

FINDING THE RELATION BETWEEN MAKE OR BUY DECISIONS AND PROFITABILITY FOR TECHNOLOGY BASED CLASSIFIED BATCH TYPE OF MANUFACTURING INDUSTRIES

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ABSTRACT

To survive in today's competitive manufacturing era, the decision on whether industries to produce product parts, in-house or outsource them, is very important. The manufacturing industries always look for their better performance by correct decision of make or buy parts of product and it depends upon technology available in-house or in the market/supplier. This paper reports an attempt made to know, the relation between make or buy decisions and profitability for technology based classified batch type of manufacturing industries.

A survey is carried out for technology based classified batch type of manufacturing industries to know the make buy trend and relation with profitability. The results obtained and reported are useful ratios of make parts to total no. of parts (in percentage) and its relation with profitability for technology based classified batch type of manufacturing industries. These results are useful to improve the performance of engineering industries.

KEYWORDS: Make, Buy Decisions Make Buy Ratio, Firm Performance (Profitability), Technology

INTRODUCTION

Decisions regarding make or buy (significant functions) are among the most strategic ones. The make-or-buy decisions are often major determinants of profitability and can be significant to the financial health of the company (Yoon and Naadimuthu 1994-source-Moschuris Socrates-2007). They can impact corporate strategy, as well as a company's cost structure and competitiveness, flexibility, customer service and the core competencies of the organization (McIvor and Humphreys 2000; Tayles and Drury 2001; Baily, Farmer, Jessop and Jones 2005). The introduction of a new and potentially radical technology into an industry should therefore be a cue for managers to review their make-buy policies (Fine, Vardan, Pethick, and El-Hout, 2002). Owing to the intense global competition in manufacturing, manufacturers need to increase their level of competitiveness in the global market. Some manufacturing companies, therefore, are forced to undergo a period of transformation in order to compete more effectively. The company starts to concentrate to produce its products leaning on its strengths.

According to Teece (1997-Source -Hanna Kropsu-Vehkaperä*, Harri Haapasalo and Jukka-Pekka Rusanen-2009), the winning companies in high technology industries have rapid and flexible product innovation together with the management capability to effectively coordinate and redeploy internal and external competencies. However, it is not known, 'whether one strategy is suitable for all types of industries for improving the performance.' Experts opine that differ industries need different strategies for improvement. Hence, industries are to be classified and strategy is to be decided.

To understand the make or buy decision and profitability, industries /companies are classified as high-tech, medium-tech and traditional technology industries. As there is no unambiguous and commonly approved definition, the concepts of a different tech company become a complex and varied issue. Hence, there is need to define the companies and classify based on technology.

A relation between make or buy decisions and profitability for technology based classified batch type of manufacturing industries is not available in literature. Hence, this work is undertaken and reported in the paper. To know a relation between make or buy decisions and profitability for technology based classified batch type of manufacturing industries, a survey is carried with the objective to find the ratio of make parts to total no. of parts (in percentage) for highest profitability. In next section, the brief report on recent literature for a) make or buy decisions and profitability for technology based classified batch type of manufacturing industries. b) Characteristics of Product Design and Manufacturing is presented. Subsequently, the results of survey are presented with discussion and conclusions are drawn.

LITERATURE SURVEY

Literature Survey of Make or Buy Decisions and Profitability for Technology Based Classified Manufacturing Industries

Tim Gallagher et al (2005- source –http://www.werc.org/assets/1/workflow_staging/publications/666.pdf) studied the manufacturing industries and concluded that OEMs often have much stronger relationships with customers, better distribution systems, deeper engineering resources, more advanced technical support, and superior quality assurance.

Moschuris, Socrates (2007) studied use of the Make or buy decision about the part in a product and related to use of technology in manufacturing a product different manufacturing industries and concluded that

- As the degree or scope of technology increases, workload fluctuations exert more impact on the make-or-buy initiation process for an item.
- As the degree or scope of use of continuous technology increases, new product development exerts less impact on the make-or-buy initiation process for an item

David Wu.S (2005) studied the electronic firm and concluded that With the increasing pace of technological innovation and the increasing cost of manufacturing equipment, many OEMs are reluctant to respond to economic cycles by adjusting their own in-house capacity (use of technology) for better performance of industries. Miegheem (1999 Source- David Wu.S (2005) observes that the manufacturer subcontracts more (invests less on his own capacity or low technology) as the demand uncertainty increases, which induces the subcontractor to invests more. Van Miegheem (1998- Source- David Wu.S (2005)) studies a two-product setting in which the firm has the option to invest in two product-dedicated resources or one flexible resource that can process both products. The paper examines the impact of price, cost, demand and demand correlations on the investment decisions.

