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Finding the Relation between Make or Buy Decisions and Capacity for Profitability and Technology in Batch Type of Manufacturing Industries

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Abstract: - Make-or-Buy decision is a choice between manufacturing in-house or outsourcing a part in the product to ensure a performance of any manufacturing industries. There are several factors involved in making such decision. Most manufacturing industries use cost as a main factor to decide whether to make-or buy a part in the product. However other factors also considered for taking making make-or buy decision. Therefore how the manufacturing capacity influencing make-or-buy decision for profitability and technology of the industry as important issue. In order to study this survey method is employed to determine how capacity plays the role in taking make-or-buy decision in manufacturing industries. The results obtained and reported are useful ratios of make parts to total number of parts (in percentage) and its relation with capacity utilization for profitability and technology based classified batch manufacturing industries. These results are also useful to know the performance of manufacturing industries with available capacity and technology.

Keywords: *Make-or-buy, batch type manufacturing industries, capacity*

I. INTRODUCTION

The growing complexity of industrial manufacturing and the need for higher efficiency, greater flexibility, better product quality and lower cost have changed the face of manufacturing practice .In today's competitive economic environment, customers do not just prefer but demand manufacturers to provide quality products in a timely fashion at competitive prices. To satisfy this requirement, manufacturers need to plan necessary and sufficient capacity to meet market demands. However, capacity planning is a very challenging task for many reasons.

Companies that are operating at less than full capacity usually make components rather than buy them. Sometimes the available capacity is not sufficient to make all the components, so choices have to be some parts to be outsourced. Typically, it is better to produce in-house those parts or products with steady demand that consume a set capacity, whereas those whose demand patterns are uncertain or volatile are usually subcontracted

According to expert opinion most important decisions that a manufacturing company should make is to determine the product mix which will maximize profits for present capacity and technology available. Given that a company has considered a factor for e.g capacity constraints, technology, it may not be able to produce every unit of product demanded by the market. The best action to take in this case is to focus on the most profitable products for the company and to use available capacity and technology of the company to produce these products for better performance of the industries.

Manufacturers face the difficulty of planning of available capacity for manufacturing of multiple products at the same time. Due to competition and the wide range of applications of a new technology, the manufacturer needs to produce a variety of generic or custom-made products to meet the requirements of its customers. Such variety in products adds complexity to a manufacturer's supply chain. Different products might share common manufacturing processes or use common components. Because of the linkage between the products, the manufacturer needs to plan together its available capacity for producing multiple products, as well as possibly multiple generations of a single product. However, finding the right level of capacity for all products at the same time is a large scale problem.

To know how manufacturing capacity plays a role in make or buy decision for different profitability and technology based manufacturing industries for better performance. Hence, this work is undertaken and reported in the paper. To know a relation between make or buy decisions and capacity utilization for profitability and technology in 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) and mean value of capacity utilization for

different profitability and technology in batch type of manufacturing industries. In next section, the brief report on recent literature for a) concept of capacity, b) factors affecting make or buy decision, c) make or buy decisions for profitability and technology in batch type of manufacturing industries, Subsequently, the results of survey are presented with discussion and conclusions are drawn.

II. LITERATURE REVIEW

This section present the previous research related to concept of capacity, factors affecting make or buy decision and. A subject that will discuss in this section is to clarify the theory about concept of capacity, survey of make or buy decisions with profitability and technology.

2.1) Concept of capacity[16]:

A) Capacity can be viewed as a measurement of the value-creating ability of a machine or system or being the ability to produce work in a given time must be measured in unit of work. For a manufacturing facility, capacity is simply the maximum output that can be attained with the existing capital equipment during a period of time. Thus, an automobile manufacturer may define its capacity as the number of cars that can be assembled in an hour, day, week, or month. It is important to consider theoretical or practical capacity when making strategic and operational decisions [10]. Capacity Management is defined as the function of planning, establishing, measuring, monitoring, and adjusting levels of capacity so that sufficient capacity is available to permit execution of the manufacturing schedules [10]. In practice, many operations managers rely on rules of thumb to manage capacity, as a structured unified analytical approach is often lacking.

b)Ideal capacity(Designed capacity) -The optimal amount of work that a process or plant can complete using a 24-hour, seven-day operation with zero waste, i.e., the maximum output capability ,allowing no adjustment for preventive maintenance, unplanned downtime, shutdown, etc or largest volume of output possible if a facility maintained continuous operation at optimum efficiency, allowing for no losses of any kind, even those deemed normal or unavoidable; also called maximum capacity, theoretical capacity, or engineered capacity. This capacity is not realistic due to repairs, maintenance, setups, and other factors that will result in down time.

