Cost Optimization Approach in Input-Output of Manufacturing Smes Growth towards Sustainability: A Review

Houssein M.A Elaswad, Abdalla Omar Dagroum Ail

Abstract— **this paper aims to describe the determinants of cost optimization to be useful for production and operation managers of small scale manufacturing SMEs. The proposed determinants have gathered by extensive review of manufacturing cost, production cost and SMEs literatures. This research is based on the case studies, corporate experience, and the views of international funding agencies on SMEs. We have studied about 95 contemporary publications on the relevant area. Literature review revealed that cost optimisation of manufacturing SME depends on some internal and external factors. The internal factors are management cost, cost of labour, and size of capital investment, plant location cost, ICT cost and capability, and cost of supply chain, smooth energy cost. Manufacturing SMEs also do not follow comprehensive framework to develop their productions and operations strategies and quantify their competitiveness. The present paper has tried to identify potential cost optimisation inputs related to manufacturing operations of SMEs.**

Index Terms — Manufacturing SME, Cost Optimization, Cost Factors, Input-output Factors.

1. INTRODUCTION

This paper presents a literature review on manufacturing SME. This work attempts to identify and describe the cost optimization factors of small and medium sized manufacturing enterprises SMEs; and strictly targeted to identify potential cost optimization factors to be used in formulating sustainable SMEs business strategy. In particular, our interest is to make study outcomes useful for the floor level managers involved in day-to-day production and operations of manufacturing SMEs. We start with reviewing literatures published in SMEs which covered both economy and operations management. However, the conceptual framework of this study is based on production function and engineering concept of manufacturing; and particularly, it is influenced by productions and operations management literatures. Information on the opportunities and bottlenecks in managing SMEs were gathered from past and contemporary research papers. However, this paper aims to open a new window in manufacturing domain for building- up a sustainable SMEs cost optimisation model.

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To identify optimization cost factors (cost of land, cost of construction, cost of utilities, cost of labour and skilled labour, supply chain management cost, inventory cost, plant location. cost, R&d cost and innovation, energy cost, ICT cost, cost of quality, management cost), Increased firm size and growth, therefore, needs to be encouraged for larger size can result in economies of scale and scope, reduced production costs, improve efficiency and competitiveness [1]. On the other hand, output growth resulting from productivity growth will cause unit costs to fall increasing the firm's profitability.

Based on the statement mentioned above, we can conclude that in the previous study emphasis was not given much to evaluate SMEs in the perspective of cost optimization in operations and production management, and therefore a gap exists in this sector. It is true that in the last few decades the research in SMEs has moved from the conceptual domain to application domain in the perspective of economic development, but still a huge gap exists in operations management perspective.

This review work has been designed to meet this gap and to address the SMEs growth factors issue which previously did not get the right attention. However, the literature review plan is made to reveal growth factors of manufacturing SMEs within the structure of cost optimization in production and operations management with aiming to build up a conceptual model of sustainable manufacturing SMEs. This paper is divided into four main sections. In the next section we review some existing definitions of and research on SMEs and growth potentials. Section three presents findings of the literature. Finally, section four contains closing comments and future study.

2. LITERATURE REVIEW

2.1 Cost Concept

Cost concept is the sum of the marginal costs over the range of each output differential between the alternatives under review.' In practice, this is often approximated by the summation of average variable cost (assumed to be constant over the affected output range), with differential fixed costs recognized when significant [2]. Also, cost concept was definitely by [3] as "the change in total cost resulting from a one-unit change in output when the firm has ample time to meet the changing in out- put by changing the scale of the plant. This definition may be amplified by providing that the firm may change not only the scale of its plant but its methods as well. It also could be objected that the one-unit increment is too small to have any operational meaning, particularly in view of the indivisibilities in many of the productive inputs.