Peter G. Klein (2005) U.S. manufacturing and service companies are increasingly contracting with specialized information technology firms for their computing and data warehousing needs, spending \$7.2 billion on outsourced computer operations in 1990. Standard and Poor's estimates total worldwide outsourcing for 2003 at \$170 billion.

Afuah (2001) later observes that, "following a technological change that is competence destroying to firms and their suppliers, firms that are integrated vertically into the new technology will perform better than those that are not. At the same time, firms that had been vertically integrated into the old technology will perform worse than those that had not been". The make-buy strategy has to change as the technology matures.

Charles H. Fine, Daniel E. Whitney (1996) studied the US and Japanese manufacturing industries and concluded that Japanese automobile firms strongly support in-house CAD development as well as that of key manufacturing equipment. Most successful Japanese car companies design and make as little as 30% of the components that go into their cars. [Clark and Fujimoto] For US car companies, the corresponding percentage on manufacturing outsourcing ranges from 30% at Chrysler to 70% at GM for better performance of the company.

Literature Survey of Characteristics of Product Design and Manufacturing

Product design is perhaps the most important dimension around which planning of manufacturing processes takes place. The different companies have different technology for product manufacturing and their selection on product design methodology and available resources for manufacturing. In conventional way product manufacturing is the processing or making (a product) from raw materials, especially as a large scale operation using machinery. While in modern context product manufacturing is defined as the making of products from raw materials using various processes, equipment, operations and manpower according to a detailed plan.

Design of Product possess the following characteristics

- **Reparability:** The design of the product should be such that it is easily repairable at any place
- **Redesigning Capability:** Redesign is necessary for the problems which come into picture while designing. Old products are continuously being redesigned and new products are developed.
- **Drawing and Specification:** The drawing of the product should be in exact size and shape of the product, its parts and sub components. The specification of each part, operation and process should be clear and detailed
- **Reliability:** Customer expects the product reliable i.e. to give trouble free service over its designed period.
- **Miniaturization:** Miniaturization means making size of the part, assembly or product too small if possible. Sometimes the whole product cannot be made so small, but some parts or components of it may be reduced in size without affecting functional ability, which result in less use of material, saving in space and reduced in weight.
- **Modular Design:** The product should be composed of detachable components or sub-assemblies so that whenever any part or components fails that part is easily replaced by new one. This helps the various models of product can be offered to the customer
- **Quality:** A good quality product design ensures that the final product quality is obtained through its components. A tolerance specified at every stage ensures end product of desired quality
- **Minimum Cost:** Design influences manufacturing cost. Product design must ensure minimum manufacturing cost considering the target customer.
- **Maintainability:** Product should ensure that repairs and replacement are carried out without much trouble. This reduces downtime and increases customer satisfaction.
- **Producibility:** The product design should be such that product can be produced easily at reasonable cost and in least number of operations.
- **Functionability:** The product design should be such that it should offer trouble free operation and satisfy needs of customer.

Paul MilGrom et al (1991) reported the characteristics of modern manufacturing firms in contrast to traditional manufacturing firms are a) make greater use of flexible programmable equipment and of computer aided design and manufacturing technologies, b) have fewer job classification, c) offer more varieties of their major products and/or update their product lines more frequently, d) put more emphasis on speed in order processing, production and delivery, e) Overall production lead times will be shortened and inventories of intermediate and finish goods levels were reduced f) rely on subcontractor to supply a greater proportion of the total value added part to reduce the working capital, g) Overlap design, product and process engineering to speed the introduction of new products.

Source (<http://spartan.ac.brocku.ca/~pscarbrough/scarb-alp-burch/Chapters%201-24-2.htm>) The traditional batch manufacturing environment is a PUSH system in which the product is produced in accordance with available capacity and moved along the production line in large batches. Inspection generally occurs at the end of the process. The following are characteristics of a traditional batch manufacturing environment:

- Producing and maintaining large raw materials, WIP, and finished goods inventories
- Producing products of low quality and performing a great deal of rework and repairs
- Striving for efficiency at the expense of effectiveness.