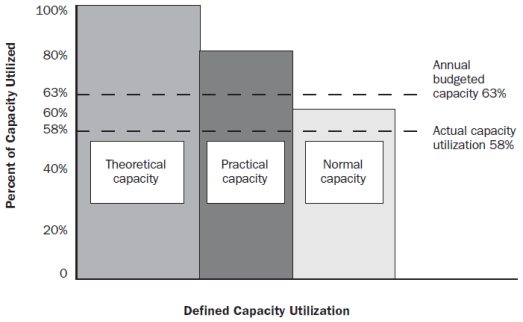
c) Practical capacity- It is defined as the actually useful capacity of a plant. It is also known as the operating capacity. This capacity takes into account the loss of time due to repairs, maintenance, minor breakdown, idle time set-up time, normal delays etc. generally the Present capacity is taken between 80 to 90% of the related capacity.

d)Idle capacity-It is that part of the capacity of a plant ,machine which cannot be utilized in production ,It may arise due to lack of product ,non-availability of raw material ,shortage of labor/ absenteeism's shortage of power fuel or supplies, seasonal nature of product etc.

e) Rated capacity- It is a determination of the maximum usable capacity of manufacturing capability. Rated capacity can never exceed ideal capacity. In fact this capacity is the maximum possible productive capacity of a plant. It is also known as the installed capacity of a plant. It is a product of ideal capacity times capacity utilization .

f) Normal capacity- The average, expected, utilized capacity of a machine, process or plant/unit over a defined period of time (day, week, month, year, etc.).It is the capacity of a plant which is expected to be utilized over a period based on the sales expectancy. The determination of this capacity considers the average utilization of plant capacity during one full business cycle which may extend over 2 to 3 years. It is also known as average capacity and is used to compute overhead recovery rate or average level of operating activity that is sufficient to fill the demand for the company's products or services for a span of several years, taking into consideration seasonal and cyclical demands and increasing or decreasing trends in demand.

g) Expected actual capacity-similar to normal capacity, except it is a short-run level based on demand, it minimizes under- or over applied overhead but does not provide a consistent basis for assigning overhead cost. Per-unit overhead will fluctuate because of short-term changes in the expected level of output. This is also called planned capacity.



h) Capacity utilization-It is a ratio between the used capacity of a firm and its ideal capacity. It can be computed by the following formula:

Capacity Utilization = Used Capacity/ Ideal Capacity

Capacity utilization is affected by an organization`s product mix, production scheduling, age of equipment, and maintenance standards.

Concept on Capacity Utilization

Capacity utilization of installed plant is the principal factor of production performance. Capacity utilization is a concept in economics which refers to the extent to which an industry actually uses its installed productive capacity. Hence, it refers to the relationship between actual output that is produced with the installed equipment and the potential output which could be produced.

In production perspective, Capacity utilization tells about how much capacity is utilized to produce parts from a plant in a production cycle time ; and indicates whether or not a plant can support future demand growth without further capital investment. Capacity utilization is also used to explain some important factor of manufacturing such as productivity, profit, assessing growth, future investment, and production cost. In operations point of view, Capacity utilization calculates how much of the rated output of the production facility is utilized; and could contribute to develop efficient production planning to meet customer demand [15].The decision about part to be made is depend on technology and capacity available, if capacity utilization increases; then industry are likely to operate with a positive output gap (capacity gap is the difference between the potential output and actual output)which contributed to reduce unit cost of a product [14].The capacity utilization rate is found by dividing index of manufacturing output by index of manufacturing capacity. A standard deviation of capacity utilization is the weighted average of the ratio between the actual outputs of the industry to the maximum that could be produced per unit of time, with existing available resource.

2.2) Factors affecting make-or-buy decision

Make-or-buy decision is about the choice of whether to carry out a particular process or activity within a business or to buy it from a supplier [11]. By survey of various manufacturing industries, found out main driving factors for make or buy decision. These driving factors, are grouped into five groups such that factors of each group are having similar characteristics or attributes .The main five groups are: i) Technology driven factors ,ii) Capacity driven factors, iii) Quality driven factors, iv) Economy driven factors, v) Risk driven factors. For successful outsourcing a industry should use the identified key driving factors and their stepwise implementation in order to achieve its objective and goals [6].