Furthermore, the costs are the amount of money representing the resources spent in the production of output. A resource is a physical entity that is required to be able to execute a certain operation. Resources of cost can be machine tools and equipment, but also operates and raw materials. Output could be products. The wide definition of costs is related to the economic resources; workforce, equipment, real of fixed and variable assets, supplies and all other resources necessary to accomplish work activities or to produce work outputs [4]. Generally, costs are expressed in terms of units of currency. Moreover, [5] stated that Honda were able to reduce manufacturing costs of the Accord by nearly 25% through process innovations. These cost savings allowed Honda to develop a product with more features that create value for customers. Added, [6] commonly attributed to the scientific management movement, the advent of cost management may actually have occurred with earlier British industrial entrepreneurs. Techniques have evolved over time as industry firms have sought to increase efficiency while maintaining competitive levels of innovation. [7] asserted that in attempting to implement any productivity improvement drive in any organisation, a business ought have a clear image and strategy in forecasting a project's likely cost and duration. Thus the definition of cost concept is total cost includes costs of production operations, fixed cost, the costs of the resources that have already been incurred and will not change regardless of any current or future decisions, costs of production that vary with quantity of output and of output marginal cost.

2.2. Cost Optimization

Manufacturing organizations face a strategic increasing revenue and decreasing costs to enhance profitability. In this situation, cost optimization is often thought to be a purely cost reduction exercise. However, [8], discussed the cost optimization aims at reducing the costs 'built-in' the product; this will ultimately help in increasing the profit margin of the product by lowering the price, and expand the footprint of the product in virgin markets as also in existing markets. Cost optimization based on process estimation criteria. However, obtaining the optimized results could be a pest time consuming, when there are a large number of processes to be evaluated [9]. Cost optimization techniques to specific methods for overhead cost, from exceptional approaches for estimation at the conceptual design stage to general costing rules designed for use at a later stage in the design cycle. Also, from classical costing methods are to highly novel cost estimation techniques [10].

Cost optimization plays an important role in a firm's to growth. It requires focus on full cost structure, culture of optimizing the costs, systems for continuous cost evaluation, and access to different cost optimization techniques. For manufacturing organizations, cost optimization requires a holistic view on the cost across the complete product realization value chain. Through effective cost optimization, firms could create differentiated products; improve their potential for innovation [8].

2.3. Impact of Cost on Manufacturing SMEs Growth

To grow successfully over an extended period, firms need to develop their internal organisation structure in ways that enable the leader of the firm to delegate responsibility for operational tasks and focus more on planning and higher level strategic functions. An important threshold for owners and managers of small manufacturing companies to cross appears to be the transition from being what is in effect a factory manager, to managing the assets of the company, so as to maximize the potential of the business [11]. Therefore, firm's emphasis in public policy was on increasing the rate of new enterprise formation, more recently there have been a growing recognition of the importance of helping expanding firms overcome growth constraints and by encouraging established SMEs to maintain and improve competitiveness [12]. Also It has been argued that putting more money into start-ups is less cost effective than helping to establish SMEs to grow faster [13].

To identify the nature and effect of obstacles, we develop a model of the space of innovation to investigate the external innovation barriers encountered by SMEs. The three sides of this triangle are opportunity of innovation, risk of innovation and cost of innovation. Opportunity of innovation covers issues related to competition fairness, industrial monopoly, and opportunity to obtain public support. The cost of innovation refers to the tax burden, access to financing, and entry barriers. Risk of innovation refers to the ability to cope with complex regulations, availability of external service, degree of market power, and channel and information for new technologies and markets [14]. Despite of the contribution that taxation can make towards the Gross Domestic Product (GDP) in general, much attention is also needed to the side effects of tax towards the growth of SMEs [15]. [16] conducts that geographical of SMEs as proximity brings supposed agglomeration effects in terms of innovation and knowledge transfer that results in cost reduction and improving the competitiveness of industrial growth sectors, regions and nations. According to [17], suggested that, if companies planning to enter foreign markets that require local adaptation of products and therefore local R&D they need to be sure that the potential of SMEs growth and the target market is sufficient to achieve a favourable cost structure. If firms have reason to expect problems for companies in achieving needed experience curves economies of scale and learning curve effects they should reconsider the market entry.

