Head-Operations/Works Manager/Director-Technical (with 10-20 years experience)	6	25
3. Assistant Manager/Production Engineer/Quality Engineer (with 5–9years experience)	4	16.6
Total	24	100

Various attributes of MSI are shown in Table 4. The questions on MSI are developed to find

prevalence of the factors and are measured on five point Likert scale (1-Not at all, 5-Large

extent). Questions related to manufacturing levers is adopted from (Avella et al., 2001; Miltenburg, 2008; Dangayach and Deshmukh, 2006). The questions on manufacturing levers are developed to find emphasis (or investment) in activities in the last three years and measured on five point Likert scale (1-Not at all, 5-Large extent). However scale for manufacturing priorities were adopted from (Miltenburg, 2008, Swink et al., 2007) and changes in manufacturing output in last three years in your plant primary product line are measured on five point Likert scale (1-Not at all, 5-Large extent). General questions regarding number of employees, sales turnover, type of packaging, etc. were framed by authors. It is a type of closed-ended question that allows respondents to indicate how closely their feelings match the question or statement on a rating scale.

The questionnaire contained in three sections 'A', 'B' and 'C'. Section 'A' contained 14 general questions pertained to plant. Section 'B' contained 12 questions related to manufacturing strategy implementation (MSI). The CEO's/Directors are targeted to fill response on MSI. Section 'C' contained questionnaire on decision making in manufacturing levers and manufacturing priorities. Middle management was targeted to fill section 'C' [29].

To assess content validity a pilot study is carried out and few questionnaires were administered to academic and industry experts. Based on their feedback the present form had been evolved and final version of the questionnaire was sent to the CEOs of 56 companies. Out of which, 24 valid responses in the form of filled questionnaire have been received (response rate 42.8%). Table 3 shows profile of respondent IPPMC.

After collecting the data, Confirmatory factor analysis for each construct is carried out and Eigen values of each factor are found more than 1. The KMO (Kaiser Mayer Oklin) factor for sampling adequacy is found more than 0.6, adequate for exploratory work (Hutcheson and Sofroniou, 1999) [16]. Cronbach's coefficient alpha is calculated for checking internal consistency and reliability of scales. Cronbach's alpha values are found more than 0.5, which is adequate for exploratory work (Nunnally JC, 1978) [22].

4. SURVEY FINDINGS AND OBSERVATIONS

The findings are divided into four sections. The first subsection describes the emphasis on MSI. The following sections deal with manufacturing levers, competitive priorities and order winners.

4.1. Manufacturing strategy implementation (MSI)

The objective of manufacturing strategy is to achieve long-term competitive advantage. This is achieved by looking into position of firm in terms of capabilities and articulating the plan to convert capabilities required in the future. We extended earlier research on MSI (Dangayach and Deshmukh, 2004; Thun, 2008). Table 4 depicts emphasis laid by IPPMC on various strategic aspects. We propose the analogy to Hayes and Wheelwright's model with the inclusion of functional integration of manufacturing. Various attributes of stages I-IV (internally neutral, externally neutral, internally supportive, and externally supportive) are included in Table 4. The emphasis on attribute say, 1-2 mean stage I of Hayes and Wheelwright's model and 2-3, 3-4, 4-5 as stage II, III, IV of Hayes and Wheelwright's model.

It is observed from Table 4 that overall mean values for IPPMC is 3.31. This shows IPPMC in stage III of Hayes and Wheelwright's model i.e. internally supportive. It seems that company A (overall mean=2.47) is in stage II of Hayes and Wheelwright's model i.e. externally neutral and company B (overall mean=3.29) are in stage III of Hayes and Wheelwright's model i.e. internally supportive, whereas company C (overall mean = 4.0) is on the verge of moving from stage III to stage IV i.e. from internally supportive to externally supportive.