Products advanced manufacturing characteristics are as follows

- **High Quality:** The product works as intended without defect or deficiencies.
- **Customer Service:** Customer service factors are used to achieve complete customer satisfaction.
- **Low Inventory:** Minimal amounts of inventory are ordered, processed, stored, and handled.
- **Flexibility:** The manufacturing process can adapt quickly to changes in demand.
- **Automation:** Self-acting and self-regulating technologies are used to perform a large variety of tasks.
- **Team Concept:** Workers and managers work together in a cooperative manner for the overall success of the enterprise.
- **Integrated Computer:** Based information system (ICBIS). A system in which various information technologies are used to connect all functions throughout the enterprise.

Johan Mater, Pontus Thagesson (2005) reported that a conventional product is often developed through established technology that can be purchased by everyone through well-known market channel (Haati et al. 1998). Modern manufacturing technology market are also often synonymous with complexity and are working under rapidly changing technological conditions with shorter life cycles and more demand for rapid decisions.

Agnieszka Zakrzewska-Bielawska (2008) point out key features of modern manufacturing firms which make it possible to differentiate with to traditional manufacturing firms are a) high demand for scientific research and intensity of R & D expenditure, b) high level of innovativeness, c) fast diffusion of technological innovations, d) fast process of obsolescence of the prepared products and technologies, e) high level of employment of scientific and technical personnel, f) high capital expenditure and high rotation level of technical equipment, replaced by more modern and innovative devices, g) high investment risk and fast process of the investment devaluation, h) intense, strategic domestic and international cooperation with other high technology enterprises and scientific and research centers, i) implication of technical knowledge in the form of numerous patents and licenses, j) increasing competition in international trade.

Lee, J.; et. al. (1999) Modern Manufacturing technologies address the capabilities to design and to create products, and to manage that overall process. Modern manufacturing takes care for product quality and reliability, responsiveness to customer demands, increased labor productivity, and efficient use of capital. Leading manufacturing organizations are flexible in management and labor practices, develop and produce virtually defect-free products quickly (supported with global customer service) in response to opportunities, and employ a smaller work force possessing multidisciplinary skills.

In this there is an optimal balance of automated and manual operations. To meet these challenges, the manufacturing practices must be continually evaluated and strategically employed. In addition, manufacturing firms must cope with design processes (e.g., using customers’ requirements and expectations to develop engineering specifications, and then designing components), production processes (e.g., moving materials, converting materials properties or shapes, assembling products or components, verifying processes results), and business practices (e.g., turning a customer order into a list of required parts, cost accounting, and documentation of procedures).

Identified Characteristics of Product Design and Manufacturing in Literature Survey

Characteristics of Product Design

Traditional Design

This design is based on judgment of individual and experience from the past. Due to non support of sophisticated software the design may be over or under design which may affect material selection, material processing, quality of part, cost of part and time required to design is also more. The special characteristic is as given in the table 1.

Table 1: Characteristics of Traditional Design

Sr. No	Characteristics	Description
01	Research and Development	The design procedure which is establish since past so many years is used and the innovative ideas are not encouraged
02	Effect of Market Trends	Traditional design affected slowly by market trend
03	Designer qualities	Experienced persons required for designing and to perform a routine work, to improve the quality in design, the person in design department given a little training.
04	Design Procedure/Method	Time require for design process is more due to manual methods and procedural changes are limited.
05	Use of Design Tools	Software or electronic devices are not used for part design calculations
06	Design Changes	The changes in design take place with out consideration of the outside/market development. The design changes in reaction to the competitors design are not taken care off.
07	Product life/Performance	Poor Performance of product’s service or utility. Generally the life is more

Modern (Hi-Tech) Design: This design is supported by sophisticated design and analysis software. This design give rise to selection of proper optimized material and optimized all processes (manufacturing, assembling, inspection, testing) which will give rise to product of best quality at first time itself with least possible cost. The special characteristic is as given in the table 2.

Table 2: Characteristics of Modern (Hi-Tech) Design

Sr. No	Characteristics	Description
01	Research and Development	Innovative ideas and recent / dynamic changes in technology for especially with R&D are used in design
02	Effect of Market Trends	Faster development/changes in competitors product as well own product
03	Designer qualities	The persons in design technology should have knowledge about use of latest tool and software and the ability of independent problem solving.

