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# Competitiveness of Indian Manufacturing

## Findings of the 1997 Manufacturing Futures Survey Pankaj Chandra and Trilochan Sastry

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This paper by Pankaj Chandra and Trilochan Sastry reports the findings of a survey to study the competitiveness of Indian manufacturing sector. The paper identifies the priorities of Indian manufacturing firms, the programmes that they undertake to reach their objectives, and the outcome or the performance of these firms. The authors also present some international comparisons based on a similar study done in the US. The paper highlights the role of innovation and supply chain management as a part of any robust manufacturing strategy in developing world-class operations.

*Pankaj Chandra and Trilochan Sastry are members of the faculty in the Production and Quantitative Methods Area of the Indian Institute of Management, Ahmedabad.*

The authors are grateful to the firms that have participated in this survey. Without their support, this study would not have been possible. They are also thankful to Prakash Vaidya for able research support. This project was funded by a grant from Research and Publications, Indian Institute of Management, Ahmedabad.

### Introduction

How competitive are Indian manufacturing firms? What are some of the key manufacturing issues that leaders of Indian manufacturing are concerned about? What kinds of initiatives are being taken by these firms in order to improve their competitiveness? How do these leaders perceive their own strengths and weaknesses? What will make Indian manufacturing world-class? These were some of the many questions we have been seeking to answer through the 1997 Manufacturing Futures Survey. While changes have been numerous at the firm level, we wanted to examine to what extent they have achieved their objectives and met the emerging competitive needs. Another key question we address is whether our industry is gearing up to realize its full potential or whether firms are satisfied with limited success. The survey measures broad trends in the Indian manufacturing sector and assesses its competitiveness through a variety of self-answered questions in a sample survey. Appendix 1 describes the methodology. The larger purpose of this study is to disseminate good practices across the industry and to help firms benchmark their performance. A closely related issue is our standing vis-a-vis the best in the world. In this report, we also present some of the key practices and characteristics of world-class plants.

The cost structure of Indian plants shows that materials constitute 66 per cent of total costs, direct labour 10 per cent, and overheads 24 per cent. This implies that initiatives to control manufacturing costs may need to focus on reduction in material costs and overheads. However, traditionally, the focus has been on managing labour costs. Efforts to control material related costs may need to address several issues including rejects and rework on the shop floor, identifying alternative materials, and better materials management and sourcing. An underlying implication is that all sources of uncertainty related to materials need to be eliminated or reduced. Otherwise costs of inventories would go up. Interestingly, the break-up of the manufacturing cost for the US was 55 per cent, 31 per cent, and 14 per cent for the three factors respectively. The emphasis on labour cost is therefore

hard to explain.

In the following sections, we describe the findings of a nation-wide survey of top executives in manufacturing organizations. In the next section, we describe the new competitive challenges that Indian firms face followed by the manufacturing strategies that these leaders have devised for their firms in order to face competition. We then examine how effective these strategies have been in the past, compare these strategies with those of US firms, look at the future in terms of efforts needed to improve manufacturing, and effectively manage the entire supply chain, and finally, present conclusions of the study.

### New Competitive Challenges

Today, Indian firms are facing a very different competitive scenario as compared to the past. They are facing competition from imports and from MNCs in the domestic markets. Several firms also have to compete as new entrants in global markets. Earlier, firms would segregate these two markets and serve them with different quality products and services, while perhaps compromising on quality in the home market. This is no longer possible. Therefore, many strategies that may have worked in the past are not likely to succeed in the future.

The new competition is in terms of reduced cost, improved quality, products with higher performance, a wider range of products, and better service — all delivered simultaneously. A lot has already been written in the business press about many of these issues. However, Indian firms have quite often followed an opportunistic approach to growth as opposed to a capability driven approach that seeks to strengthen key aspects of manufacturing. Consequently, firms have paid very little attention to their shop floors in the last few decades. There have no doubt been notable exceptions to this and some firms have systematically built up their capability in the recent past. Firms have also started paying attention to quality, but it is not clear whether enough is being done about faster throughput and delivery, introduction of a wider range of products, and better service. It would not be incorrect to say that we are still struggling to get the "quality" right and that firms will perhaps focus on other issues at a later date.

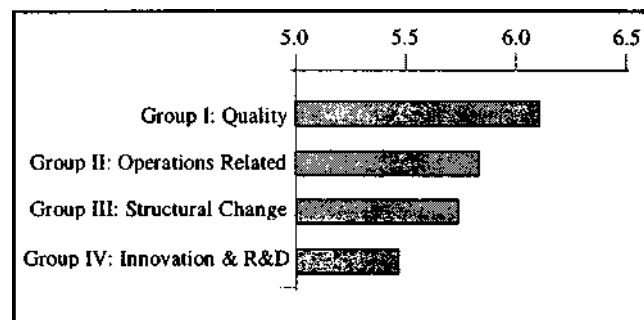
The Indian market place has been witnessing a quiet revolution where old products are being substituted by better ones. In fact, for the first time, products and services are being introduced to meet certain customer needs that were only partially met in the past. One implication of this rapid introduction

of new products is the pressure on manufacturing facilities to profitably produce a larger variety in smaller volumes. Firms have to search for new processes, new materials, new vendors, new shop floor layouts, new ways of reducing cycle times, new designs, new channels, etc. to deliver these products and services. In addition, manufacturing firms are being increasingly required to integrate services with products to meet customer needs. The real challenge is, therefore, to improve substantially on several dimensions, including quality, technology, shop floor practices, supply chain coordination, and new product introduction over a short period of time.