4.2 Manufacturing levers

The competitive priorities are achieved by properly investing in structural and infrastructural issues in manufacturing. The emphasis on issues focuses decision making on processes of choosing, technology, capacity, manufacturing planning and control systems, and quality (Skinner, 1969 ,

Hayes and Wheelwright 1985, Ward et al 1998). We extended the choices in manufacturing as manufacturing levers (Miltenburg, 2008). From Table 5 and Table 6, we find that main values for IPPMC are the highest for the process technology

(3.18), followed by organization and control (3.12), facilities (3.01), Human resource (3.0), Sourcing (3.0), and production planning and control (2.95).

Table 4 Emphasis on MSI factors

Factor	Mean	Std. Deviation	Company A	Company B	Company C
<i>Manufacturing as a competitive force(MCF)</i> (Eigen value=2.40,Cronbach's alpha=0.61,KMO=0.75)					
• In our company, manufacturing is considered to be a source of competitive advantage	3.3	1.16	2.0	3.0	4.0
• We have manufacturing strategy that is actively pursued	3.5	0.97	3.0	5.0	2.0
• Decisions about materials, systems and services sourced from outside our company are screened for consistency with our manufacturing strategy	3.5	0.95	4.0	4.0	4.0
• Our manufacturing competence is a substantial source of value added	3.3	1.16	2.0	3.0	4.0
<i>Factor mean</i>	3.4	1.06	2.75	3.75	3.5
<i>Functional integration of manufacturing (FIM)</i> (Eigen value=2.02,Cronbach's alpha=0.58,KMO=0.88)					
• Our plant's functions coordinate their activities	3.2	1.14	2.0	3.0	3.0
• The functions in our plants are well integrated	3.3	1.16	2.0	3.0	5.0
• The functions in our plants work well together	3.3	1.16	2.0	3.0	4.0
• The marketing and finance areas know a great deal about manufacturing	3.3	1.06	4.0	3.0	4.0
<i>Factor mean</i>	3.27	1.13	2.5	3.0	4.0
<i>Formal strategic planning and communication of manufacturing strategy (SPC)</i> (Eigen value=2.43,Cronbach's alpha=0.68,KMO=0.67)					
• In our plant, goals, objectives and strategies are communicated to me	3.6	0.97	3.0	4.0	3.0
• I understand the long-run competitive strategy of this plant	3.3	1.16	2.0	3.0	4.0
• Our plant has formal strategic planning process, which result in a written mission, long range goals and strategies for implementation	3.7	0.95	4.0	4.0	4.0
• Plant management routinely reviews and updates a long range plan.	3.3	1.16	2.0	3.0	5.0
<i>Factor mean</i>	3.47	1.06	2.75	3.5	4.0
<i>Manufacturing strategy-Business strategy integration (MS-BSI)</i> (Eigen value=4.1,Cronbach's alpha=0.9,KMO=0.849)					
• Manufacturing strategy is well aligned with business strategy	3.1	0.88	2.0	4.0	4.0
• Our business strategy is translated into manufacturing terms	2.9	0.99	2.0	3.0	4.0
• Manufacturing management is aware of business strategy	3.1	0.88	2.0	3.0	4.0
• Business strategy at our firm drives manufacturing decisions	3.5	1.18	2.0	3.0	5.0
• Potential manufacturing investments are screened for consistency with our business strategy	3.2	1.03	2.0	3.0	5.0
<i>Factor mean</i>	3.15	0.99	2.0	3.2	4.4
<i>Overall mean</i>	3.31	1.05	2.47	3.29	4.0

4.3. Competitive priorities

Competitive priorities are the basis of competition and content of manufacturing strategy (Dangayach and Deshmukh, 2001). Competitive priorities denote strategic intent on developing certain manufacturing capabilities that may improve competitive position of the plant in marketplace [8]. Many researchers have stressed the importance of cost, quality, delivery and flexibility (Ward et al., 1998, Boyer and Lewis, 2002). Miltenburg (2008) suggests innovativeness to be required to quickly introduce new products and to make product design. IPPMC is supplier to various organizations including high demand consumer product firms. We have included innovativeness to keep pace with changing needs of customers. Table 7 shows mean values of competitive priorities for IPPMC and case companies and standard deviation of competitive priorities for IPPMC. Respondents were asked to indicate degree of importance on changes in manufacturing output in last three years in your plant primary product line are measured on five point Likert scale.