Table 2: Contd.,

04	Design Procedure/Method	Reliability and accuracy of design is more due to use of different software techniques and recent methodologies for design calculation and hence cost and time required for design process is less
05	Use of Design Tools	Advanced software of design and analysis are used for part design calculation and to get optimum results in time
06	Design Changes	The design changes especially with cooperation of R&D are adopted
07	Product life/Performance	Satisfied Performance of product's service or utility for expected period

Characteristics of Product Manufacturing

Traditional Manufacturing

This comprises of conventional process of forming, machining, assembling, testing, inspection. This will leads to more time for process and inaccuracies during processes, assembling, inspection, and testing. This manufacturing method is largely depending up on skill and knowledge of operator and concern person (Engineers, supervisor, inspectors). The special characteristic is as given in the table 3.

Table 3: Characteristics of Traditional Manufacturing

Sr. No	Characteristics	Description
01	Process Development	Production processes are designed based on design of the product .Finally previously developed process is used
02	Facility: Machines	Conventional machines with limited features, manual control machines are used
03	Facility: Tooling	Less précised tooling will serve the purpose of manufacturing and inspection
04	Facility: Material handling	Material handling is not atomized, in majority of cases manual material handling is used
05	Facility: Labor	Skill is prominent feature
06	Rate of Production	Rate of production is low due to use of conventional machines and tooling for manufacturing parts.
07	Quality of product	Conventional machine with human interference delivers quality with constraint of operator's skill
08	Flexibility in production	In traditional manufacturing companies make use of low technology machine or general purpose machine and thus this system can easily adapt changes in products and production levels for job and low batch production
09	Productivity	Manufacturing is based on labor skills and less on automation hence low productivity
10	Production control	Limited quantity and variety leads to control by general thumb rules and procedures

Modern Manufacturing

Which comprises of advanced process of material forming, machining, assembling, inspection, and testing.. This will leads to less time for processing and final output. Modern Manufacturing give rise to high quality product in less time by high quality manufacturing, inspection and testing processes and advance machines. Advanced manufacturing involves the use of technology to improve products and/or processes, with the relevant technology being described as "advanced," "innovative," or "cutting edge."

For example, one organization defines advanced manufacturing as industries that "increasingly integrate new innovative technologies in both products and processes. The rate of technology adoption and the ability to use that technology to remain competitive and add value define the advanced manufacturing sector."

"Advanced manufacturing centers insist upon improving the performance of industry through the innovative

application of technologies, processes and methods to product design and production.” The special characteristic is as given in the table 4.

Table 4: Characteristics of Modern Manufacturing

Sr. No	Characteristics	Description
01	Process Development	Production processes are innovatively developed and designed suitable to design of the product
02	Facility: Machines	Flexible and modern hitech machines are used which leads to large no of features/facilities for manufacturing
03	Facility: Tooling	Highly précised tooling will serve the purpose of manufacturing and inspection
04	Facility: Material handling	Automized Material handling system are used and these systems enhances production time to cope up ordered quantity
05	Facility: Labor	Skill of labour/operator is replace whenever possible
06	Rate of Production	Rate of production is high due to use of hitech machine and tooling for manufacturing a parts and less changeover time of machines and technical inventions
07	Quality of product	high-tech machines and tooling with less human interference delivers higher quality
08	Flexibility in production	In modern manufacturing companies make use of high end technology machine thus this system is flexible enough to sustain in all the products and at all production levels
09	Productivity	Manufacturing is based on high-tech modern systems and with an automation / machine capability ,hence improved optimized productivity
10	Production control	Advanced controlling techniques / methodology / technology controls the in all production system

Literature Gaps: Following literature gaps are observed from the literature study.

- Studies about how many (number of) items (from the total items) for getting highest profitability are to be outsourced for technology based batch type manufacturing industries, are not reported by researchers.
- Studies about the firm performance (profitability) relation with make/buy ratio for technology based batch type manufacturing industries are not reported in the literature.
- Studies about classification manufacturing industries on technology base are not reported.

Considering the gaps the problem of finding the relation of ratio for make/buy for components and profitability in technically classified industry is undertaken.

RESEARCH METHODOLOGY

According to Leedy and Ormond (2005), “Research is a systematic process of collecting, analysing and interpreting information (data) in order to increase our understanding of the phenomenon about which we are interested or concerned.” Due to data and methodology being interdependent, the researcher when selecting a methodology must always take into account the nature of the data that will be collected in the resolution of the problem.

Research Categories /Classification /Methods

Scientific research can be separated into five basic categories: field experiments, laboratory experiments, field studies, case studies and survey research (Yin, 2003). Each category possesses differing logic, techniques of data collection and ways to analyze the data; and each has its own sets of advantages and disadvantages. These five research categories are also associated with experimental or non-experimental research; or whether the data is collected in the field or in a laboratory setting.