### Manufacturing Strategies

The 1997 survey shows that to improve their competitive position, Indian firms will give the highest priority to quality improvement in the next five years. Figure 1 shows the relative importance given to four sets of issues by Indian firms on a 7 point scale, with higher scores indicating higher priority. These are Quality, Operations, Structural Changes, and Innovation and R&D. For purposes of this research, Quality comprises conformance quality or adherence to specifications, performance quality of products, product reliability, and product durability. Operations related practices were those that improved the distribution network and performance, on-time delivery, ability to handle production volume changes, product support, and after-sales service. These practices can usually be changed or improved without fundamental changes in the manufacturing system. For instance, production volumes can often be increased by the use of overtime or by operating an additional shift. On the other hand, Structural Changes, which include fast delivery capabilities, low prices, and ability to change product mix, often require major changes in manufacturing. For instance, to substantially improve delivery performance of a wide variety of products, firms would need to cut down on production throughput times, reduce set up times, improve scheduling, and in some

**Figure 1: Competitive Priorities of Firms: Group Averages**



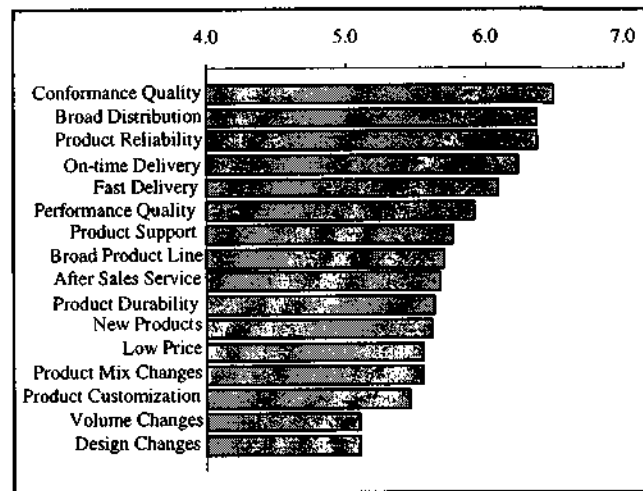
cases, change the manufacturing system or bring in new equipment. These changes require much greater effort and often take time to implement. Innovation and R&D included new product introduction, broadening the product line, making design changes, and customizing the product. Quality is the number one competitive priority, followed by Operations, Structural Changes, and, finally, Innovation and R&D.

However, there is a close link between Quality and Structural Change, and between Quality and Innovation and R&D. For instance, quality often cannot be improved without major changes in production processes. In discrete part manufacturing, use of some key ideas from the Toyota Production System, which in turn requires changes in layouts, process improvements and so on, has helped several firms across the world to improve quality. An exclusive focus on quality tools like SQC and SPC, or on programs like TQM and TPM without some basic changes may not achieve the desired purpose. However, this is currently not a priority, and it is not clear whether this link between quality and other required changes is well understood. Similarly, quality is largely a function of design. Without attention to product design, it is unlikely that improvement can be sustained. The recent interest in Business Process Re-engineering (BPR) within the manufacturing function is more encouraging since it focuses on making some required fundamental changes.

Figure 2 gives a relative ranking of various manufacturing priorities of Indian firms. At the top of the list is the ability to provide consistent quality with low defects. It is being widely recognized that by reducing defects, firms can improve not only on price but also on delivery and flexibility parameters significantly as lead times reduce drastically. World-class firms are now targeting six-sigma quality levels and are measuring defect in parts per million (or ppm). Figure 2 shows that firms are planning to pay attention to several aspects of manufacturing and this is encouraging. Interestingly, firms also perceive quality (as shown in Figure 3) as their key strength with respect to their primary Indian competitor. The figure shows how firms have rated themselves with respect to domestic competition on a 7 point scale where a score of 4 indicates that they are as good as the competition, and higher scores indicate that they are better. These firms rate their ability to introduce new products and offer flexibility (in terms of managing volume changes, design changes or product mix changes) as being relatively low.

The competitive gap, or the difference between

Figure 2: Competitive Priorities of Firms (Degree of Importance over Next Five Years)



stated importance and strength, gives an idea of areas that require maximum attention in order to make manufacturing more "market driven." The largest gap is for broad distribution, followed by fast and on-time delivery, developing new products, offering consistent quality with no defects, and reducing costs (Figure 4).

It seems that the manufacturing strategy of most firms is focused on improving product and process quality, after sales service, and on delivering products on-time. However, as mentioned earlier, improvements often require more fundamental changes in the way manufacturing is organized. Firms, on the other hand, are currently giving low priority to these fundamental changes which require changing processes, developing the ability to change product mix rapidly or investing in R&D to develop new processes and products.

Figure 3 : Perceived Competitive Strengths of Firms (Degree of Strength Relative to Indian Competitors)

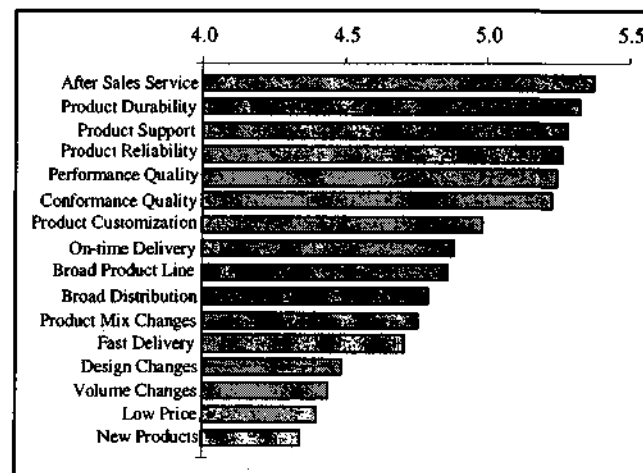
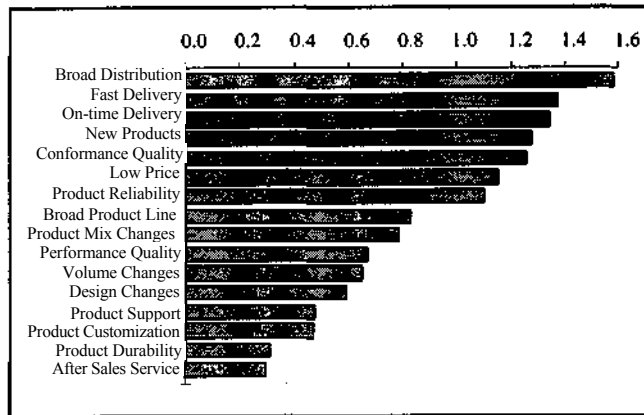