We have extended the six competitive priorities identified by researchers (Miltenburg, 2008, Swink et al., 2007) into 19 dimensions. Table 7 shows that top most competitive priority for IPPMC is ability of features to do things (3.7), followed by ability to produce range of products (3.6), decrease in lead time to introduce new products (3.6), and delivery speed (3.6). However overall mean for IPPMC is highest for delivery (3.43), followed by flexibility (3.37), performance (3.36), innovation (3.4), quality (3.3) and cost (3.16).

4.4. Order winners

We have identified 9 criteria as order winners for packaging product manufacturing sector based on literature (Hill, 1989). We have selected manufacturing related criteria to find contribution of manufacturing levers to enhance order winners. We have selected 9 criteria, which are relevant to IPPMC. Order winners include ability of product features to do things, ability to produce range of products, delivery speed, decrease in main time to introduce new products, promptly handle customer complaints, ability to modify features,

conformance to design specification, product durability, and reduction in production cost. Respondents were asked to indicate degree of agreement on five point Likert scale. Table 8 shows that top most order winner for IPPMC is ability of product features to do things (3,7), followed by ability to produce range of products (3.6), delivery speed (3.6), decrease in Lead time to introduce new products (3.6), promptly handle customer complaints (3.5), ability to modify features (3.46), conformance to design specification (3.4), product durability (3.4), and reduction in production cost (3.3).

5. CASE STUDIES

We adopted case study method to analyze and in-depth study of companies under consideration. The case study was intended to aid in further concept development and framework development. Based on survey, we present cases of packaging product manufacturing companies (labeled as A, B, C). Company A is a printed flexible manufacturer, company B is a multi-layer flexible film manufacturer, and company C is coextruded laminated tube manufacturer. Each plant was visited thrice, once for an understanding of general operations, second for discussion on various strategy implementation factors and third for discussing the exhaustive questionnaire for the analysis. Data collection consisted of documentary evidence, observation in the plant, structured questionnaire and unstructured questioning. The discussion on strategy implementation is generally carried out with CEO's/Directors of the firm. Senior managers are interviewed for emphasis on manufacturing levers and competitive priorities. We get consent from 4 companies from western region of India for participation in detailed study. We have selected two companies (B and C) as they are geographically located in close proximity (suburbs of Mumbai i.e. Thane), and third company (A) located at Silvasa in Gujrat state. Table 9 shows overview of the companies under study. We study companies on following points:

- challenges and opportunities for company
- relative positioning of the companies in manufacturing strategy implementation
- emphasis on manufacturing levers

- competitive priorities and order winners of the company.

5.1 Company A

5.1.1 Challenges and opportunities for company

Company A is manufacturer of printed flexible laminates and operates in multi-plant environment with 120 employees. The annual sales of company is ₹40 crore. The company is focusing on improving product development, customer satisfaction, and capabilities for providing innovative solutions for continuously changing market needs. However, company has developed its core competence in the manufacture

of superior quality and customized flexible packaging solutions. The Company is empowered with sophisticated technology and is offering excellent services.

5.1.2 Relative positioning of the companies in manufacturing strategy implementation

Based on challenges and opportunities, company formulates the plan for competitive advantage. Table 4 shows mean score of emphasis placed on various aspects of MSI. Company C is placing more emphasis on the following aspects:

- Decisions about materials, systems and services sourced from outside our company are screened for consistency with our manufacturing strategy.