2.4 Product Costing Framework

The SMEs has begun improving manufacturing cost of using methodologies such as:

Activity-based costing (ABC): ABC assumes that activities related to products, and cause of the costs. ABC first assigns costs to the activities performed by the organization (direct labour hour, machinery hour, training of workers, regulatory compliance) and then attributes these costs to products, customers, and based on a cause and effect relationship between each activity [18].

Life cycle assessment (LCA), in its various forms and levels of detail from life cycle thinking to detailed LCAs, is the primary and established tool for assessing the environmental performance of a good or service within LCM Life-cycle assessment (LCA): LCA is a design discipline used to minimize the environmental impacts of industrial systems, products, materials technologies, processes, activities. Life-cycle cost has defined as the amortized annual a product of cost, including investment cost, and disposal cost discounted over the lifetime of a product [19].

Full cost accounting (FCA): FCA considers four levels of environmental costs: direct costs such as labour, capital, and raw materials; hidden costs such as monitoring and reporting;

contingent liability costs such as fines and remedial action; and intangible costs such as public relations and goodwill FCA destines all direct and indirect costs to a product or product line for inventory valuation, profitability analysis, and pricing decisions [20].

However, the product is the aggregated value of all expenditure involved in the manufacturing process. Mathematically the product can be presented by the following equation:

$f(Cp) = \sum_{i=1}^{n} Ci \quad n > 0 \ , \ i = 1$,n=1,2,3,…, (1)

Where ; $f(cp)$ is the product cost ; Ci- input cost such as raw materials, plaint location, machine hours, labour , ICT, energy, inventory, supply chain management, R&D and invention, operation of production management.

3. Dossier of Cost Factors for Manufacturing SME Growth

3.1 Supply Chain Management Cost

SCM represents a conscious effort by a firm or group of firms to develop and run supply chains in the most effective and efficient ways [21]. [22] stated that the supply chain aims to be able to link different functions and entities within and outside the company from raw materials to manufacturing. Moreover, SMEs are not only in search of ways to integrate the disparate systems within the organization, they also propose to extend the whole domain beyond the limitations of the organization to include their trading partners and customers [23]. Furthermore, [24] investigated the cost structure in the supply chain. In his study, having the minimum economic order quantity and minimum net profit requirements, the static cost optimization model for distributing was established, could adjustable parts of customer order quantities as the control variables.

Cost pressures and management it's included those related to technology development, quality and performance were driving industry consolidation on a global scale, extending the span of the supply chains. Political government influences and other market driven trends were as well influencing demand and ultimately forcing further reconfigurations of the networks. The operational level these were undermining efforts to maximize efficiency (Major and Helen, 2003). According to [25] defined SCM is an incorporated manufacturing process wherein raw materials are that transformed into final products, then delivered to customers. A supply chain is comprised of two fundamental parts, integrated processes: (1) the Production Planning and Inventory Control Process, and (2) the Distribution and Logistics Process see figure 1.

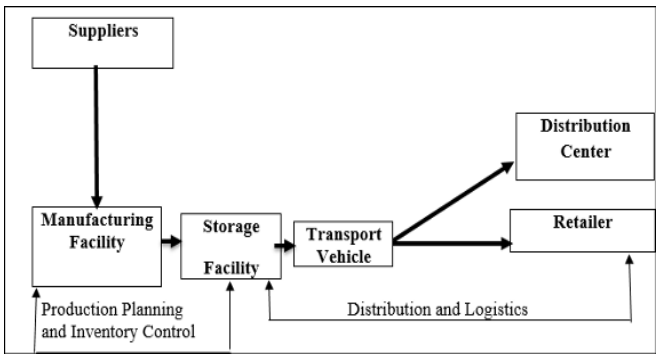

Figure:1. The Supply Chain Process, [25]

3.2 Maintaining operational Supply Chain Coordination with optimal cost

The objective of each heuristic is to determine a minimum cost production and/or product distribution schedule that satisfies the final demand of the product. The total cost is a sum of average inventory holding and fixed costs [26]. [27] was developing a deterministic model for determining the base stock levels and lead times associated with the lowest cost solution for an integrated supply chain on a finite horizon.