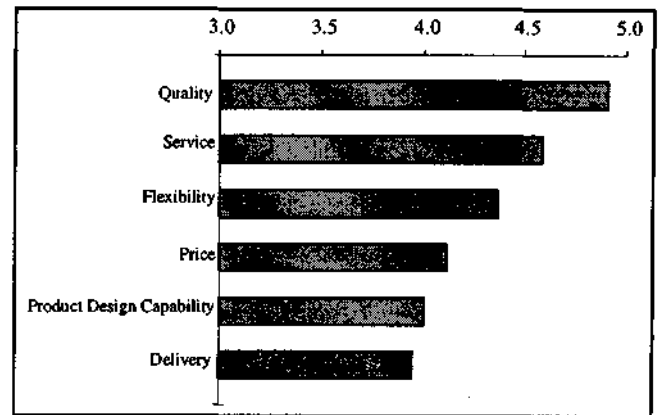
Figure 4 : Competitive Gap (Difference between Future Priorities and Current Strengths)



On the other hand, in the US, Innovation and R&D has the highest priority followed by Structural Changes. We discuss this issue in greater detail in the section on International Comparisons. Interestingly, most Indian firms believe that they are at least as good as or better than their foreign competitors on price, flexibility, quality, service, and product design capabilities. This is seen in Figure 5 which has a 5 point scale, and where any score above 3 shows that the firm considers itself to be superior to foreign competitors. It is obvious that the average Indian firm's perception of its abilities differs considerably from its status in the global market place. This perception could be because many firms are not directly competing with MNCs in the same product market segments, or due to an inherent bias when firms are asked to rate themselves.

Manufacturing companies have recently invested in a variety of improvement programmes or activities in order to enhance their competitiveness. Table 1 gives the changes in emphasis on various manufacturing related programmes. It lists the top ten programmes that Indian managers have implemented in the last two years and compares them with the top ten initiatives that they will focus on in the next two years. It is evident that firms are investing in training their employees (note: worker training was accorded the eleventh position in terms of future emphasis) and on making their workers cross functional. In addition, firms believe that their investment in information technology (IT) in manufacturing will increase in the future. What is not clear is how they plan to use this information for better decision-making. While managers have rated functional teamwork quite high in their list of priorities, they have given low priority to "reconfiguration of plant layouts" — a step necessary

Figure 5: Comparison with Foreign Firms on Various Factors



for implementing functional teamwork. Perhaps, many firms have already made some of these changes. Automation in the form of robots, CIM, CAM, FMS, automated inspection, etc., have been rated in the bottom ten in terms of future importance.

The absence of some practices that have become synonymous with world-class manufacturing from the top ten list in Table 1 is noticeable. Just-in-Time (JIT) manufacturing has still not found acceptance in Indian firms. This could be because of several hurdles encountered while trying to implement such programme, or in some cases, due to poor understanding of JIT or pull production systems in the industry which has led to "unfavourable" myths developing around it. Other practices that have not been given adequate importance include forging customer and supplier partnerships, strategic outsourcing, use of statistical process control (SPC) effectively and continuously, value engineering and product re-design, use of CAD/CAE systems, etc. Moreover, inadequate attention

Table 1: Changes in Emphasis: Top Ten Manufacturing Initiatives of the Past and the Future

<i>Initiatives in the Past</i>	<i>Initiatives in the Future</i>
1. Work Enlargement	1. Continuous Improvement
2. Management Training	2. Management Training
3. Continuous Improvement	3. Manufacturing Strategy
4. Worker Training	4. Information System within Business Unit
5. Supervisor Training	5. Total Quality Management
6. ISO 9000	6. Supervisor Training
7. Manufacturing Strategy	7. Information System within Manufacturing
8. Quality of Work Life	8. ISO 9000
9. Functional Teamwork	9. Cross Functional Teams
10. Cross Functional Teams	10. Functional Teamwork

from top managers has sometimes not allowed firms to develop manufacturing into a competitive strength. Manufacturing related interventions are sometimes done piece meal, in line with the fads of the time. A well defined strategy with a clear understanding of the sequence of manufacturing programmes that must be implemented is missing.

It must be mentioned that Indian industry has "islands of excellence," i.e., firms that have recognized the need to change and have a well thought out plan of action to become competitive. Such firms have started implementing practices that are employed by world-class plants. However, many firms do not seem to have a coherent plan about what needs to be done. For instance, in discrete part manufacturing, one possible route could be to first implement housekeeping and preventive maintenance programme, followed by conversion of manufacturing to flow shops, introduction of quality systems, set up reduction, and ISO certification, with the eventual goal of getting close to JIT manufacturing systems.

House-keeping involves maintaining a proper discipline in demarcating parts, tools and equipment locations, cleanliness, etc. (including 5S Tools); preventive maintenance of equipments (including TPM) follows a regular schedule for machine and tool checkups instead of doing maintenance during breakdowns; flow manufacturing involves process flow analysis and cellular production layouts to smoothen flows of material on the shop floor and reduce Work-in-Process (WIP); quality systems include SPC and process capability analyses; setup reduction further enhances process effectiveness by trying to reduce changeover times and thereby increasing the flexibility of firms; and ISO certification helps the firm strengthen its internal systems. Finally, JIT manufacturing facilitates pull based production control, reduces investments in inventory, drastically cuts throughput and delivery times, improves quality on a sustained basis, and makes new product introduction much easier. Similarly, a well thought out plan is required for continuous production or process industries. Establishing a programme that implements these practices in a defined sequence allows the development of process discipline that is necessary to become a competitive manufacturer. Moreover, improvements of the nature mentioned above require little capital investment except those in training, instrumentation and calibration, and some changes in tooling and layouts.

### **Manufacturing Performance**

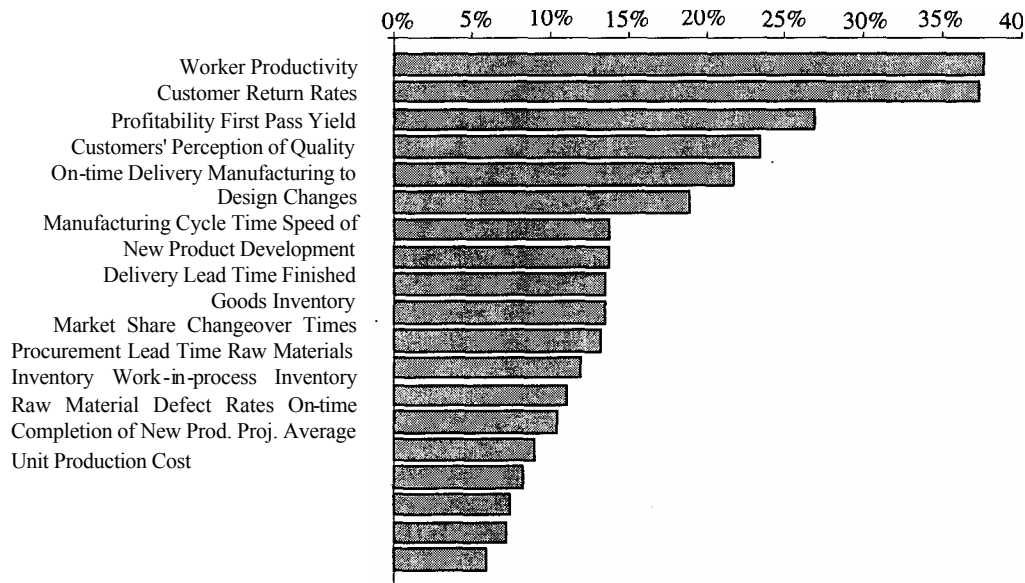
The first question that needs to be asked is, given the

