

An Empirical Study on Make-or-buy Decision Making

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Received: 09 July 2021; Revised: 28 July 2021; Accepted: 16 August 2021; Published: 08 February 2022

Abstract: Every enterprise will be based on the other enterprise to manufacture, product items/parts, for make or buy. The make-buy decision is based on the assessment whether it should be manufactured or buy it from an outside supplier to produce a component internally or to buy it from the outside. It depends on cost and profitability. The cost for both the alternatives may be calculated and the alternative with less cost is to be chosen. The aim of any enterprise is to improve its performance that is measured in terms of profitability. There is some research that has been carried out to make the decision based on profitability of the enterprise for make or buy decision. The strategy is based on cost, flexibility and responsiveness of work to be carried out. However, some of the research is required to maintain the relationship between profitability and make or buy decision.

The reports of this paper attempt made on how buying decision influences the performances of an enterprise. The different sectors were chosen for the study such as Manufacturing, Automobile, Food, Textile and Hospitality. The focus of the study was based on three theories such as operational control, performance management and decision. The paper reveals the current trends and make or buy decision of the components and its relationship in taking decisions. It also discusses the two techniques break even analysis and economic analysis for decision making in make or buy decision. The study discusses the advantage of outsourcing and discusses the four theories in the study for make and buys decision

Index Terms: Inhouse, Outsource, Enterprise, profitability, make-buy

1. Introduction

Make and Buy (MoB) decision will be acting to manufacturing in-house or purchasing it from outside. It is not an easy task to decide upon. Many factors are depending upon the decision to make or buy. The decision is not easy. Many factors are responsible for the analysis of the Make or Buy criteria. In this Paper MoB decision is based on strategic level decision, operational level, firm-level, and performance management decision. The private companies in India have to invest more in their research and development (R&D) department, particularly to provide a leadership solution and also have more businesses in India [2].

There are many factors in favor of insourcing (manufacturing) decisions. Some of them are quality, cost, design, lead times, warehousing expenses, transportation, political, environmental, and social reasons. Also, the factors in favor of outsourcing are suppliers, lack of expertise of suppliers, cost aspects that suppliers sell at low cost, Brand of suppliers who supply the different companies, Inventory, and procurement. Various types of expenses can be involved for insourcing and outsourcing. The expenses for in-housing manufacturing companies are labor expenses, operational expenses, managerial expenses, purchasing expenses, capital expenses and material expenses, etc; (Mudambi and Tallman, 2010). While for outsourcing expenses are transportation, go-down, management expenses. The criteria for making can be cheaper to make but the product quality control, flexibility, quick response are the other factors imbibed in whereas the criteria for buy high- investment would be required.

The advantages or disadvantages of an MoB decision can be considered at the time of the finalization of the deal. The generalized advantages in making decisions are easier communication, agility and ability to respond to the market quickly, cost-effectiveness and no minimums, IP address, and physical property protection. The disadvantage is the company has to share the secrets with the third party or outsourcing company

It is the most crucial decision for the organization to Make-or-buy (MoB), especially for manufacturing companies. Typically, manufacturing companies have hundreds of components, each of which can be made in-house or outsourced. The decision of sourcing not only depends on cost but also the quality of the products and sub-products [37]

Production environments of organizations in new ways have been emerging, allowing manufacturing companies to address the increasing demand for flexibility, to improve on-time delivery, and to reduce lead times. Companies generally recognize that tight interaction and coordination among all the participants of their supply chain is a key requirement for their survival and success [22]. Constant change and complexity are challenges imposed by current and future markets. There are many companies in the market that face Competition by shorter product life cycles, volatile demand, and time to market is market, globalization, and mass product customization. This new reality naturally leads companies to network with other companies and drives integration along different axes, namely geographical(physical) and functional (process)[15].

Companies are in the general part of much broader business systems composed of customers, suppliers, products, and global information. To participate in these forms of global business, manufacturing companies need to develop their ability to respond quickly to customer's requirements and to co-operate closely with their restricted materials and the components of a product but also apply to non-manufacturing activities such as support services [17]. Many organizations want an enormous potential number of outsourcing decisions. Besides profit and cost, outsourcing decisions also involve consideration of strategy issues, risk dimensions, and efficiency relating to lead times, supplier quality, and delivery performance. When we will club all these factors and will be taken together, a sourcing decision can be highly complex that impact the profitability of the firm. A wrong decision can lead to ineffective firm performance [21, 16, 26].