According to [5], the key of issues around supply chain integration, interoperability, seller-buyer relationships, cost reduction and Small and medium enterprises- size, which were tackled through different contributions, are outlined leading to a number of recommendations: Supply chain integration in almost all manufacturers, supply chains are becoming a much more important strategic and competitive variable. Businesses are increasingly relying on their suppliers to reduce costs, improve quality and create or develop new processes and products faster that their rivals could.

3.3 Optimization of transportation cost

Technological developments in manufacturing technology contribute to globalization also. Miniaturisation is such a development. Clearly, miniaturisation leads to a lower proportion of transportation costs in the value chain. Therefore, manufacturing for remote markets becomes feasible. Further, competitive prices for miniaturised products imply large investments and high volumes. This development too leads to globalization. At the same time, large investments and high volumes lead to more subcontracting and outsourcing [28]. According to [29] the transportation costs are reduced due to the shorter distances which, by dentition, reduce the risks and therefore the insurance costs. The costs for transportation that need obtaining information could be reduced due to easy access to information about cluster members and their specific competencies and reliability.

Generally, a transportation problem can be represented by linear programming problem in which the objective function is to minimize the cost of transportation subjected to the demand and supply constraints. Following the general mathematical model [30] and [31] which taking the assumption that supposes there are *my* points of original *A*1, . . ., *Ai*, . . ., *Am* and *n* destinations *B1*, . . ., *Bj*, . . ., *Bn*. The point *Ai* (*i* = 1, . . ., *m*) can supply *ai* units, and the destination *Bj*(*j* = 1, . . ., *n*) requires *bj* units. The transportation model is shown in Figure 2 below:

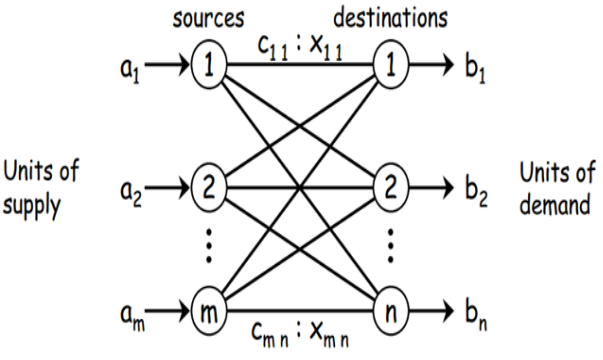

Figure:2 The transportation model [31]

These can be represented by following mathematical model:

$$\sum_{i=1}^{m} a_i = \sum_{j=1}^{n} b_i \quad (2)$$

Where the cost of shipping a unit from A*i* to B*j*, is computed as C_{ii}. If x_{ij} is the number of units being shipped from A_i to B_j , then the minimum total shipping cost can be found by determining the variables of x_{ij} where i= 1,…,m and j= 1, …,n. which can be represented by Equation (9):

$$\sum_{i=1}^{m} \sum_{j=1}^{n} C_{ij} x_{ij} \quad (3)$$

Where,

$$\sum_{j=1}^{n} x_{ij} = a_i \; ; i = 1,\ldots,m$$

$$\sum_{i=1}^{m} x_{ij} = b_j \; ; j = 1,\ldots,n$$

$$x_{ij} > 0$$

Hence, the objective function to minimize total transportation cost is shown in Equation (10):

$$Z = c_{11}x_{11} + c_{12}x_{12} + \cdots + c_{mn}x_{mn} \quad (4)$$

Such model has adopted in Berlin's Telebus service for handicapped people involving more than 2000 requests per day and hundreds of thousands of vehicle tours [32]. According to [30] the Berliner Verkehrsbetriebe (BVG), the main public transport company of Berlin is expected to save about USD70million (DM 100million) per year by using mathematical optimization software.