Table 5: Emphasis on key decisions in manufacturing levers

Manufacturing Levers	Measures	Mean	Std. Deviation	Company A	Company B	Company C
Human Resource (HR) (Eigen value=2.40, Cronbach's alpha=0.61, KMO=0.75)	Job enlargement or enrichment(increase variety of tasks to be carried out by employees)	2.9	0.99	2.0	3.0	4.0
	Technical skill among employee	3.0	1.05	2.0	4.0	4.0
	Organizational skill development among employee	3.1	0.88	3.0	4.0	4.0
	Plant employees are encouraged to work as a team	3.0	1.15	3.0	2.0	5.0
	<i>Lever mean</i>	3.0	1.01	2.5	3.25	4.25
Organizational Structure and Controls (OSC) (Eigen value=5.2, Cronbach's alpha=0.93, KMO=0.68)	OSC allows people to operate as integrated unit in production system	3.1	1.29	2.0	3.0	5.0
	There are robust processes for sharing learning between group of employees	3.0	0.82	2.0	3.0	4.0
	Employees are authorized to make changes in production system where it is most appropriate	3.1	0.88	2.0	2.0	4.0
	Incentives for quality improvement ideas	3.0	0.82	2.0	3.0	4.0
	Efforts are made to improve work design	3.4	1.07	1.0	4.0	3.0
	<i>Lever mean</i>	3.12	0.97	1.8	3.0	4.0
Production Planning and Control (PPC) (Eigen value=6.4, Cronbach's alpha=0.94, KMO=0.68)	Preventive maintenance	3.0	1.25	2.0	2.0	5.0
	Development of new processes for products	2.9	1.29	1.0	3.0	4.0
	Improvement in production and inventory control system	3.2	1.03	2.0	4.0	4.0
	Reduction in machine setup time	2.9	0.74	3.0	3.0	4.0
	Reduction in manufacturing lead time	3.0	0.94	3.0	2.0	4.0
	<i>Just in time</i> purchase management	2.7	1.16	1.0	3.0	5.0
	<i>Lever mean</i>	2.95	1.06	2.0	2.83	4.33
Sourcing (SR)	We rely on small number of high quality suppliers	3.1	1.10	2.0	2.0	4.0

<i>(Eigen value=4.5, Cronbach's alpha=0.86, KMO=0.63)</i>	Customers involvement in product development	3.2	1.03	2.0	3.0	5.0
	Subcontracting parts of current manufacturing processes	3.1	1.10	2.0	2.0	4.0
	Early supplier involvement in product design	2.4	1.26	1.0	2.0	3.0
	Long-term contracts with suppliers	3.2	1.14	1.0	3.0	4.0
	<i>Lever mean</i>	3.0	1.12	1.6	2.4	4.0

Table 6: Emphasis on key decisions in manufacturing levers

<i>Manufacturing Levers</i>	<i>Measures</i>	<i>Mean</i>	<i>Std. Deviation</i>	<i>Company A</i>	<i>Company B</i>	<i>Company C</i>
Process Technology(PT) <i>(Eigen value=4.5, Cronbach's alpha=0.86, KMO=0.69)</i>	Computer-aided design (CAD) is used	3.6	1.07	2.0	4.0	5.0
	Computer-aided manufacturing (CAM) is used	3.3	0.95	3.0	3.0	4.0
	We use design-for-manufacture/assembly (DFMA) methods	3.2	0.79	2.0	3.0	4.0
	Group technology	3.1	0.57	3.0	3.0	3.0
	Flexible manufacturing system(FMS)	3.1	0.74	3.0	4.0	4.0
	Product designers make use of environment protection guidelines	3.1	0.88	2.0	4.0	4.0
	Product designers make use of manufacturability guidelines	2.9	1.29	1.0	3.0	4.0
	<i>Lever mean</i>	3.18	0.89	2.28	3.42	4.0
Facilities(FC) <i>(Eigen value=5.1, Cronbach's alpha=0.92, KMO=0.66)</i>	Factory location and relocation	3.0	1.05	2.0	2.0	5.0
	Expanding factory capacity	3.4	0.7	3.0	3.0	3.0
	Reconfiguration of factory layout	2.9	1.29	2.0	3.0	4.0
	Factory reconditioning	2.7	1.25	1.0	2.0	3.0
	Factory reorganization	2.9	0.99	2.0	2.0	4.0
	Investment in plant	3.1	0.99	2.0	3.0	5.0
	Investment in equipment	3.1	0.74	2.0	2.0	4.0
	Investment in R&D	3.0	0.67	2.0	3.0	3.0
<i>Lever mean</i>	3.01	0.96	2.0	2.5	3.8	