The factors that affect the decision-making of MoB can be subdivided into positive and negative categories. The factors, which support the decision of outsourcing are called the drivers for outsourcing and are also known as the positive factors. Negative factors are those factors, which do not support (against) outsourcing and that's why can be called concerns for outsourcing [37].

Better focus on core business and cost reduction appear to be the major motivating factor for a firm to analyze the MoB decision. The drivers/concerns of outsourcing can be projected into various border categories. There is a strong need to understand the following reasons behind the decision of the Make or Buy Strategy [24] as shown in Table 1.

Table 1. MoB Study

Broad categories	Drivers/ Concern	References
Core business	This focusses on the core business as that is their competency and another task of business can be considered for buy	[2,13]
	There should be a loss of core activities and Competencies as we are going for buy. So take care of the competencies of the organization.	
Dependent on third parties	The dependence on the supplier for parts and subparts. The supplier chosen should be reliable.	[21,16,26]
	There should be more investment in supplier selection and innovation on the selection of suppliers.	
	The unreliable or incompetent suppliers cannot be considered for either make or buy decision	
	The most important quality is the Trustworthiness of the supplier. While finalizing the supplier it has to be trustworthy.	
Cost dependency	Cost reduction and convert fixed cost into a variable cost. The important cost for make and buy decision	[15,37]
	Loss of internal control if considered for buy	
	Failure to realize hidden costs of contract which includes the cost of the raw material etc.	
	Inadequate cost and benefit analysis systems are important to gain maximum profit in any organization	
Size of requirement and workload	Small-volume requirements then one can considered buy instead for make	[20, 19,12,24,37,18]
	Workload fluctuations as the workforce involved in making	
	Sales fluctuations depend on make and buy decision	

Lack of expertise and New product	Design secrecy is essential to defend proprietary technology as it has to disclose if you go for buy instead for make.	[17, 22]
	Lack of expertise in-house, limited production facilities, or insufficient capacity	
	New product development considered making instead of buy as many important characteristics and parameters are important	

The decision is based on cost and profitability. Both the parameters have equal importance in the evaluation of the organization based on the industry. Based on the study this paper was focused on the study for the flow of action for the make and buy decisions. The objectives are considered further in the study are:

1. Understanding of the importance of outsourcing in the Make and Buy decision
2. The role of breakeven analysis and economic analysis in make or buy decision
3. Limitation and future of decision of Make-or buy

If you consider manufacturing, textile, automobile, hospitality, and food. Something more crucial for the manufacturing industry may not be so important for others and vice versa. There are hundreds of components as a manufacturing company, many of them can be made in-house or can be outsourced, they have to decide upon, and other factors. The sourcing decisions are not only trusted on the material or the component of the product, but also the activities such as the support services, which lie on the outside sources. There are different criteria for sourcing whether it can be making or buying. Many companies usually perceived sourcing positive move for the company. Factually, we know little or what impacts the Strategic decision also.

This research concentrates on the limitations of make and buys decision as it depends from company to company and also the future direction was discussed to help the decision of make and buy in any organization. Also, the study results to discuss the decision of make or buy depend on a variety of factors and this will depends on the field of expertise of the organization.

2. Literature Review

The different kinds of studies have been considered to assess the reasons behind make or buy in the organization. There are many dimensions carried for the make and buy decision, in the 1990s there is a decision on innovative practices and characteristics. But in the 2000s, the firms include operational challenges, economic challenges, and were open for outsourcing. Outsourcing has continued and helps everyone to gain the maximum profit and also the growth of an economy. Now, outsourcing has added a value advantage and also helps in make and buys decisions. The detailed literature review was discussed in this section. The present paper takes the literature from the year 1999-2021.

Veugelers and Cassiman (1999) discussed the innovative characteristics in the strategy of manufacturing firms and scrutinizes the relation between the innovative imbibed characteristics and industry/firm. The study was based on the manufacturing unit of a Belgian company [1]. Azevedo and Sousa (2000) has conducted a study that was on order planning and discussed the limitation on outsourcing of IT and services. The study has been covered in the manufacturing unit. There were many operational challenges for control mechanisms resulting from strategic decision-making on outsourcing, particularly for cases of engineering-to-order were discussed[3]. Arnold (2000) has explored the situation for “make or buy” decisions. It has discussed the various economic factors of outsourcing decisions. It also has discussed the alternatives based on economic theory and used for outsourcing arrangements[2].