Most of the industries considered cost as a major factor when deciding to make-or-buy decision because the company always seeks ways to maximize profit by minimizing cost of manufacturing parts [7].

There are only few industries that took a strategic view of their make-or-buy decisions, with many industries deciding to buy rather than make based on a short-term reason of cost reduction and capacity [2, 5].

A industries should not only take the cost as a consideration in determining make-or-buy decision, but also need to consideration about other factor such as quality, capacity, delivery, Core Business/ Competence and etc for to improve the overall performance of manufacturing industries and effects on its future survival. [11, 6].

David Wu S. [4],"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 and also 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.

2.3 Literature survey of make or buy decisions for profitability and technology in manufacturing industries:

In most of manufacturing industries, make or buy decision based on the comparison of the cost of manufacturing a part in-house or outsource for more profit with consideration of available manufacturing capacity and technology [7].

Tim Gallagher etal [17] studied the manufacturing industries and concluded that OEMs took the decision about a part to make in-house or outsource by considering available capacity and level of technology to give superior quality assurance to the part and improve the firm performance.

Afuah. A. [1] 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 careful decision should be taken about part to be make or buy in case of industries who used old technology for manufacturing a part ,which will affect the performance of the industry.

Moschuris, Socrates J. [9] studied use of the Make or buy decision about the part in a product and related to use of technology in manufacturing a product in 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

Charles H. Fine, Daniel E. Whitney. [3] studied the US and Japanese manufacturing industries sand concluded that Japanese automobile firms strongly support by in-house technology such as CAD development as well as that of key manufacturing equipment for better firm performance. This in-house support considered at the time of make or buy decision, which results in the 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 industry.

Through survey and after studied the various batch type manufacturing industries, the industries were classified in to three categories based upon the methodology used for product design and product manufacturing and find relation between make or buy with profitability for different technology based manufacturing industries. The result of this is to know of much part to be making from the total number of parts and its cost. The finding of the study are as 1)ratio of make parts to total number of parts (in percentage) is increases from low profit making industries to high profit making industries for different level of technology based industries, and 2) Cost of Make parts is decreases from low profit making industries to high profit making industries for different level of technology based industries[8].

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

1) A relation between make or buy decisions and practical capacity utilization for profitability and technology in batch type of manufacturing industries is not available in literature.

2) Studies about firm capacity utilization with make/buy ratio for technology based batch type manufacturing industries are not reported in the literature.

3) Studies about how many (number of) items (from the total items) for getting effective firm capacity utilization for profitability and technology based batch type manufacturing industries, are not reported by researchers.

4) Studies about relation between cost of make part with available capacity utilisation for profitability and technology based batch type manufacturing industries are not reported in the literature.

Considering the gaps the problem of finding the relation of ratio for make/buy for components and capacity utilization for different profitability and technology classified is undertaken.

III. RESEARCH METHODOLOGY

This section discusses the methods used to obtain required information from the respondents. It is also explained how the data and information were analyzed in order to answer the research question which thus aims to achieve the objectives.

3.1 Research design

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 endeavor of descriptive research is to obtain a)ratio of make parts to total no. of parts (in percentage) for different capacity utilization for different profitability and different level of technology based industries, b) effect of in-house capacity utilization on cost of Make parts for different profitability and 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 capacity utilization for different profitability and 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.

3.2Survey

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 to one basis so that 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.

3.2.1Design 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.

3.2.1.1 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.

a) 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.

b) 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.

c) 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 ,technology used and capacity .The respondents has choice to select one of the three choice for profitability and technology used and a five point Likert scale is used to assess the capacity .

3.2.1.2 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 [12]. 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.

3.2.1.3 Data collection methods:

In order to gain a better understanding of make-buy and capacity utilization for different profitability and technology in batch type of manufacturing industries, data collection method selected is to collect the data by personally meeting with expert from industries.

3.2.1.4 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 % and consideration of capacity for different industries under survey is grouped into three categories on basis of profitability and technology. The data collected is in quantitative form and is entered in tabular form in Excel in order to find the objective. The quantitative data is to be analyzed using descriptive and inferential statistics.