3.4 Optimal Cost Reduction Using of Innovative Capacity

Cost reduction is one highly desired result of supply chain integration, but not the only one and to some not even the most important one. Do immediate benefits of lower wage costs outweigh the long term benefits of investing in relationships Certainly the wide spread of Internet technologies to get the support of suppliers to compete fiercely on cost efficiency, such as introducing reverse auctions to get the lowest price for components as Ford did, has enabled OEMs to push prices down [5]. However, examples that not all manufacturing is going to move to low-wage countries are the two Japanese car manufacturers Toyota and Honda. They do not source much from low income countries. Their suppliers' innovation capabilities are more important than their labour costs. Accordingly, the two companies aim at a long-term relationship that involves trust and reciprocal well-being. At the same time relationship implicit discipline and the expectation are of improvement and growth. When creating the partnerships, the two car producers try to learn as much as possible about the suppliers, thus being able to cooperate effectively with the suppliers to make their processes leaner [5] and [33]. Whatever approach is chosen, manufacturers require accurate and rapidly available cost estimates at different points in the product life cycle in the decision process,

3.5 Labour cost

The "scientific costing" also showed the need to standardize manufacture of parts in order to reduce costs and eliminate waste. Thus accounting actually affected the production process itself. The whole notion of scientific production many in fact under our principle be viewed as a means to detect or deter cheating. Time motion studies, norms and standards that are used as a basis for standard cost accounting, can be viewed as cheater detection because once employees are trained to do things in the most efficient they no longer have an excuse to not perform according to the norms they were taught. The elimination of excuses through training can be viewed as a way of reducing excuses for cheating through ignorance or incompetence [34]. [35] has suggested that the means of attempting to achieve this end were threefold the restriction of output, the elimination of the control labour costs and price competition. Increasing the labour cost causes higher investment in automated equipment economically justifiable to replace manual operations; machines could produce at higher rates of outputs, automation results in a lower cost permit unit of product. Despite facing somewhat lower wage rates than large large firms, and some fluctuations from year to year, the average growth rates of wage rates (employment costs per capita) were quite similar between SMEs and large Enterprise-Suez (LEs). The greater labour intensity of production in SMEs is reflected in a 15–22 percent differential in the share of labour costs in value added in errand of SMEs [36]and [37]. Farther, [38], findings a significantly positive correlation (r > 0.7) are found between R&D expenditure and productivity. The study concludes that a higher level of labour skills, favourable working environment and R&D are important inputs to a labour intensive manufacturing process, which is optimistically associated with productivity. The manufacturing productivity based on the input-output parameters can be expressed by the following equation:

$$Y(M) = f(K, L, F, R, fp). \quad (5)$$

Where; $f(K, L, F, R, fp)$ is the total factor of inputs: K-capital consists of cost of the cost materials, energy and machine hours; L-cost of labour hours associated directly with the manufacturing process: R-expenditure of R&D associated directly with conducting research on the manufacturing process. Fp–factors associated with production costs that consist of motivation cost of labour and other logistics; Y(M)–outputs in conditions of revenue. In this valid while industries are operating in a highly competitive market, followed by the price difference (ΔM), among the same group of products is nearly zero.

However, the new regulation by raising costs and constraining overtime work triggered different reactions among SMEs. The surveyed SMEs seeks different answers to their changing environment. Hence, only a few case studies have turned to "external flexibilisation" of labour via the combination of short-term with part-time contracts, and the use of subcontractors. Their main motive in implementing this employment strategy is the cost reduction by keeping the amount of labour in response to changes in demand [39]. Moreover, Family firms given a significant preference for part time labour, on average, fewer employees and family firms do not necessarily enjoy cheaper labour in terms of wage costs as a proportion of total operating cost. Although the results vary across industry and for the most parts are insignificant, it makes observe some significant differences in the