Tayles and Drury (2001) have studied the outsourcing components and processes. It conducted the study and designed a strategic sourcing model for make or buy decisions[4]. Anderson and Parker (2002) have discussed the relationship between outsourcing fraction and the rate of technological change. It uses the prediction to study the model more effectively and perfectly[5]. Barthelemy (2003) refers to seven deadly sins of outsourcing, like losing control, hidden costs over the outsourced activity, and being unable to plan an exit strategy. Study shows that the outsourcing has a calamitous effect on the productivity of labor. Finally, there is a trend towards insourcing in Germany[32]. Quelin and Duhamel (2003, p. 647) discussed that the saving on the cost of monitoring suppliers must be balanced with the operational cost of outsourcing. Also, it has discussed the parameters effective for strategic decisions [33].

Lammers (2004) has built a decision framework combining the resource-based view, transaction cost economics, and production economies. The arguments used in the framework are the resource-based view, transaction cost theory, and production cost theory to decide upon making, buying, or sharing an activity[6]. Weidenbaum (2005) has evaluated Outsourcing(domestic and international) in response to management's desire. It has also focused on the identification of the firm's in-house activities on its core competency for development [7]. Gilbert et al (2006) have explored the production and outsourcing decisions in the manufacturing units. It has worked to maximize combined profits[8].

Ruffo et al (2007) have discussed the qualitative approach. The considerations were the firm based on its experience in Rapid prototyping or Rapid manufacturing[9]. Arya et al. (2008, p. 255) have discussed the trend used in

the make and buy decision such as flexibility, capacity bottlenecks, quality and coordination costs, etc. It also works on the back sourcing decisions that perceived outsourcing as a positive move for the companies[10]. McIvor (2009) based on the performance management techniques that were applied in outsourcing. The span was taken for a three - year period[11]. Ekelund and Pettersson (2010) studied based on the innovative strategy of manufacturing firms. It is also based on examining the relationship between innovation strategy and industry[12].

Mudambi and Tallman (2010) explained the innovation in strategy. It has been seen that risks and costs and low appropriability of innovations do not discourage innovation. It has been found that Small firms restrict their Z-Z innovation. In this case study, Survey data has been used that is based on empirical analysis[13]. Dekkers (2011) has conducted the study based on three theories: decision making, operational control, and performance management. This study has been carried out with 5 cases of a variety of firms and conducted a study on the make or buy decisions. The explorative study was considered and it indicates that strategic decision-making on outsourcing-based systems[14]. Martens and Teuteberg (2012) have studied the operational issues in the manufacturing area and the full involvement of management and its activities. The use of outsourcing in manufacturing strategies resulted in academic literature. Many researchers have related outsourcing confidently to the performance of manufacturing organizations [15].

Danese(2013) suggested a sustainable outsourcing strategy in which a textile manufacturer outsources to international markets for cost savings and outsources to the domestic market for capacity flexibility[16]. Bianchi et al (2014) have discussed that Operational cost, penalty cost, and outsourcing risk are considered to be objective functions[17]. Mensen and Atan (2014) conducted the study that includes the assignment of contracts to suitable facilities, the quantity of each contract, and allocation of reserved capacity flexibility among domestic suppliers. The study was based on a Multi-objective problem of this research was solved using three variants of goal programming[18]. Hübner et al (2015) discussed the various dimensions in the theoretical literature to explain the firm's decision to innovate or not and when innovating, to make and buy technology. It is based on the type of firm, size, and technological innovation. It also depends on organizational attitude, nature of the know-how and internal R&D capabilities, etc [19].

Domestic outsourcing provides capacity flexibility which will result in cost-saving and is considered to be a reason for international outsourcing [23]. Therefore, the outsourcing risk and capacity flexibility were combined in a sustainable outsourcing strategy. Pratama and Rosyidi (2017, November) discussed the Make or buy decision model which was based on a multi-stage manufacturing process and is also based on the supplier supplying the imperfect quality of goods[25]. Kim and Choi (2018) proposed insights for outsourcing decision-making in the current global environment[26].