- The marketing and finance areas know a great deal about manufacturing,
- Our plant has formal strategic planning process, which result in a written mission, long range goals and strategies for implementation,
- We have manufacturing strategy that is actively pursued,
- In our plant, goals, objectives and strategies are communicated to me.

5.1.3 Emphasis on manufacturing levers

The emphasis on manufacturing levers is based on competitive priorities required by the company. Table 5 and Table 6 show main score for various manufacturing levers for the company. The main score for emphasis on manufacturing

lever is found more on process technology (2.28), followed by human resource (2.5), Production planning and control (2.0), facilities (2.0), organizational structure and controls (1.8), and sourcing (1.6). However more emphasis is placed on following aspects:

Table 7: Competitive priorities among IPPMC

Manufacturing outputs	Mean	Std. Deviation	Company A	Company B	Company C
<i>Cost</i>					
Increased capacity utilization	3.4	1.07	3.0	2.0	4.0
Reduce production costs	3.3	0.95	2.0	3.0	5.0
Increase labor productivity	2.8	1.03	2.0	3.0	4.0
<i>Overall mean</i>	3.16	1.01	2.33	2.66	4.33
<i>Quality</i>					
Conformance to design specification	3.4	0.82	2.0	3.0	4.0
Provide overall quality performance	3.2	0.79	3.0	2.0	3.0
Product reliability	3.2	0.92	2.0	3.0	4.0
Product durability	3.4	1.07	2.0	3.0	4.0
<i>Overall mean</i>	3.3	0.90	2.25	2.75	3.75
<i>Delivery</i>					
Delivery dependability (delivered on the agreed upon date)	3.2	0.63	3.0	3.0	4.0
Delivery speed	3.6	0.84	2.0	4.0	4.0
Promptly handle customer complaints	3.5	0.71	3.0	3.0	4.0
<i>Overall mean</i>	3.43	0.72	2.66	3.33	4.0
<i>Performance</i>					
Ability of features to do things	3.7	0.95	3.0	3.0	5.0
Ability to modify features	3.4	0.70	2.0	3.0	4.0
Extent of unique features in our product	3.0	0.82	3.0	3.0	3.0
<i>Overall mean</i>	3.36	0.82	2.66	3.0	4.0
<i>Flexibility</i>					
Ability to customize products	3.2	0.92	3.0	3.0	4.0
Ability to produce range of products	3.6	0.70	3.0	4.0	4.0
Manufacture broad product mix within same facilities	3.2	0.79	3.0	2.0	4.0
Rapidly handle custom orders or engineer-to-order	3.5	0.71	2.0	3.0	4.0
<i>Overall mean</i>	3.37	0.78	2.75	3.0	4.0
<i>Innovation</i>					
Decrease in Lead time to introduce new products	3.6	0.84	3.0	4.0	5.0
New products introduced each year	3.2	1.03	2.0	3.0	4.0
<i>Overall mean</i>	3.4	0.93	2.5	3.5	4.5

- Expanding factory capacity
- Flexible manufacturing system
- Group technology
- Computer aided manufacturing (CAM)
- Reduction in lead time

5.1.4 Competitive priorities

The competitive priorities for company A is shown in Table 7. The order of mean score of competitive priorities for company A are:

- Flexibility
- Delivery
- Performance
- Innovation
- Cost

- Quality.