above mentioned manufacturing strategy of Indian firms, how well have they performed? It would also be useful to identify areas where intervention has been most beneficial and where it has not been successful. The 1997 survey shows that, over the last two years, there has been a marked improvement in the performance of firms on a variety of factors. Improvements in quality, especially within the plant, have been significant. In fact, 77 per cent of firms that were surveyed reported an increase in profitability while 87 per cent of firms claimed to have increased their market share. While these improvements should be viewed in terms of the low base value in many cases, the fact remains that the Indian industry has been changing rapidly for the better.

Figure 6 shows the extent of improvement in Indian manufacturing firms over the last two years. The maximum improvement has occurred in the productivity of direct production workers (about 38%). There could be a variety of reasons for the same:

improved as well as increased emphasis on training of workers, incorporation of faster machines that also require fewer workers, etc. This has been followed by reduction in customer returns, improvements in first-pass yields and in the overall perception of quality by customers. Other dimensions that are worth mentioning in terms of improvements are on-time delivery, speed of response on the shop floor to design changes, and reduction in manufacturing cycle times. It is apparent that shop floor improvement programmes, in many firms, are proving to be beneficial. However, there are three disturbing trends. First, though the mean improvement scores for factors like productivity of direct labour, customer return rates, and profitability were the highest, the variance was also very high. Thus, many firms have done well on these factors, but several others have not. In fact, 9 per cent of firms have reported a decline in productivity of production workers, 13 per cent have seen an increase in return rates, and 23 per cent of firms have witnessed a loss in profitability in the last two years. Second, there has not been adequate improvement on inventory levels, i.e., raw material, WIP, and finished goods. In this case, 27 per cent, 26 per cent and 27 per cent of sample firms have reported an increase in raw material, WIP, and finished goods inventory respectively, over the last two years. This increase is not entirely explained by a corresponding increase in turnover. Third, the pre-occupation with labour productivity is evident although, on an average, labour is only 10 per cent of total cost. This is reflected in the fact that improvements in costs are relatively low compared to other improvements. More attention

**Figure 6: Per cent Improvement on Various Manufacturing Performance Indicators over the Last Two Years**



to materials and overheads which comprise 90 per cent of costs is perhaps needed.

Therefore, we may have gained in some areas, but may be losing on others. Many of our firms have not yet been able to tightly control inventories across the supply chain. They still appear to be using inventories to meet demand rather than developing quick response manufacturing to meet changes in market needs. The relationship between batch sizes, WIP, and lead times is very close. Increase in batch sizes leads to higher WIP and longer lead times. The key is to perform process analysis, de-bottleneck, reduce setup times and synchronize order release with throughput rates. In short, manufacturing has to become process oriented.

A summary of manufacturing performance of the sample firms is given in Table 2. It provides a comparison on various indicators across industry types (e.g., automotive, consumer goods, electronics, engineering and machinery, textiles and process industry). We also present averages on these indicators for the entire sample as a whole. Some of this data can be benchmarked against overall industry averages from a similar survey done in the US in 1994<sup>1</sup>. Performance appears to be varying across industry types. Interestingly, for the period under study, Indian firms on the whole had a higher growth rate in sales (in unit as well as rupee terms) as compared to firms in the US though the pre-tax profit ratio was lower for the Indian firms. This lower realization of profits

might indicate hidden costs due to low first pass yields, low inventory turns, high outstanding accounts, long lead times, etc. in Indian firms.

As can be expected, capacity utilization in the process industry is higher than that in discrete part manufacturing. The consumer goods, electronics, and engineering and machinery industries stand out in terms of low capacity utilization. The inventory turns in the process industry is quite low implying that working capital is tied up in this sector for longer periods of time. Often, process industries feel compelled to operate their plants continuously even when the demand is low thereby building up inventory. Inventory turns across the industry are low — an issue which has been discussed earlier as well. Firms sometimes tend to keep expensive resources like machines busy all the time in order to recover their fixed cost. This approach, stemming from an accounting view of manufacturing, often adds inventory, schedules production in large batches, and prevents firms from being market driven. Similarly, the first pass yield is relatively low in the automotive, consumer goods, and electronics industries.

Many firms in the textile sector seem to be doing well financially but modern manufacturing practices and their benefits are yet to take roots here. Average

<sup>1</sup>Source: Kim, J S and Frohlich, M T (1994). "Summary Results from the 1994 US Manufacturing Futures Survey," Boston University's Manufacturing Roundtable, Boston University, Mimeo.