Meng et al (2018) discussed the outsourcing risks in international destinations. The risks for the outsourcing were entitled as “the product of the probability of risk at a destination and the production quantity assigned to that destination”. The probability of risk can be estimated based on risk factors[27]. Arya et al (2008) discussed the essential inputs of make or buy. The study was based on independent suppliers. It was based on the cost of production. Retail management is a rival and has a margin to decide on the make or buy i.e. in-house and outsource[10]. Zhang et al (2019) examined the firm boundary for product-service offerings for a manufacturing unit. It also developed a product-service ecosystem through collaboration with service providers in certain types of business services that can increase performance[28].

Rosyidi (2020) has determined the optimal model which will help the decision-maker in making decisions. The study has considered the comparison of price and quality and found that it is a dependent demand model. It has discussed two models based on the make regime and the buy regime. The price and quality level will determine the demand for the product. Also, the cost components include material purchasing cost, manufacturing cost, and quality loss[29]. Shang and McEwan (2021) studied the production of corn farms in Ontario. The study was based on cause-effect analysis to identify the requirement of corn. A new theoretical model is proposed that enables efficiency and profitability to the stakeholders[31]. Rosyidi (2021) discussed the tolerance in technological aspects in engineering design and manufacturing stages. The study of making and buy decisions depends on manufacturing cost and quality loss. In any design, the tolerance should not be compromised on quality[30].

3. Research Methodology

This indicates the various studies and is a decision to justify the theories involved for making or buying decisions. They are explained in Fig.1. There are four theories for MoB Strategic decision making, operational level, performance management, and Firm-level.

In strategic decision making, analyzing for making or buying decisions in the Indian industry can be explored by using two techniques: a) break-even analysis and b) economic analysis. The Indian industry has taken over many operations concerning the product and services. The main thing about the make and by whether we should go for making a product or we should go for a third party for buying the product.

For operational level, Operational matter for outsourcing involves Scheduling and planning, organizational structure, and purchasing activities, such as Production process, logistic activities, and control mechanisms

Next, the Theory for decision is performance level, Performance measurement is uncertain activity. It is difficult to measure the performance of logistics service providers for this activity. The performance is based upon Quick Response, Reliable and consistent delivery, Minimum product damage, and Inventory Reduction. Finally based on all the researches in a variety of areas it was examined a framework analysis was done and try to identify the sources based on cost and time analysis for the make and buy decision.

That is a very crucial decision for a company because it involves quality, cost, and profitability. There are many other activities or parameters in the organization that is responsible for making and buying decisions for any industry. It is a very crucial and indirect decision. The strategic decision is a cyclic activity which constituted as shown in Fig 1

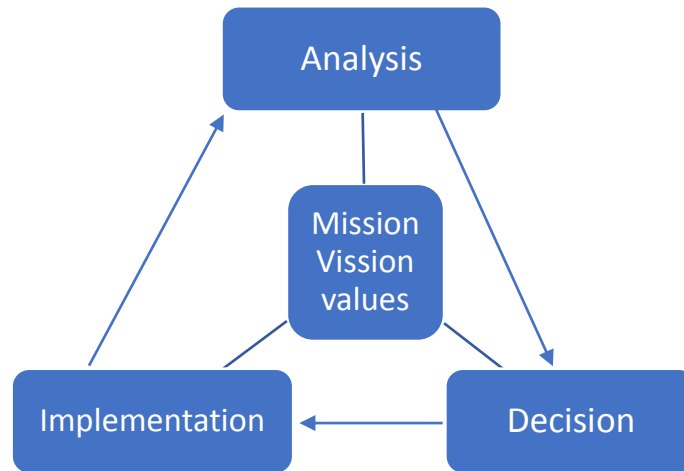


Fig.1. Strategic Decision Learning cycle

The approaches for make and buy decision are;

Simple cost analysis: It is often helpful in determining the price you should charge for a new product or the number of units is an important factor. We have used the variation of quantity and determined the revenue, variable cost, total cost and profit and details are discussed in the analysis section.

The formula used for the calculation of simple cost analysis is based on variable cost (VC) and Fixed Cost (FC) and Revenue. The details of calculation are as under:

$$\text{Revenue (R)} = \text{Price(P)} * \text{Units Sold (US)} \quad (1)$$

$$\text{Variable Cost (VC)} = \text{Cost Per Unit (CPU)} * \text{Units Sold (US)} \quad (2)$$

$$\text{Total Costs (TC)} = \text{Variable Cost (VC)} + \text{Fixed Cost (FC)} \quad (3)$$

$$\text{Profit(P)} = \text{Revenue(R)} - \text{Total Costs (TC)} \quad (4)$$

Economic analysis is a study of a production process or an industry. The analysis aims to determine how effectively the economy or something within it is operating. For example, an economic analysis of a company focuses mainly on how much profit it is making. Let's consider the example for better understanding.