The descriptive method of research was used for this study as researcher gathered information about the current condition of the industries. Descriptive research is a type of research that is mainly concerned with describing the nature or condition and the degree in detail of the current situation of the industries. This method is used to describe the nature of a situation, as it exists at the time of the study and to explore the reason (s) behind a particular phenomenon. The endeavour of descriptive research is to obtain a) ratio of make parts to total no. of parts (in percentage) for different profit making industries for different level of technology based industries, b) effect of in-house technology on cost of Make parts for different profit making industries for different level of technology based industries. Descriptive type of research's emphasis is on describing rather than on judging or interpreting. The descriptive approach is quick and moreover, this method allows flexibility, thus, when important new issues and questions arise during the duration of the study, further investigation may be conducted.

In this study, the descriptive research method is employed so as to find ratio of make parts to total no. of parts (in percentage) for different profit making industries for different level of technology based industries. The researcher chose to use this research method considering the objective to obtain first hand data from the respondents. Apart from flexibility of the descriptive method, it can employ either qualitative or quantitative data or both, giving the researcher greater options in selecting the instrument for data-gathering.

Survey

Objective of this research can be achieved through the collection and analysis of the desired data. As the data is not directly available, personal contact with respondent is necessary to collect the data. Hence, it is decided that the data required is to be collected through contact only. As survey method allows researchers to contact respondents on one on one basis that is why survey method is being used. It is relevant, appropriate and viable in given context. Questionnaire method is selected for this survey in which combination of closed ended and open ended questions are considered.

Design of Survey

This consist of a design of survey questionnaire for quantitative data collection, deciding respondents and sample size, method for data collection, data analysis method etc.

A questionnaire is designed to collect quantitative data of manufacturing outsourcing with focus on batch type engineering industries. Following guidelines are used to design a questionnaire.

- While formulating a question, its content should be such that each respondent grasp the intention of the question very quickly as originally thought by the researcher.
- Questionnaire must contain simple but straight forward direction for the respondents so that they may not feel any difficulty in answering the questions. This will minimize the distortion of the research focus.
- The format of a question can be divided into two categories as open-ended and closed ended. The open –ended questions may bring unconventional answers which are not known to the researchers. These questions are for the collection of the data for number of make and buy part, total number of part, selling price ,profit decided in percentage The close-ended question is used to collect data about profitability status and the respondents has choice to select one of the three choice.

Respondents and Sample Size

The respondents for the survey are selected as high level employees (senior level purchase manager or member in

cross functional team such as design, manufacturing, production planning and control, quality) who are regular participants in the manufacturing business.

Following guidelines are followed to decide the sample size.

The sample size is an important feature of any empirical study in which the goal is to make inferences about a population from a sample. Inappropriate, inadequate, or excessive sample sizes continue to influence the quality and accuracy of research. Hence the sample size was calculated for a research work using a table of recommended sample sizes (n) for population (N) with finite sizes, developed by Krejcie and Morgan and adapted by Patten (2004), and Parasia Alagheb (2006). According to the sample size determination table, and for purposes of this study, a finite population size N = 60 (From Maharashtra industrial directory and information from MIDC Pune- -2012, the number of industries who manufactures the ball valve with automation in Pune and around Pune are 60, which are selected for study) revealed a sample size n = 55 as the goal for this study.

Data Collection Methods

In order to gain a better understanding of make-buy and its trend, data collection method selected is to collect the data by personally meeting with expert from industries.

Deciding the Data Analysis Method

The aim of the research is to investigate range and average in percentage of (numbers as well as in value form) make or buy parts in a product for manufacturing industries. The data collected about make parts, buy parts, selling price, profit decided in % for different industries under survey is grouped into three categories on basis of profitability. The data collected is in quantitative form and is enter in tabular form in Excel in order to find our objective. The quantitative data is to be analyzed using descriptive and inferential statistics.

WORK CARRIED OUT

Industry Classification

As the objective of this study is finding the relation of ratio for make/buy for components and profitability in technically classified industry, the classification is done as given below.

High Technology Industries/Companies

These companies employ the tools like high end software for product design, material selection, component design, planning the production against the appropriate quality of manufacturing with advanced machines with the support of rigorous R & D activities.

The high tech companies select the high technology with minimum possible investment and with least possible production cost where by the dependence on the skill labor is avoided and consistency in output is ensured as the process is almost machine dependent.