5.1.5 Order Winners

Table 8 shows the order winners for company

- A. The order winners for company A are:
- Ability to produce range of products
 - Promptly handle customer complaints
 - Decrease in Lead time to introduce new products
 - Ability of product features to do things
 - Ability to modify features
 - Conformance to design specification
 - Delivery speed
 - Reduction in production cost
 - Product durability.

Table 8: Order winning criteria

Criteria	Mean (rank)	Std. deviation	Company A	Company B	Company C
Ability of product features to do things	3.7(1)	0.95	3.0(4)	3.0(7)	5.0(2)
Ability to produce range of products	3.6(2)	0.70	3.0(1)	4.0(1)	4.0(3)
Delivery speed	3.6(3)	0.84	2.0(7)	4.0(2)	4.0(7)
Decrease in Lead time to introduce new products	3.6(4)	0.84	3.0(3)	4.0(3)	5.0(1)
Promptly handle customer complaints	3.5(5)	0.71	3.0(2)	3.0(5)	4.0(5)
Ability to modify features	3.4(6)	0.70	2.0(5)	3.0(4)	4.0(4)
Conformance to design specification	3.4(7)	0.82	2.0(6)	3.0(6)	4.0(6)
Product durability	3.4(8)	1.07	2.0(9)	3.0(9)	4.0(9)
Reduction in production cost	3.3(9)	0.95	2.0(8)	3.0(8)	5.0(8)

Table 9: Overview of companies

Attribute	Company A	Company B	Company C
Product	Coextruded Laminated tubes	Multi-layer flexible films	Printed flexible laminates
Sales turnover (Crore)	400	150	40
Number of employees	750	250	120

5.2 Company B

5.2.1 Challenges and opportunities

Company B is a leading manufacturer of multi-layer flexible films located in western region

of India. The company operates in multi-plant environment with 250 employees. The annual sale of company is `150 crore. The company is working on to improve cost competitiveness and flexibility of production system. The company has technical collaboration with leading Finland

packaging manufacturer.

5.2.2 Relative positioning of the companies in manufacturing strategy implementation

Table 4 shows means for various strategic aspects. It is observed that means for company B is higher for following aspects.

- We have manufacturing strategy that is actively pursued,
- Decisions about materials, systems and services sourced from outside our company are screened for consistency with our manufacturing strategy,
- In our plant, goals, objectives and strategies are communicated to me,
- Our plant has formal strategic planning process, which result in a written mission, long range goals and strategies for implementation,
- Manufacturing strategy is well aligned with business strategy.

5.2.3 Emphasis on manufacturing levers

Table 5 and Table 6 shows mean score for various manufacturing levers for the company. The mean score for emphasis on manufacturing lever is found more on process technology (3.42), human resource (3.25), organizational structure and control (3.0), production planning and control (2.83), facilities (2.5), sourcing 2.4). However, more emphasis is laid on following aspects:

- Technical skills among employees
- Technical skill among employee
- Efforts are made to improve work design
- Improvement in production and inventory control system

5.2.4 Competitive priorities

The competitive priorities for company B is shown in Table 7. The order of mean score of competitive priorities for company B are:

- Innovation,
- Delivery,
- Flexibility,
- Performance,
- Quality, and
- Cost.

5.2.5 Order winners

Table 8 shows the order winners for company B. The order winners for company B are:

- Ability to produce range of products,
- Delivery speed,
- Decrease in Lead time to introduce new products,
- Ability to modify features,
- Promptly handle customer complaints,
- Conformance to design specification,
- Ability of product features to do things,
- Reduction in production cost
- Product durability.

5.3 Company C

5.3.1 Challenges and opportunities for company

Company C is a leading laminated tube manufacturer located in western region of India. The company operates in multi-plant environment with 750 employees. The annual sale of the company is `400 core. The company is working on to improve on cost competitiveness and relationship with customers. The company is the largest producer of laminated tube globally and aggressively expanding packaging solutions to the value added pharmaceutical and cosmetics applications where technology and product innovation are key differentiators.