The abbreviations used in the formula are

Demand /year(D)
Purchase price/ Item cost (P)
Carrying cost/ Holding cost (Cc)
Ordering cost/Procurement cost (Co)
Production rate /no. of unit per year(K)
Demand /year (r)

$$\text{For purchase model, } Q1 = \sqrt{\frac{2 * c0 * D}{Cc}}, \quad (5)$$

$$\text{Total Cost for purchase model} = D * P + \frac{D * C_0}{Q_2} + \frac{Q_1 * C_c}{2} \quad (6)$$

$$\text{For Manufacturing model, } Q_2 = \sqrt{\frac{2 * C_0 * D}{C_c(1 - \frac{r}{k})}} \quad (7)$$

$$\text{Total Cost for manufacturing Model} = D * P + \frac{D * C_c}{Q_2} + C_c(k - r) * \frac{Q_2}{2 * k} \quad (8)$$

Break Even Analysis: Breakeven is that point where the difference of Total sales and Total cost is zero, which means profit equals zero or in other words there is no loss and no profit.

Simple cost analysis: A company produces number of items as 500, 5000, 50000, the fixed, variable and variable cost, Labor Cost, Material, Overhead Cost are mentioned below in the table-2. Which decision is profitable for the company considering the three slab of quantity 500, 5000 and 50000? Create model and justify the results.

Table 2. Simple cost analysis

	Model 1	Model2	Model 3
Number of Units	500	5000	50000
Fixed Cost	10,00,000	10,00,000	10,00,000
Variable cost	300/Unit	300/Unit	300/Unit
Labor Cost	350/Unit	350/Unit	350/Unit
Material	100/Unit	100/Unit	100/Unit
Overhead Cost			
Buying price	1000	1000	1000
Cost of Making	1375000	4750000	38500000
Cost of Buying	500,000	5,000,000	50,000,000
Difference	-875,000	250,000	11,500,000

It has been examined that the breakeven for this case is Rs 4000/- as shown in Table 2. It means the quantity to be manufactured is less than 4000, then the company should go for buy, else go for make. The graphical interpretation is as defined in Fig.2

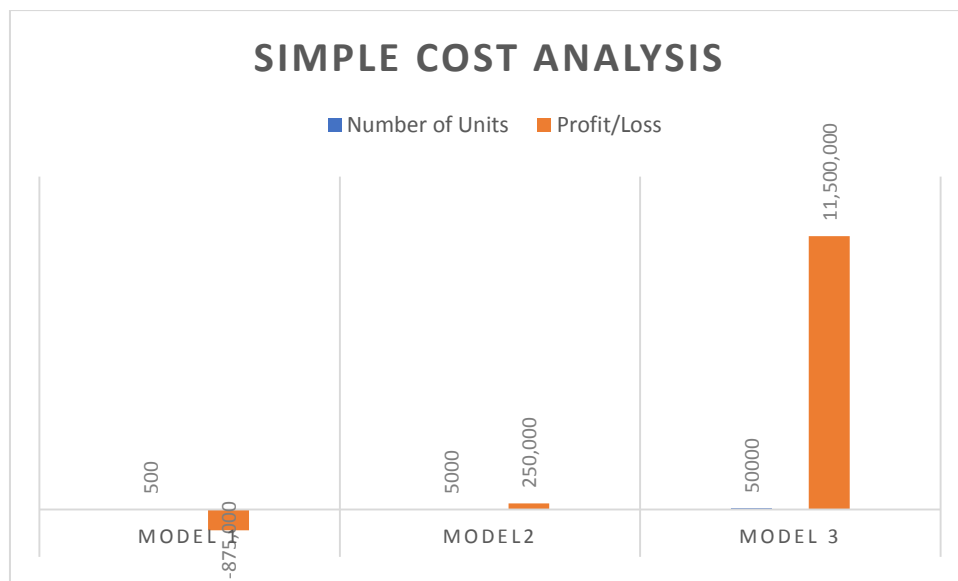


Fig.2. Simple cost analysis

Economic analysis: The quantity of machine part on demanded yearly is 5000 units. The other costs in respect of make or buy are as given in the table below:

Table 3. Economic analysis

Purchase Model-Buy		Manufacturing Model-Make	
Economic Analysis		Economic Analysis	
Demand /year(D)	50000	Demand /year(D)	50000
Purchase price/ Item cost (P)	10	Purchase price/ Item cost (P)	10
Carrying cost/ Holding cost (Cc)	2	Carrying cost/ Holding cost (Cc)	2
Ordering cost/Procurement cost (Co)	150	Ordering cost/Procurement cost (Co)	80
Q1	2739	Production rate /no. of unit per year(K)	10,000
		Demand /year@	5000
		Q2	2828
Total Cost	505477	Total Cost	502828

The calculations in different slab as under:

Table 4.Total cost calculation

Total Cost		
Quantity	Purchase Model	Manufacturing Model
500	5548	6556
5000	51732	50894
50000	505477	501556

The pictorial display of the purchase and manufacturing model is as given in Fig.3

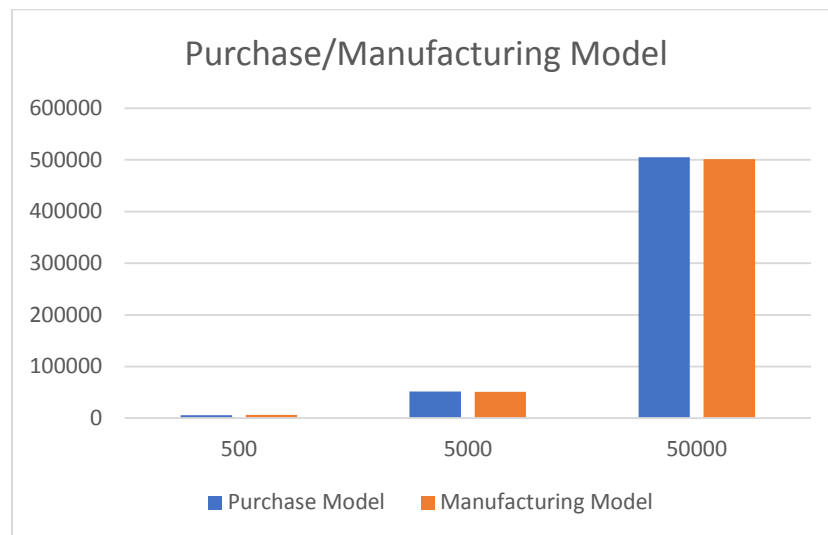


Fig.3. Purchase/Manufacture Model

This is a learning curve that will go on and on for the Strategic decision, making it appropriate. go for analysis, then decision and implementation. The first is the simple cost analysis, the second economic analysis and the third is the break-even analysis. The decision of the comfortability for the company to make and buy decisions. The other analysis factors are Operational control and performance management. The operational control where you can stress upon the control over the processes and their quality. The profit involved in, deciding on the purchase of raw material. The operation matters to the Outsourcing involve not only the cost but the resource planning. This will help the individual to look forward to other mechanisms as well when looking for the decision of make or buy. The processes such as Production processes, logistic activities and control activity, and in-house and outbound logistics. The other analysis dimension is Performance Management that plays an important role in the making or buys decisions. It is difficult for

the performance of Logistics providers where one can judge the activity by parameters such as Quick Response, reliable and consistent. Delivery time should be minimum, the less product damage and inventory reduction. The cost comparison between the make and by there is different costs which are being involved for the cost for making. The in-house is the protection causes the extra cost, monitoring cost, storage cost, and the waste material disposable cost. The cost of buying involves the product purchase cost, sales tax costs, shipping cost, inventory cost, and ordering cost.

Barthe lemy (2003) refers to seven deadly sins for outsourcing, like hidden costs, losing control over the outsourced activity, and failing to plan an exit strategy. The text analytics was applied for the research papers studied for secondary research analysis and found that using the network diagram [32]. The important words having high weightage are bold and showing the strong association between them. Text Analytics is used in Network diagram analysis which will help in distinguishing the important factors related to logistics and outsourcing as shown in Fig.4.