Table 5

Industry	Product Design	Manufacturing
High Technology companies	Modern Design	Modern Manufacturing

Medium Technology Industries/Companies

These types of industries are the using mediocre software for design of parts, raw material selection, process

selection and manufacturing methodologies. The quality of product manufacturing is less as high-tech companies and with high cost due to use of low tech machines and methods implemented for the production of parts.

The product design is based on experience staff / judgments which has almost minimum use of R & D activities for value addition to the product or cost reduction. Cost of material selected is high as the production is not supported by R & D activities and is with support of traditional design and process.

Table 6

Industry	Product Design	Manufacturing
Medium Technology companies	Modern Design	Traditional Manufacturing
	Traditional Design	Modern Manufacturing

Low Technology Industries/Companies

In a low –tech company production and development process does not involve technologies that can be described as “cutting –edge” or the most advanced currently available. The development and production of product are made through established technologies that are not protected by any patents. Low tech companies have generally lower costs for R & D but more fixed costs than the companies in the high –tech sector. This is due to the product features that demand a minimum of technology development but more expensive raw material compared to the high tech sector.

The low tech companies have least investment in material handling equipment and R & D activities which result in to high raw material cost, more scrap generation, more skill labor dependent and hence the consistency in the quality, quantity and delivery is not reliable having the major impact on productivity and profitability and reputation of the company.

Table 7

Industry	Product Design	Manufacturing
Low Technology companies	Traditional Design	Traditional Manufacturing

Survey Details

This consist of a design of survey questionnaire for quantitative data collection, respondents selection, method for data collection, data analysis method etc.

Design of Questionnaire

The questionnaire is designed with open-ended and close-ended questions based on experiences. In a questionnaire the data required about a different parts in a product selected is included. The desire questions to collect the data are planned in two categories as number of make parts, number of buy parts from the total parts in a product for manufacturing and factors considered to take decision about a part to make or buy.

Questions are also included for profitability. Profitability classified (as per pilot study carried out) as less than 10% profitability as- Low profitability, in between 11 to 20% profitability as—Medium profitability and above 20% profitability as-High profitability to know the performance of industry for their current make –buy decision about a product under manufacturing.

A pilot study is carried out. During the discussion with managers, senior managers of industries and subsequent discussion with expert in academic, the questionnaire is modified and enhanced to give the appropriate information for the purpose of research.

Respondents Selection

The respondents for the survey are selected as high level employees (senior level purchase manager or member in cross functional team such as design, manufacturing, production planning and control, quality) who are regular participants in the manufacturing business.

Data Collection

The interview with each person with prior appointments is held for about 45 minutes along with questionnaire and other issues such as: core business, total number of parts in a product selected for survey, manufacturing process and technology, profitability status in percentage, factors for make or buy decision are discussed. Based on the discussion the data is entered in questionnaire. Data is also collected from respondents about technology used by their companies for design and manufacturing a part in a product. The data is collected as per questionnaire for selected number of industries for survey and is used for this study.

Data Analysis

Data Tabulation

After collecting data from respondents, the data is tabulated for analysis. Sorting of data is done as per the profitability status given by the industries. The arrangement of the data separated is presented in chronological order as data for high profitability first, second data for medium profitability and third data for low profitability industries.

Analysis of Data Collected

The analysis of quantitative information is done through the use of tools like Excel to get following results-a) To know the number of industries based on Different Profitability and Technology used shown in table 8, b) Average of (No. of Make Parts, Total no. of parts, ratio of make parts to Total No. of parts, cost of Make parts, Total Cost of a product, Ratio of cost of make parts to total cost of a product)for Different Technology and profit shown in table 9.

Table 8: Categorization Industries Based on Different Profitability and Technology Used

High Tech.		9	9	18
Medium Tech	9	7	7	23
Low Tech	10	4		14
	Low Profit	Medium Profit	High Profit	Total No.of Industries
Total No. of Industries	19	20	16	