**Table 2: Mean (Standard Deviation) Values of Manufacturing Business Unit Performance by Various Industry**

<i>Indicators</i>	<i>Automotive</i>	<i>Consumer Goods</i>	<i>Electronics</i>	<i>Engineering &amp; Machinery</i>	<i>Textile</i>	<i>Process</i>	<i>Overall (India) Mean</i>	<i>Overall (US) Mean*</i>
Annual Sales Revenues (Rs Crore)	292.7 (286.5)	248.0 (171.3)	160.9 (237.8)	162.8 (341.0)	601.1 (1197.3)	1096.6 (384.4)	393.4 (941.6)	4327.5
Net Pretax Profit Ratio (Profit/Sales)* 100	9.6 (5.0)	7.5 (4.6)	9.8 (6.7)	11.6 (7.8)	5.1 (6.8)	12.0 (9.5)	9.9 (7.2)	11.8
Growth Rate in Unit Sales (%)	13.7 (14.7)	13.5 (6.6)	17.9 (10.5)	8.0 (13.1)	12.2 (5.5)	9.4 (17.7)	11.9 (12.5)	7.7
Growth Rate in Rupee Sales (%)	26.5 (14.3)	20.4 (10.0)	15.9 (12.1)	25.7 (21.2)	24.4 (10.4)	15.9 (16.9)	21.5 (16.0)	6.4**
Market Share of Primary Product (%)	33.6 (30.8)	35.0 (19.0)	18.3 (14.1)	28.6 (17.9)	36.3 (41.2)	13.8 (10.5)	26.5 (20.6)	34.1
Capacity Utilization (%)	80.0 (11.0)	70.3 (11.6)	69.6 (38.4)	64.2 (37.6)	90.6 (1.59)	91.7 (21.7)	76.1 (27.5)	73.7
On-time Deliveries (%)	80.8 (14.6)	84.8 (8.2)	75.0 (24.0)	80.2 (11.1)	93.0 (4.5)	92.9 (7.3)	83.7 (13.7)	88.9
Average Manufacturing Lead Time (Days)	19.2 (9.0)	21.3 (40.3)	13.3 (10.5)	74.7 (51.3)	19.2 (23.4)	30.0 (38.8)	39.5 (45.4)	-
Annual Inventory Turns Per Year	8.0 (3.4)	6.6 (3.7)	5.3 (2.5)	6.4 (6.6)	8.12 (6.7)	6.4 (3.0)	6.6 (4.7)	11.2
First Pass Yield (%)	74.4 (41.3)	75.4 (29.4)	82.3 (16.9)	91.0 (7.5)	96.0 (5.4)	92.8 (12.7)	85.6 (21.2)	-
Sales from New Products (% of Annual Sales)	22.7 (29.0)	24.3 (20.4)	44.5 (34.7)	12.8 (13.6)	52.8 (29.4)	16.1 (13.4)	25.4 (25.3)	-
Cash-to-cash Cycle (Days)	50.3 (64.1)	41.3 (31.2)	61.0 (53.6)	116.5 (78.4)	76.6 (59.4)	72.0 (58.8)	75.0 (64.4)	-
Value of Existing Backorders (% of Annual Sales)	10.4 (13.6)	17.5 (17.5)	10.1 (9.9)	62.9 (45.1)	26.0 (42.5)	9.6 (11.8)	30.1 (37.7)	-
Value of Outstanding Accounts Receivable (% of Annual Sales)	9.8 (6.1)	13.1 (10.5)	21.8 (9.9)	21.6 (10.4)	14.2 (13.7)	15.7 (8.1)	17.2 (10.4)	-

the US industry are given for the year 1994. \*\* Reflects growth rate in dollar sales.

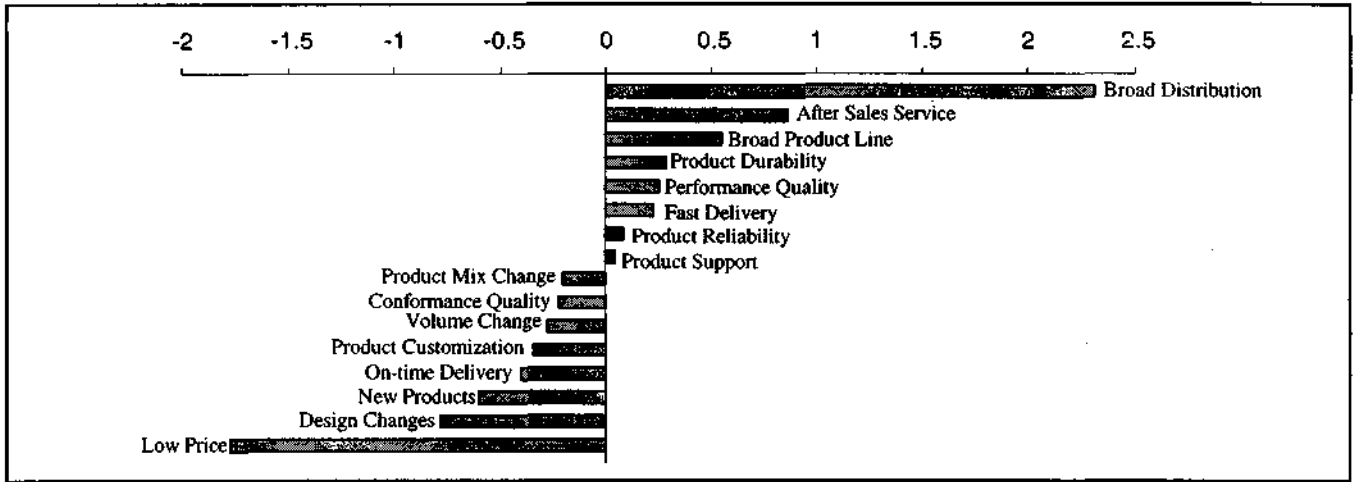
cash-to-cash cycle (i.e., total elapsed time from the date that a firm paid its suppliers for materials to the date it was paid by its customers for the products that were made from the same materials) ranges from over one month in the consumer goods industry to over two and half months in the textile and slightly less than four months in the engineering and machinery sector. A similar picture emerges if we look at the value of outstanding accounts. There is scope for improvement on these dimensions.

### International Comparisons

We now examine how we stand in comparison to the US industry for which a similar survey was done in 1994. As seen in Figure 7, the importance given to

different aspects of manufacturing is different in the two countries. The data shown there is the difference in the level of importance to Indian firms and the US firms on various attributes. Each attribute value (on a scale of 1 to 7) was first normalized for each country before computing the difference. The US is paying more attention to several Innovation and R&D type of issues like product customization, new products, design changes, and to issues which require manufacturing to be more flexible like product mix changes, production volume changes, and finally, low price. Indian industry on the other hand is paying attention to more basic issues like broad distribution, after sales service, product reliability, and durability. Indian industry is also interested in broadening its product

**Figure 7: Comparison of Manufacturing Priorities between India and the US**



line; however, to do that, it would need to invest in R&D, which is currently not a priority. To some extent, these differences reflect the current realities and requirements. In future, the Indian industry might need to change some of its priorities, especially if it wants to compete globally.