5.3.2 Relative positioning of the companies in manufacturing strategy implementation

Table 4 shows means for various strategic aspects. It is observed that means for company C is higher for following aspects.

- The functions in our plants are well integrated,
- Plant management routinely reviews and updates long range plans,
- Potential manufacturing investments are screened for consistency with our business strategy,
- Business strategy at our firm drives manufacturing decisions,
- Decisions about materials, systems and services sourced from outside our company

- are screened for consistency with our manufacturing strategy,
- Our plant has formal strategic planning process, which result in a written mission, long range goals and strategies for implementation,
- Manufacturing strategy is well aligned with business strategy.

5.3.3 Emphasis on manufacturing levers

Table 5 and Table 6 shows mean score for various manufacturing levers for the company. The mean score for emphasis on manufacturing lever is found more on Human resource (4.25), followed by Organization and control (4.0), Production planning and control (4.33), sourcing (4.0), Process technology (4.0), facilities (3.8) on five point Likert scale. However, more emphasis is laid on following aspects:

- Plant employees are encouraged to work as a team,
- Preventive maintenance,
- *Just in time* purchase management,
 - OSC allows people to operate as integrated unit in production system[20].

5.3.4 Competitive priorities

The competitive priorities for company C is shown in Table 7. The order of mean score of competitive priorities for company C are:

- Innovation,
- Cost,
- Delivery,
- Flexibility,
- Performance,
- Quality.

5.3.5 Order winners

Table 8 shows the order winners for company C. The order winners for company C are:

- Decrease in Lead time to introduce new products,
- Ability of product features to do things,
- Ability to produce range of products,
- Ability to modify features,
- Promptly handle customer complaints,
- Conformance to design specification,

- Delivery speed,
- Reduction in production cost,
- Product durability.

6. CONCLUSION

The difference in emphasis on manufacturing strategy implementation is vivid from the response from IPPMC. This clearly explains the changes in the manufacturing priorities over the last three years. Manufacturing is still in the evolving stage and more emphasis is required to compete on various competitive priorities for packaging product manufacturers. Based on survey and response on five point Likert scale, the IPPMC seems to be in stage II or transition from stage to stage III of Hayes and Wheelwright's model. Company A seems to be in stage II, company B in stage III and company C is making manufacturing function more proactive. It seems company C is moving towards stage IV of Hayes and Wheelwright's model.

The most important competitive priority for IPPMC is ability of features to do things. This is possible by properly incorporating manufacturability guidelines for designing the product. Still, it is found that few companies are not emphasizing it. Second priority is to produce range of products. Companies are investing more in process technology to enhance the capability of production system to produce range of products. To decrease in lead time to introduce new products, companies are emphasizing improvement in relations with suppliers and enhancing the technical and organizational skills of human resource. Delivery speed is increased by improving inventory and control system, developing new processes for products and accommodating computer aided manufacturing in production system. However mean score of quality and cost is least, as companies are compete on other parameters. It is surprising and contrary to previous results (Noble MS, 1995; Vickery S et al., 1993) where quality forms solid foundation at bottom of sand cone. This is because IPPMC is suppliers to large size consumer and pharmaceutical industry[21, 31]. The quality and cost became the price for product selection and companies yield to bargaining the power of buyers (Porter, 1980). Innovation is the top most priority

for case companies. Aesthetic and creative package attracts customers. Packaging product manufacturer has to design and manufacture products as per demand of the customers. This study tried to assess manufacturing strategy aspects in IPPMC. We have adopted mono-respondent approach in administration of questionnaire. This approach brings in bias with

the same issue. Multi-respondent approaches incur high cost, but reduce the bias in response. This limitation could be considered in the future research. More sample size and more respondents at various levels in the company could be considered for future study to get more insight into manufacturing levers and priorities.

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