Mean score and standard deviation analysis are done to determine the frequency of answers given by the respondents for practical production capacity utilization factor which would influence the decision of batch type manufacturing industries make-or-buy strategy.

In order to fully appreciate the response about factor by respondents, the central tendency and spread of individual element should be reviewed. Table No.1display the range to measure the level of central tendency [13].

Table No.1 Central Tendency Level Measurement Central of Tendency

Central Tendency	Mean Range
High	3.67-5.00
Medium	2.33-3.66
Low	1.00-2.32

(sourceSekeran,2003)

IV. WORK CARRIED OUT

4.1 Survey Details:

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

4.1.1 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 desired 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. A five point Likert scale is used for assessment of the capacity utilization. Practical production capacity is classified (as per pilot study carried out) as less than 80% practical production capacity as low capacity ,in between 80 to 90% practical production capacity as Medium capacity and above 90% practical production capacity as –High capacity. Questions are also included to get information related to profitability and technology. 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.

4.1.2 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.

4.1.3Data collection:

The interview with each person with prior appointments was conducted 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, capacity utilization profitability status in percentage, factors for make or buy decision are discussed. Based on the discussion the data is entered in questionnaire. The data is collected as per questionnaire for selected number of industries for survey and is used for this study.

4.2. Data Analysis:

4.2.1 Data Tabulation:

After collecting data from respondents, the data is tabulated for analysis. Sorting of data is done as per the profitability status and technology used given by the industries. The arrangement of the data separated is presented in chronological order as data for High Profitability and High-Tech. first, second data for Medium Profitability and Medium Tech, and third data for Low Profitability and Low-Tech industries. In the data analysis the assumption that all the firms are operating in single shift so as to have common basis for comparison.

4.2.2 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 No..2, 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 and mean and standard deviation for capacity shown in Table No.3.

Table No.2 Categorization of industries based on Different Profitability and Technology used

High Tech.(HT)		9	9	18
Medium Tech (MT)	9	7	7	23
Low Tech(LT)	10	4		14
	Low Profit P<10% (LP)	Medium Profit 10%<P<20%(MP)	High Profit P>20%(HP)	Total No.of Industries
Total No.of Industries	19	20	16	

Table No.3-Details of Average value of parts , cost and capacity for different technology and profit

	Average of No.of Make Parts in %	Average of No.of Make Parts in a product	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%	Capacity		Capacity Utilization decision
								Mean	Standard Deviation	
HT.- HP	42	15.67	37.33	42.5	8303.03	12599.55	65.90	1.96	0.916	90%<C
HT - MP	38	14.89	39.22	38.3	9804.63	13234.44	74.08	4.65	.0483	80<C<90 %
MT- HP	41	15.14	36.43	40.2	8518.68	13096.42	65.05	1.69	0.469	90%< C
MT-MP	37	14.43	39.86	36.5	10080.46	13863.71`	72.71	3.66	0.864	80<C<90 %
MT- LP	34	13.33	38.22	35	11770.04	14387.7	81.81	4.10	0.566	C<80%
LT- MP	36	14.75	40.25	35.5	12250.83	15021.44	81.56	3.61	1.168	80<C<90 %
LT- LP	33	12.50	37	33.4	12463.26	15200.5	82.99	3.75	1.262	C<80%

Table No.4 – Detail of values for Number of Industries, Parts, Cost, Mean value of capacity

High Tech.		(9) * (38.3) ** (9804.63) ***(4.65)	(9) * (42.5) ** (8303.03) ***(1.96)	18
Medium Tech	(9) *(35) ** (11770.04) ***(4.10)	• (7) * (36.5) ** (10080.46) ***(3.66)	(7) * (40.2) ** (8518.68) ***(1.69)	23
Low Tech	(10) *(33.4) ** (12463.26) ***(3.75)	(4) *(35.5) **(12250.83) ***(3.61)		14
	Low Profit	Medium Profit	High Profit	Total NO. of Industries
Total NO. of Industries	19	20	16	

- 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 ******* Mean value of capacity utilisation