Figure 8 shows the ten programmes which are most important for US firms and least important for Indian firms. Here, there are really significant differences in issues like design for manufacturability (DFM), supplier partnerships which now include global partnerships, worker training, BPR, cross functional teams, and JIT. The numbers in the figure are the difference between the normalized values of different attributes for US firms and Indian firms.

There are significant differences in terms of payoffs from manufacturing programme carried out in the two countries. The top ten programmes where Indian industry reported greater payoffs than the US industry are shown in Figure 9. These include improving quality of work life, outsourcing, teamwork, benchmarking, new processes, and training. These programmes seem to be aimed at bringing manufacturing up to a basic minimum standard. In contrast, Figure 10 shows the programmes where the US industry reported greater payoffs. These include programme like JIT, SQC and SPC, CAD/CAE, design for manufacturability (DFM), and relocation or closing of plants. Although some of these options may not be practical in India at least at this point of time, programmes like JIT, SPC, and DFM have shown quite clearly that they substantially improve manufacturing costs, quality, and flexibility.

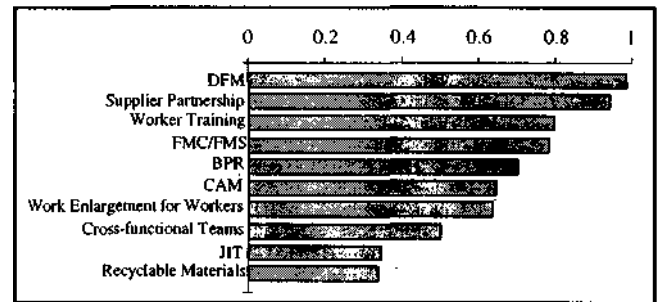
The differences in priorities and in the type of

programmes in the two countries reflect perhaps different stages in the evolution of a manufacturing firm. Indian firms seem to be addressing some basic issues like improving existing products and delivering them to the customer more effectively. US firms, on the other hand, have moved to the next level and have a different set of concerns.

**Towards the Future: Innovation**

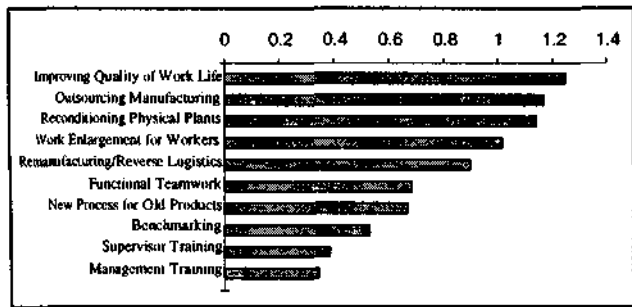
Innovation is widely seen as delivering long-term benefits to an organization. In this context, innovation includes any new or substantially improved products that have been commercialized or any new or substantially improved manufacturing processes that have been used for the commercialization of products. Figure 11 shows the nature and extent of benefits that sample firms have enjoyed from innovation in the past with 7 denoting very high benefits and 1 denoting little or no benefits. The firms have also reported the future importance of these benefits via innovation. The top three benefits of innovation in the past have been improvement in product quality, improvement in working conditions and safety, and ability to meet government regulations. Interestingly, product quality

**Figure 8: Programmes which are Most Important in the US and Least Important in India**





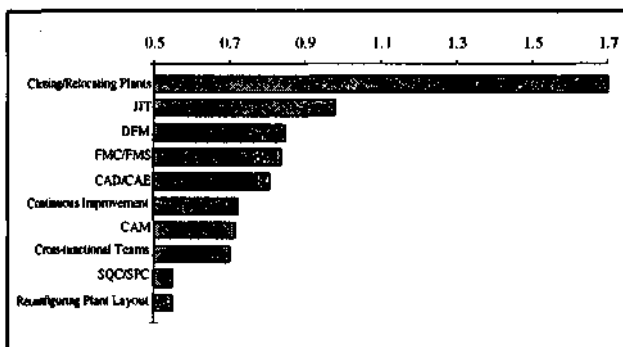
**Figure 9: Programmes where Indian Companies Got Better Payoffs than US Companies**



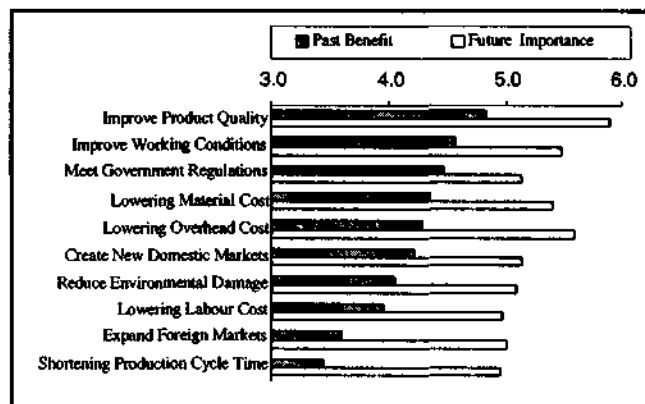
remains the top focus for innovation even in the future. However, the potential for maximum benefits of innovations are expected to come through product design changes, design for manufacturability, shortening of production cycle times, developing or expanding into foreign markets, and reduction in overhead costs.

While almost all the firms recognize the benefits of innovation, very few are investing adequate resources to make such programmes successful. On an average, the sample firms invested barely 0.84 per cent of their sales revenue on internal research and development, 0.15 per cent on acquiring externally developed technology, 1.15 per cent on training for the implementation of new technology, 2.57 per cent on toolings and other engineering changes to start-up new technology and 0.93 per cent on coordination for commercializing new technology. These amounts are woefully inadequate given the relatively low turnovers in the Indian industry. As Figure 12 shows, Indian firms do not plan to change these patterns of investment significantly to develop long-term capabilities. In this figure, a score of 4 indicates that firms plan to invest about the same amount in each of the innovation activities as they did in the past two years. The maximum score of 7 represents a plan to invest "much more" in the future.