manufacturing and mining industries, where the wage ratio is respectively 2 percent and 18 percent higher. The wage ratio as an indicator of labour cost is a very crude measure as it accounts for total labour expenses across all levels of employment, however following such a measure may be useful as an alternative measure of labour input as far as the production function is concerned [40]. [41] they used the standard log transformed Cobb–Douglas production function has been re-specified to include a family business intercept variable, Where Y is a measure of homogenous total output of the firm, L and K are measures of homogenous labour and capital inputs, respectively, and A, otherwise known as total factor productivity, is a constant for all qualitative forces which contribute to output yet are not represented in the quantitative measures of labour and capital so that:

$$\ln(Y1) = \ln(A\,ij) + \alpha \ln(li) + \beta \ln(ki), \quad (\alpha, \beta) > 0;\ j = 1,2. \tag{6}$$

$$ln\,(Y1) = ln\,(A\,ij) + \alpha\, ln\,(li) + \beta j\, ln(ki) + \Theta XI + ei\,(X,\beta) > 0;\ j = 1,2. \tag{7}$$

3.6 R&D Cost and Innovation

Innovation is often linked with organizational efficiency, especially process innovation. Firms are able to develop more efficient means of conducting business through innovation. Nevertheless, innovations generally require substantial startup costs and investment by the organization that could lead to inefficiency. [42] sgest that R&D activities could not improve firm performanc e directly since they are just an input that involves the short term of cost and, those investments that make noun result in innovations are sunk cost that will not improve firm performance. For example, Honda was able to reduce manufacturing costs of the Accord by nearly 25% through process innovations. These cost savings allowed Honda to develop a product with more features that create value for customers [5]. Although commonly attributed to the scientific management movement, the advent of cost management may actually have occurred with earlier British industrial entrepreneurs [43]. Techniques have improved over time as firms have sought to increase efficiency while maintaining competitive levels of innovation. Additionally, the results demonstrate that the costs associated with innovation have a disproportionate impact on small firms, which are affected more than larger firms. Moreover, it means that process innovation is more likely to have a labour substituting effect at the firm level than product innovations, that meaning firms facing decline capacity investment in a labour saving process innovation to reduce costs [42]. The relation between technology, innovation and firm performance see Fige.3.

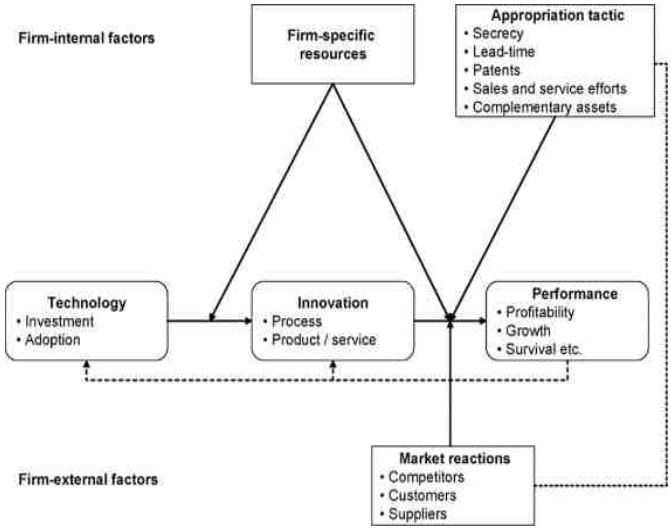

Figure:3. Relation between technology, innovation and firm performance [42].

On the other hand, the managers of SMEs should invest less intangible assets, but more in those areas that wish to directly generate their future competitive advantage in R&D to generate knowledge, and in their workers' creativity to stimulate additional new innovations in existing technologies [44]. [45], indicate the resources provide organizations with the flexibility to practice innovation. That is not only doing available resources provide the necessary inputs to innovation, but also reduce obstacles and risks to the organization when implementing the innovation. Also, [46], unless the factors of berries invention to product, process, and management innovation among a sample of 294 Spanish manufacturing SMEs located in the Murcia region of Spain. A major finding of the study is that barriers have a differential impact on the types of innovation. Manage innovation and Product process are affected differently by the different barriers. Process and management innovation are negatively affected by internal barriers, such as human resources and weak financial position, and positively affected by barriers originating from the environment. The risk factor associated with cost and financing problems is significant for only management innovation. The most significant barriers are associated with costs, whereas the lowest barriers are associated with manager and employee resistance. Moreover, the results demonstrate that the costs associated with innovation have a disproportionate impact on small firms, which are affected more than larger firms.