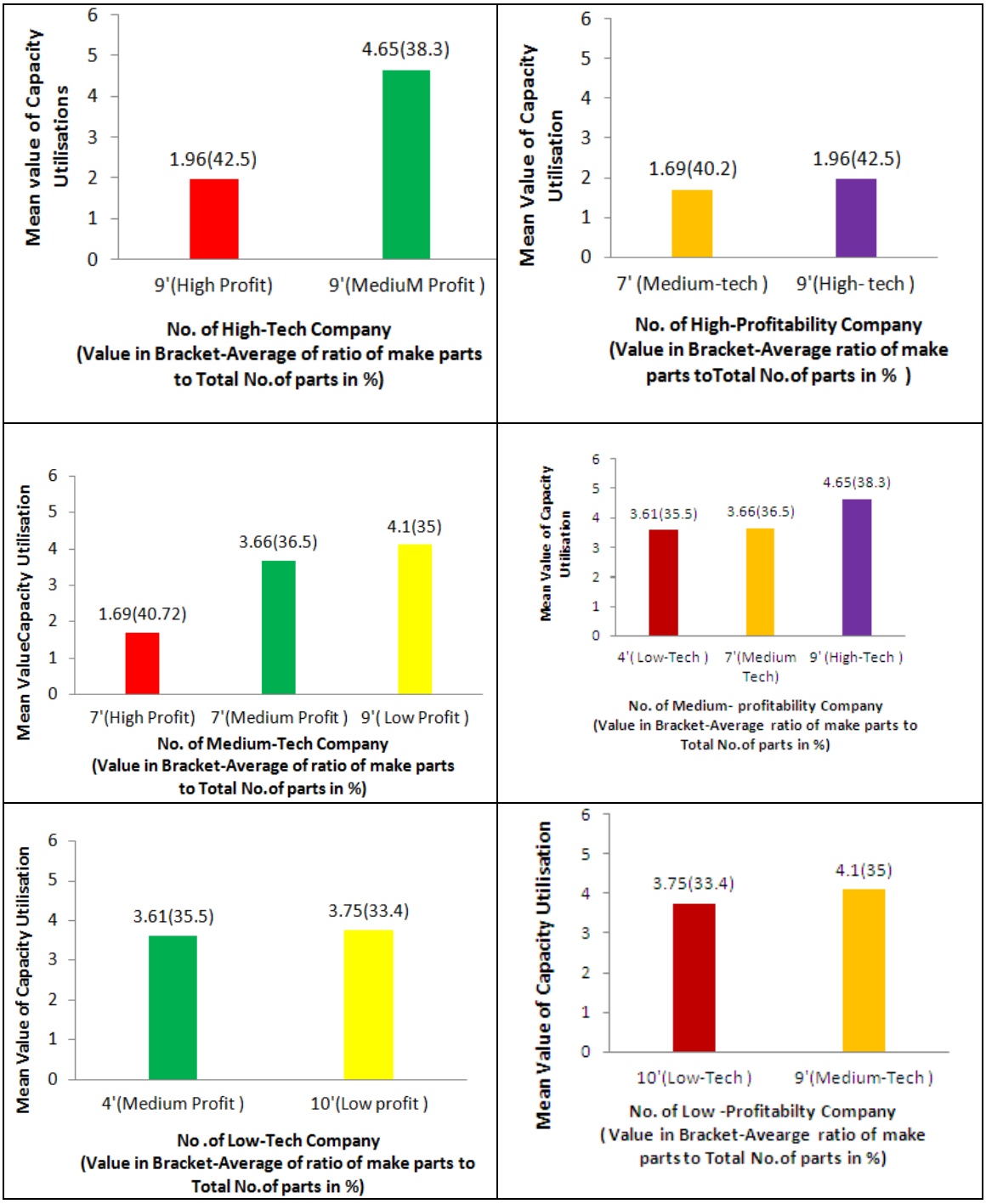
Table No.5 – Caparisons of average of (No.of Make Parts in %, Capacity utilization in %, Total Cost of a product (Rs))

	Average of No.of Make Parts in %	Average of No.of Make Parts in %Graphical	Average Capacity utilization in %	Average of Capacity utilization in % Graphical	Average of Total Cost of a product (Rs	Range for Average ofTotal cost in Rs (Graphical)	Capacity Utilization decision
HT.- HP	42	41-42	91	93	12599.55	9000-10000	90%<C
HT - MP	38	37-38	87	89	13234.44	10000-11000	80<C<90%
MT- HP	41	40-41	92	92-93	13096.42	11000-12000	90%< C
MT-MP	37	37-38	84	87	13863.71`	10000-11000	80<C<90%
MT- LP	34	33-34	73	74-75	14387.7	12000-13000	C<80%
LT- MP	36	37-38	82	83	15021.44	14500-15000	80<C<90%
LT- LP	33	33-34	70	70	15200.5	13500-14000	C<80%

Graphical Representation.