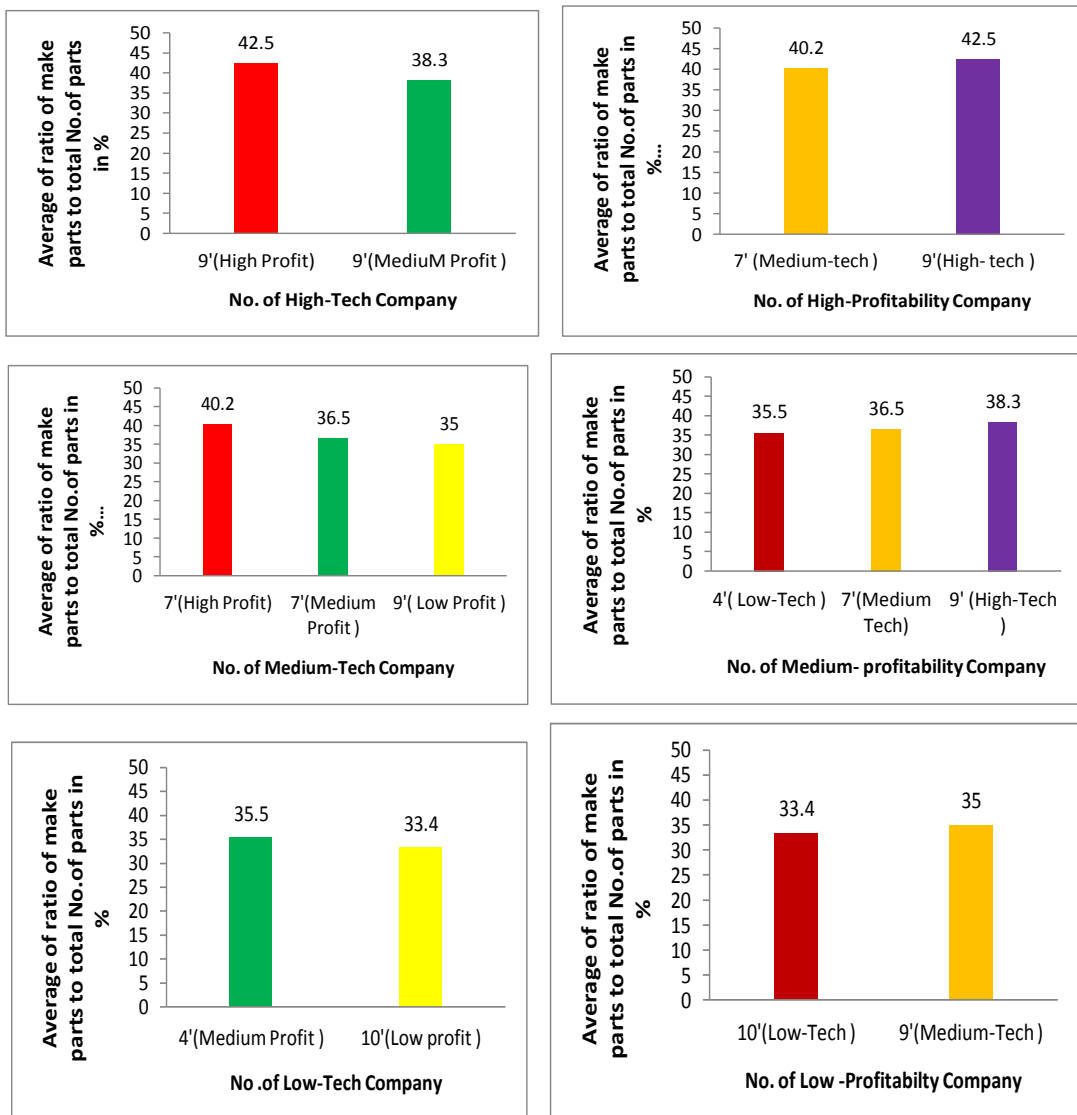
Table 9: Average of (No. of Make Parts, Total No. of Parts, Ratio of Make Parts to Total No. of Parts, Cost of Make Parts, Total Cost of a Product, Ratio of Cost of Make Parts to Total Cost of a Product) for Different Technology and Profit

	Average of No. of Make Parts	Average of Total No. of Parts	Average of Ratio of Make Parts to Total No. of Parts in %	Average of Cost of Make Parts(Rs)	Average of Total Cost of a Product (Rs)	Average of Ratio of cost of Make Parts to Total Cost of a Product in%
High Tech./ High Profit	15.67	37.33	42.5	8303.03	12599.55	65.90
High Tech / Medium Profit	14.89	39.22	38.3	9804.63	13234.44	74.08
Medium Tech/ High Profit	15.14	36.43	40.2	8518.68	13096.42	65.05
Medium Tech/ Medium Profit	14.43	39.86	36.5	10080.46	13863.71	72.71
Medium Tech/ Low Profit	13.33	38.22	35	11770.04	14387.7	81.81
Low Tech/ Medium Profit	14.75	40.25	35.5	12250.83	15021.44	81.56
Low Tech/ Low Profit	12.50	37	33.4	12463.26	15200.5	82.99