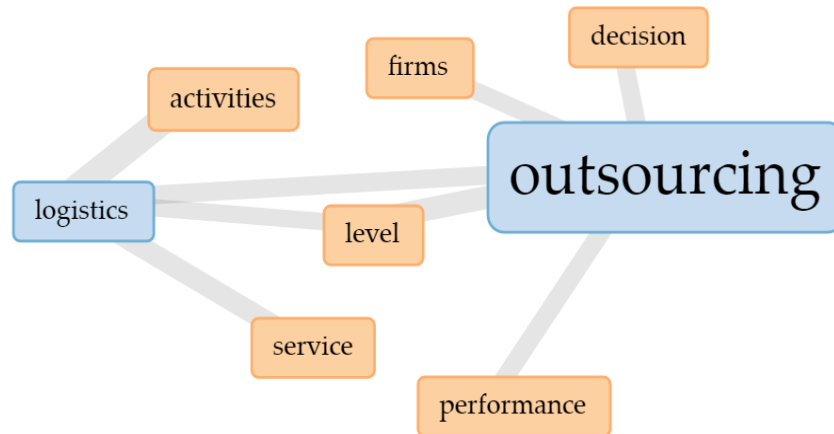


Fig.4. Network diagram

This network diagram validates the study and the study and analysis carried out for the study to make or buy decisions.

The results of the analysis are considered as follows:

1. There is a high correlation between sourcing and logistics. The sourcing decision is based on the logistics of the company/firm
2. The activities and services offered by the company/firm are important for their logistics
3. Performance, level, firm, and decision are important theories used for sourcing decisions of any company/firm.
4. Logistics and outsourcing are connected through the level or operation level of the company/firm

Limitations

The predominant factors were identified from this empirical research for the analysis of make or buy decisions that influence the organisation to some extent but this cannot be generalized for all domains and companies. The decision depends on the factors such as size, organization structure, skilled resources working in the organization, capacity, turnover, and longevity of the organization, etc. The study has been followed on specified sample size, so there is a possibility that it suffers certain limitations. The results will be more accurate considering the bigger sample where more criteria/conditions are considered for analysis.

The sourcing also depends on the type of industry such as hospitality, manufacturing, textile, automobile, and manufacturer. The nature of work will also be a key factor for analysis. Also, the location of the firm whether it is in the village, semi-urban, urban or city, organization or country.

4. Discussion and Conclusions

This research has carried broadly the two types of analysis, i.e breakeven analysis and economic analysis. Both the analysis doesn't provide the results to make the decision for make or buy. There are many other factors as well for the make and buy decisions. They are quality, sustainability expertise of manpower and feasibility, and finally the amount of quantity. The analysis is not sufficient for any organization to decide on Make or Buy. In general, many other dimensions will decide the decisions.

Skilled and Unskilled resources are the valuable asset that is most important for the company. The analyses prove that every organization must be focused on keeping the staff satisfied and happy. The longevity of the employees helps in taking the decision and it becomes a repetitive task to be carried out in making and buying decisions. The self-analysis will work and it helps the company to grow and take the decision in favor of the company. The company can

take a risk by trying or a combo approach to start with. Valuable feedback and self-analysis will be provided and helpful for the company to make decisions. Thus, top management should have trust in their subordinates and also wants their customer happy. This will be very dynamic for the growth of the company.

5. Future Research Directions

The limitations of the study have provided a new dimension to the companies. There are third-party vendors who have come forward and will be discussing all the related and interrelated tasks such as booking for tables and order for food etc. Many companies opened their business such as Urban Clap has started extended in almost all directions. Also, during pandemics, Uber has diversified their business to food delivery like Zomato and Swiggy. Many SMEs have also started their business in an online format as well. Together, digitalization has evolved and helped all SMEs in their businesses. Based on the research study, the future directions are as follows:

- The comparison of different countries can be considered for the broader results.
- Based on existing literature, the review was conceptualized on this topic.
- Receiving different types of inputs from top management and the company owner may have provided very useful vital inputs.

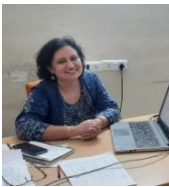
The future of the study may think for the techniques Artificial Intelligence, Artificial Neural Network and Blockchain [34,35,36].

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How to cite this paper: Monika Arora, Anand Kumar, "An Empirical Study on Make-or-buy Decision Making", *International Journal of Education and Management Engineering (IJEME)*, Vol.12, No.1, pp. 19-28, 2022. DOI: 10.5815/ijeme.2022.01.03