**Figure 10: Programmes where US Companies Got Better Payoffs than Indian Companies**



**Figure 11: Potential Advantages from Innovation (Past Benefits and Future Importance)**



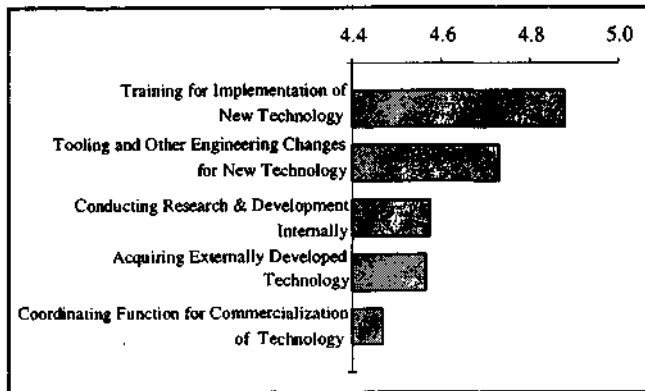
## Supply Chain Management

Supply chain management deals with the process of coordinating the flow of information and goods to customers across a network of suppliers, manufacturers, and distributors. Two factors often affect the bottom lines of firms significantly — uncertainty in demand or in availability of men, materials, and machines; and long lead times. This is often not well understood in the industry. It has been seen that by improving the flow of information across the supply chain and by reducing cycle times, firms are able to reduce the impact of uncertainty. As we have seen in an earlier section, Indian firms have started paying attention to reducing lead times. However, availability of information on current inventory levels, flow of materials, as well as demand forecasts to different functions within a firm remains poor. As a result, coordination across functions is based either on inaccurate data or personal contacts. This leads to high inventories and delays in most supply chains. There is an absence of a systems approach to planning across the chain.

Most firms in the sample rate the capabilities of their suppliers lower than those of their distributors. Figure 13 shows the difference between the current capabilities of the distributors of firms and those of their suppliers. The key concern that firms have relates to inventories. On a scale of 1 to 7, the firms on an average rate the ability of their suppliers to optimize inventory levels as 4.18 and those of its distributors as 4.98. Both these figures are not very good, and there is scope for improvement.

The supply chain of an Indian firm has an interesting structure. The mean (median) values for number of suppliers per firms, number of regional distributors, and number of approved retailers were around 436 (112), 210 (15), and 35,077 (200) respec-

Figure 12: Projected Investments (over Next Two Years) in Activities Involved in Innovation

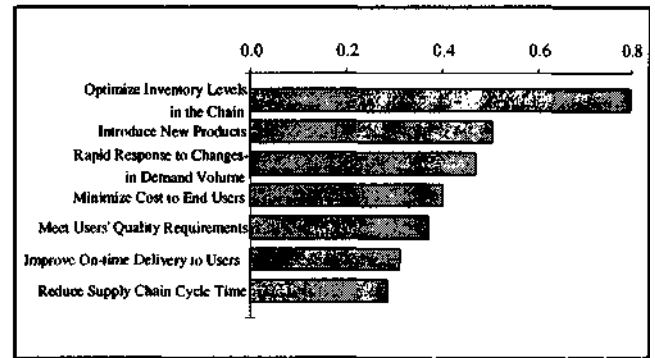


tively. By international standards, firms still have far too many suppliers. This adds to problems of coordination, delivery, quality, and cost. A smaller supplier base sometimes allows firms to work closely with suppliers and raise the level of the entire operations in terms of product quality, cost, and even product design. The data show that about 43 per cent of firms had less than 100 suppliers. Similarly, 46 per cent firms had less than 100 distributors and 23 per cent of firms had less than 100 approved retailers. As the chain progresses from the suppliers to customers, the number of entities increases. While development of capabilities in suppliers becomes crucial, effective coordination of flows and information is the key to successful channel management.

### Becoming World-class Manufacturers

The focus of this survey has been to understand how top managers are trying to develop a coherent strategy for improving the manufacturing competitiveness of their firms. We also try to identify factors that these top managers find important in order to enhance the performance of their operations in the future. It can be clearly stated that our firms are going through a "quiet" quality revolution — quality systems are being developed and put in place, measurements are being refined, and people are getting trained. The benefits are also obvious. However, the distribution of firms with significant quality programmes is highly skewed. A few firms have progressed by leaps and bounds where workers plot control charts and practice SPC, their managers are trained in TPM (often in Japan) and are implementing the same, process capability of their machines is strictly monitored (with world-class  $cp_k$  levels above 1.33), in-process defect rates are in the range of 200-700 ppm, and customer return rates are less than one per cent. On the other hand, a large

Figure 13: Difference between Current Capabilities of Distributors and Suppliers

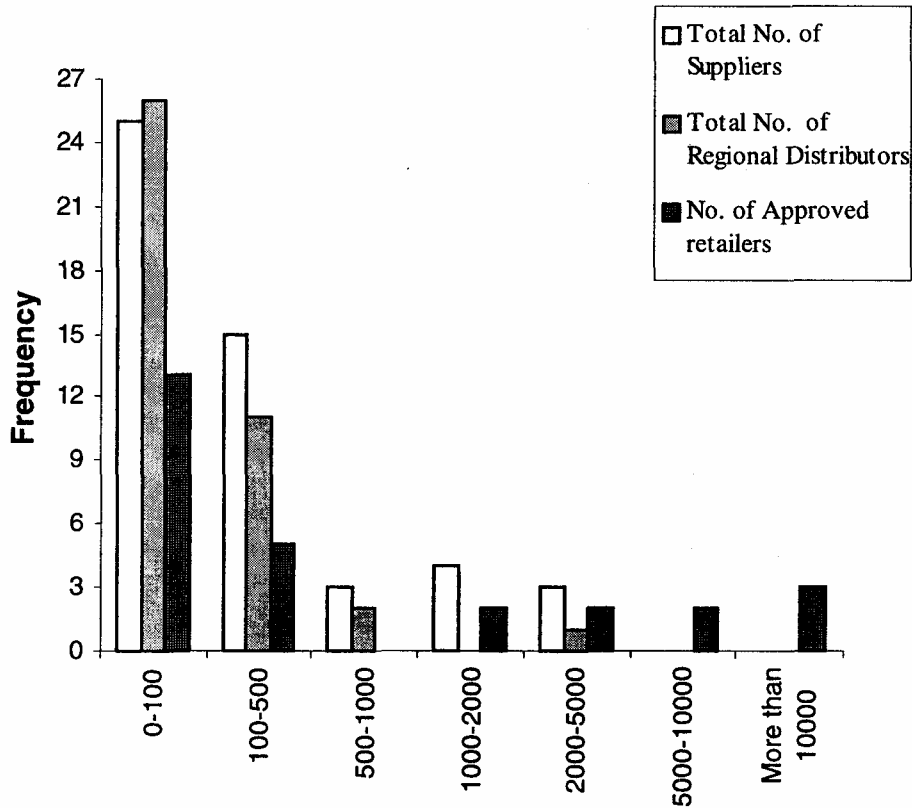


number of firms are struggling with house-keeping, monitoring quality problems, training of managers but not of workers. There are two related observations: first, in a large number of firms, the understanding of quality tools is superficial — as a result, progress beyond a certain level is slow; second, many firms are not consistent in their emphasis on quality which results in employees not taking it very seriously.