Table 10: For
 • Total No. of Industries in Different Profit Region and Technology Used * Average of Ratio of Make Parts to Total No. of Parts in %, ** Average of Cost of Make Parts

High Tech.		• (9) * (38.3) ** (9804.63)	• (9) * (42.5) ** (8303.03)	18
Medium Tech	• (9) *(35) ** **(11770.04)	• (7) * (36.5) ** (10080.46)	• (7) * (40.2) ** (8518.68)	23
Low Tech	• (10) *(33.4) ** (12463.26)	• (4) *(35.5) ** (12250.83)		14
	Low Profit	Medium Profit	High Profit	Total NO. of Industries
Total No. of Industries	19	20	16	

Graphical Representation



X axis: Type of company (High-Tech, Modern-Tech, Traditional); or Profitability

Y axis: %Make parts: No of companies

Figure 1

RESULTS

From the analysis using software following results are found.

From Table No. 9 it can be seen that the (average of) total cost of product /unit goes on increasing from High –Tech /High-profit industries to Low –Tech/Low –Profit industries .Also the percentage of outsource components goes on increasing and (average of) cost of make parts is on the rise from High-Tech/High-Profit industries to low-Tech /low-Profit industries. It is a clear indication that the outsourcing is excess and without giving consideration to the total cost of product per unit is overlooked i.e purchasing is done at improper price and keeping more capacity installed in idle conditions because orders are not continuous or less orders for low-Tech /low-Profit industries.

Findings –Referring to Table No. 10

High Tech. / High Profit: These companies were established before almost 20 years back. This is the categories of industries who have implemented high technology and almost full manufacturing capacities. In this type of categories the policy of manufacturing in-house of the parts has implemented by the excellent scheduling and delivering at proper time. The most cost has been absorbed in depreciation and getting better quality of product due to high end technology. Hence could maintain high profit which is indicated in table no.2.

High Tech / Medium Profit: In this category of industries, the technology implemented is of advanced in nature and with almost full capacity and capability of manufacturing in the parts. The company has outsource more components as compared to high tech-high profit companies at improper cost of purchasing (outsourcing) hence total cost of product increases, hence resulted into mediocre profit.

Medium Tech/ High Profit: In this category of industries the technology adopted is of medium nature but in this some of industries could reach into the high profit area by proper scheduling, maintaining the delivery and manufacturing more components in-house. Hence resulted into high profit.

Medium Tech/ Medium Profit: This is the category of the industry of medium technology and has improper utilization of capacity of manufacturing as compared to the medium tech-high profit companies and hence resulted into purchase of components at higher prices than manufacturing in-house and resulted into medium profit industries.

Medium Tech/ Low Profit: This is category of industry who has implemented medium technology and adequate manufacturing capacity but have poorly utilize a capacity of manufacturing because of orders are not continuous and stress on buying more number of parts. Outsourcings is done improper cost which has impacted on profit percentage and hence the companies lies in the range of low profit

Low Tech/ Medium Profit: This is the category of industry which has implemented the low technology with general purpose machine of manufacturing .The cost investment is high as compared to industry of high tech and medium tech which were establish 20 and 15 years back respectively. Hence to cover up the cost through more depreciation percentage of investment. This type of category of industry utilize the capacity of manufacturing more efficiently to have less total cost of the product than Low Tech/ Low Profit. This type of category of industry are outsource a less number of parts which result into higher profit than Low Tech/ Low Profit and hence lies in the area of medium profit .

Low Tech/ Low Profit: This is category of industry the industries which has implemented the low technology with general purpose machinery and have not implemented a scheduling properly and have stress on outsourcing more number of components at in appropriate purchase price which increases the total cost of product. Hence this category of industry resulted into low profit.

CONCLUSIONS

Following conclusions are drawn from this study

- Ratio of make parts to total No. of parts (in percentage) is increases from low profit making industries to high profit making industries for different level of technology based industries.
- Cost of Make parts is decreases from low profit making industries to high profit making industries for different level of technology based industries.
- For High-Tech industries (average of) ratio of make parts to total no. of parts in percentage is 42.5 for high profitability and 38.3 for medium profitability.

For Medium-Tech industries (average of) ratio of make parts to total no. of parts in percentage is 40.2 for high profitability, 36.5 for medium profitability and 35 for low profitability.

For Low-Tech industries (average of) ratio of make parts to total no. of parts in percentage is 35.5 for medium profitability and 33.4 for low profitability.

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