X Axis - Type of company (High-Tech, Modern-Tech, Traditional); or Profitability and corresponding values for Average of Ratio of make parts to total no .of parts in %

Y Axis –Mean value of capacity utilisation



4.3 Results: From the analysis using software following results are found.

From Table No.3 It has been observed 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.4

High Tech. / High Profit/Capacity utilization >90%: These companies were established before almost 20 years back. This is the categories of industries which has 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.3. Although the production capacity is reached more than 90% and above the component will be outsourced to cater the additional demand generated, which may be temporary in nature. Hence instead of increasing the capacity to produce the additional demand, a spare capacity of machine tools required by the critical components (but being presently used for some uncritical component)shall be utilized to manufacture the critical components to face additional demand received and non critical components shall be outsourced.

High Tech / Medium Profit/Capacity utilization in between 80 to 90%: 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 outsourced more components as compared to high tech-high profit companies at improper cost of purchasing (outsourcing) hence total cost of product increases .This resulted into mediocre profit. When demand is such that the production capacity is only utilized in the range of 80 to 90% ,has more room for manufacturing in-house to take care of additional demand, hence industry will not outsourced the components.

Medium Tech/ High Profit/Capacity utilization >90%: 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. To keep up profit above 20% though the demand is equal to production capacity, Industry will manufacture components in-house on reworking on scheduling, maintaining the delivery time and if necessary going to second shift.

Medium Tech/ Medium Profit/ Capacity utilization in between 80 to 90%: 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 .This resulted into purchase of components at higher prices than manufacturing in-house and hence resulted into medium profit industries. This type of categories industries has come into the range of profit 11-20% due to improper utilization of capacity of manufacturing and not maintaining the production schedule and purchasing the components at higher prices the manufacturing in-house. When the demand is equal to 80 to 90 % of production capacity ,industry will not outsourced to improve on the scheduling , production and improve the profit by outsourcing the components which are of higher in-house price and manufacture in-house components whose purchasing prices are higher than manufacturing in-house .

Medium Tech/ Low Profit/ Capacity utilization < 80%: 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 at improper cost which has impacted on profit percentage and hence the companies lies in the range of low profit .If the demand is equal to production capacity i.e. up to 80% in a medium tech/low profit industries which has a profit<10% .The profit is less due to poor utilization of capacity, outsourcing at improper cost which has impacted on profit percentage. Hence demand is equal to production capacity, industry will not outsource to improve on the profit and utilize the capacity in better fashion.

Low Tech/ Medium Profit /Capacity utilization in between 80 to 90% : 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 .This type of categories of industries, when the production has reached between 80 to 90% of production capacity then industry will outsource the components which can be brought from the market at lower prices than manufacturing in-house to improve the profit.

Low Tech/ Low Profit /Capacity utilization < 80%: This is category of industry the industries which has implemented the low technology with general purpose machinery .Industries in this type of category 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. When the demand is higher than the capacity industry have necessarily go to higher outsourcing at appropriate purchase price to improve on the low profit

5.0 Conclusion:

Based on the research conducted, it is found that the capacity is a significant factor influencing ‘ make a decision ’ of a part with a different mean values and standard deviation. To keep up with the increasing demand from the customers, respondents have to outsource some of its part/component to supplier maintaining the same

quality standards and at less prices than in-house manufacturing cost of company, so that they can shorten waiting time and deliver the product on time. If production capacity reaches its limits shows that at lowest limits total cost increases with decrease in percentage of make parts, and at the higher limit the total cost decreases marginally, while the percentage of make parts increases. However it may lead to loss in quality .It is leads to a poor capacity management implemented in the company. Therefore respondents should plan, establish, measure, monitor, and adjust levels of capacity so that sufficient capacity is available to permit execution of the manufacturing schedules

Following conclusions are drawn from this study

5.1 Ratio of make parts to total number of parts (in percentage) increases from low capacity utilization to high capacity utilization (Mean value of capacity decreases) for different type of profit making industries and for different level of technology based industries.

5.2 Cost of Make parts decreases with decrease in mean value of capacity utilization for different type of profit making industries and for different level of technology based industries. This is because of higher mean value indicating more outsourcing (low capacity utilization) and lower mean value is obtained for High Tech-High Profit industries, indicating more capacity utilization.