Some firms have improved their performance on lead time, and have started simplifying the flow of information and material. However, in discrete part manufacturing, most firms have not adequately addressed some difficult issues like drastically cutting lead times by changing the mode of operation from push to pull, reducing setup times, converting job shops to flow shops or using cellular layouts. Very few implementations of JIT are found in our plants—partly due to the fact that we are unable to contain the impact of uncertainty, partly due to high setup times, and partly due to the fact that many managers still do not understand the basics of JIT. There is a widespread feeling that JIT simply transfers inventory to suppliers, or that it does not deliver any benefits, especially in India. However, JIT goes far beyond inventory reduction and improves quality, lead times, cuts cost, and makes manufacturing more flexible and responsive. Cellular manufacturing is also not a priority for similar reasons. On the positive side, the recent interest in BPR is encouraging because it is process oriented and helps bring about fundamental changes.

One area of concern is the management of inventories across the supply chain. Most firms have not appreciated the advantage of coordinating various decisions and plans across different entities in the chain — the suppliers are optimizing locally, the plants are optimizing locally, and the distribution channels are doing the same. As a result, inventories remain high with working capital being tied up for longer

Figure 14: Distribution of Various Entities in Indian Manufacturing Supply Chain



periods of time, there are delays in delivery, and the overall cost across the chain remains high. Decisions that seem to be good for one entity turn out to be bad for the entire supply chain. More information has to flow between entities in the supply chain and more decisions have to be made collectively. Many firms are still reluctant to help their suppliers improve their capabilities.

Investments in Innovation and R&D activities continue to be very low. Indian manufacturing managers must be aware of the potential dangers of becoming over-dependent on borrowed technology (i.e., products, processes as well as practices). It must be recognized that, in future, firms can stay competitive only through their own innovations. While one-time import of technology might be useful, continuous dependence on borrowed technologies may not be feasible in the future with several multinational corporations themselves entering the Indian market. For firms in the export market, a certain level of strength in manufacturing and R&D is even more important. Put simply, there is no world-class company in the manufacturing sector which does not have world-class manufacturing and innovation.

One factor that may be partly responsible for the inadequate attention to innovation and continuous improvement is a lack of right type of training to workers. Whenever firms have paid attention to workforce training, benefits have followed. The authors have documented a number of such cases. Training of workers has been a significant contributor to improvements in several other countries. The automotive sector in India seems to have appreciated the need for worker training. One of the worst training records can be found in the textile sector. As a result, the former is quite modern while the latter is very outdated.

Finally, we must get into the habit of benchmarking our performance. The perception of our top managers that their plants are at least as good as their global competitors' plants is a little disturbing. Benchmarking reveals a lot of information on our strengths and weaknesses and several world-class manufacturing plants have used this as a starting point in their improvement efforts.

Manufacturing in India is at a critical juncture. Many of our firms are already on the way to becoming world-class, and several others are standing at the threshold. But, the average firm is still very far from

this threshold. A fundamental issue here is our view of manufacturing. The traditional view that manufacturing is a support activity for marketing or finance, and therefore needs little top management attention is perhaps no longer there in Indian firms. However, a more subtle view still persists. Thus, top managers often want to invest in one large effort to improve manufacturing. After that, they want to go back to their traditional concerns. Meanwhile, international competitors are continuously working on improving manufacturing, bringing in new products, and making manufacturing more flexible and responsive. These firms view manufacturing and R&D in a different way: they recognize it as one of the key sources of their competitive advantage. Therefore, they are continuously honing and perfecting their skills and capabilities in manufacturing. A senior executive of a well known international company, widely acknowledged as the industry leader in manufacturing, said at a conference " it seems we enjoy a good reputation.

But, internally, we know our weaknesses and are constantly striving to overcome them."

To effectively institutionalize a culture of continuous improvements, top management must have a well thought out manufacturing strategy. Instead, companies often rely on a massive one-time effort or a series of piece-meal efforts. Top management must understand the strategic dimensions of manufacturing as well as it understands marketing or finance. Very often, top management's involvement in manufacturing is confined to approving capacity expansion plans, approving budgets for equipment purchase, training, or for hiring consultants. But, evolving a strategy and carrying it through requires much more than that. Companies that have successfully done this have either become industry leaders worldwide, or have established a secure and profitable niche. They have realized that competitors can quickly imitate marketing or financial strategies, but it takes several years to duplicate a manufacturing advantage.

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### Appendix 1: Details of the Survey Methodology

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This survey was based on the Manufacturing Futures Survey questionnaire that was developed initially by Boston University and is now administered in many countries around the world. The questionnaire for the survey comprised six sections, namely. Business Unit Profile, Manufacturing Strategy, Competitive Health Check for Manufacturing, Managing Innovation for Competitive Advantage, Integrated Supply Chain Management, and Thinking Differently about Manufacturing Strategy. There were three types of questions in the survey instrument — those which required firms to rate various aspects of their operations vis-a-vis their competitors; those that required firms to rate the nature of past and future interventions in manufacturing in order to improve the competitiveness of their units; and some that required firms to give information on various performance parameters.

The survey instrument was mailed to managing

directors of 700 select medium and large firms in India. These firms were chosen from various sources' — they represented a cross-section of size, industry type, and performance. The response, however, was extremely poor. Follow-up letters were sent to all these firms and phone calls made to many in order to remind them of the questionnaire. Duplicate copies of the questionnaire were mailed to many firms. Finally, the number of valid questionnaires that we used for the analysis was 56. This number itself provides a lot of information on Indian firms ! Interestingly, our sample consisted of firms that have been generally performing well according to many published sources. Whenever comparisons were made with US firms, the data were first normalized by the mean and standard deviation of each attribute score for each country to reduce any systemic biases.