5.3 For High-Tech industries (average of) ratio of make parts to total number of parts in percentage is 42.5 for high profitability with 1.96 mean value of capacity utilization and 38.3 and 4.65 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 with 1.69 mean value of capacity utilization, 36.5 and 3.66 for medium profitability , 35 and 4.10 for low profitability

For Low-Tech industries (average of) ratio of make parts to total number of parts in percentage is 35.5 for medium profitability with 3.61 mean value of capacity utilization and 33.4 and 3.75 for low profitability.

REFERENCES

[1] Afuah. A. (2001), "Dynamic Boundaries of the Firm: Are Firms Better Off Being Vertically Integrated in the Face of a Technological Change?," Academy of Management Journal ,Vol.(44).No. (6),pp. 1211-1228.

[2] Canez, L., Platts, K. and Probert, D(2000). , "Developing a framework for make-or-buy decisions", International Journal of Operations & Production Management,Vol.(20),No.(11), pp. 1313-30

[3] Charles H. Fine, Daniel E. Whitney.(1996), " Is The Make-Buy Decision Process A Core Competence?", MIT Center for Technology, Policy, and Industrial Development,pp.1-31

[4] David Wu S.(2005),"Managing Capacity In The High-Tech Industry :A Review Of Literature", The Engineering Economist, Vol.(50),pp. 125–158

[5] Humphreys, P., Lo, V. and McIvor, R.(2000) , "A decision support framework for strategic purchasing", Journal of Materials Processing Technology, Vol. (107), pp. 353-62

[6] Katikar.R.S,Dr.Pawar.M.S(2009), "Identification of driving factors for outsourcing of the Batch engineering industries", Inter National Conference on "Simulation modeling and data analysis ,Proceedings of SMDA- NIT Calicuit, India, pp 624-629

[7] Katikar.R.S,Dr.Pawar.M.S (2012), "Cost Analysis For 'Make-Or-Buy' Decisions For Manufacturing Industries ", International Research journal of commerce, Business and Social science(IRJCBSS), Vol.(1).No.(9),pp.151-156.

[8] Katikar.R.S,Dr.Pawar.M.S(2013), "Finding the relation between make or buy decisions and profitability for technology based classified batch type of manufacturing industries ", International Journal of Mechanical Engineering (IJME)ISSN(P): 2319-2240; ISSN(E): 2319-2259,Vol. (2), No.(5),pp 135-150

[9] Moschuris, Socrates J. (2007), "Triggering Mechanisms in Make-or-Buy Decisions: An Empirical Analysis": Journal of Supply Chain Management ,Vol.(43),No.(1)

[10] Mohamed I.H. P.and Ahmad R.I.K., " Non-Financial Factor For Make-Or-Buy Decision In SME", Proceedings The 2nd International Conference on Global Optimization and Its Applications 2013 (ICoGOIA2013) Avillion Legacy Melaka Hotel, Malaysia 28-29 August 2013

[11] Nikolarakos, C and Georgopoulus, N(2001)., " Sourcing: Issues to be considered for Make-or-Buy Decision"'. Operational Management, Vol.(1),No.(2), pp. 161-179

[12] Parasia Alagheband.(2006), "Adoption of e-Banking services by Iranian customers", Master thesis, Lulea University of technology

[13] Sekaran,U.,Research Methods for Business, A Skill Building Approach (4th Edition), 2003, New York: John Wiley & Son

[14] Richard B, Nicholas J.A. and Robert F.J. (2002),Operations Management for Competitive Advantage, theMcGraw Hill Publication, 9th ed., pp. 356-367

[15] Shahidul,M., S. T. Syed Shazali, Abdullah Y., C. H. Ting, A. H. Hishamuddin, M. S. M Azrin,and A. F. K. Adzlan,(2013), Measuring Machinery Capacity Utilization and Its Impact on Manufacturing

Performance and Environment, Journal of manufacturing Operations Research andSustainability, Vol.(1), No. (1) pp. 7-12.
[16] Source: http://www.allbusiness.com/glossaries/planned-capacity/4945922-1.html#ixzz2FIapZeAJ
[17] Tim Gallagher etal (2005) :http://www.werc. /assets /1/workflow_staging/Publications/666.PDF

Graphical representation for Capacity utilization ,Make parts in % and Total cost of a product