However, often scholars have posited that while innovation has the potential to create the opportunity for increased performance the act of innovation can be very costly and risky and has the potential to decrease financial performance [47]. Also [48]and [49] added the small firms start, on average, with lower overall skills of knowledge resources, adding more or new types of innovation linkages is likely to have a larger proportionate effect on small firms. For small firms the search for knowledge created elsewhere may also be a more viable way of acquiring new knowledge than an in-house generation due to the costs and risks involved in R&D activity.

3.7 Energy Costs

Currently the attempts to use optimize energy efficiency and environmental impact are increasingly present in all activity areas and specifically in manufacturing industry. An

innovative proposes to achieve these optimizations lies in an advanced combination of Ambient Intelligence technologies and Knowledge Management. The following describes such a solution of an ambient intelligent condition monitoring system for energy management, consecrated to manufacturing SMEs, to extend comprehensive information about the energy use, also the knowledge based support for improvements in energy efficiency [50]. Focusing on the structure of the industrial, firstly, it could be observed that is largely composed more than 99 percent in almost all countries of Small and Medium Enterprises. That also covers a consistent portion of the domestic industrial consumption in some cases, as from the most recent estimates in Italy, more than 60% and, secondly, industry is mainly devoted to non-energy intensive activities of manufacturing, defining here non-energy intensive manufacturing industries as firms whose energy costs do not exceed 2% [51].

Energy is an important input for many manufacturing industries, reducing energy supplies could reduce or lower energy costs, reduce greenhouse gases and improve productivity per units of outputs [52]. Reducing energy is an essential task for the future as the world's greatest environmental impact originates from the use of energy [53]. According to [54], the energy intensive SMEs, that use of investment decision support when considering strategic investments - not least for the foundry industry with complex interactions between different production units Also investment decision support may thus be one means of emphasising energy efficiency for energy-intensive SMEs beyond the level of traditional energy auditing when the products are costly, strategic, production related investments it to be made. Also [55], described the energy consumers, with problems of ignorance or awareness, high initial costs, existence of other issues than energy costs, sector of support on investing in new energy efficient technologies, and uncertainty about current and future energy prices. While studying [56], he measured Energy Efficiency Indicators in Scoter of small and medium industry, and divided it in two ways. Energy efficiency could be expressed in two forms: energy consumed per unit physical product, or SEC and the energy intensity. Several data including electricity energy consumption during a year, amount of sandals produced in term of tons, and monetary value of total production in a year are required. Both indexes are respectively calculated by:

$$SEC = TAEC / TAP. \quad (8)$$

$$EI = TAEC / TAV. \quad (9)$$

Where: TAEC is Total Annual Energy Consumption (kWh); TAP is Total Annual Production (tons or unit); TAV is a Total Annual Value addition (US$). The indexes can indicate opportunities for improvements in energy and process efficiencies.

Furthermore, [57], have examined the energy of SMEs using a methodology for the energy scan, and combining costs with environmental impact, a ''Criticality Index'' (CI) that could be: the index expresses the importance of a given unit considering both energy expenditures and environmental impact. The practice gained in the application of the methodology, testing firms into different sized, for a wide range of industrial districts, adopting different process technologies, has further suggested to slightly modify the score. Cost and the screen indexes, weighting them considering the firm's priorities and environmental strategy (e.g. pro-active, reactive).

$$[\, CIi = (scoreCost\ .WC) + (scoreEnvi\ .WE)\ WC + WE = 1 \quad (10)$$

Where: CIi is the criticality index for the eighth cell; WC is the cost policy importance; and WE is the environmental policy importance. In synthesis, the methodology has created an index able to divide the energy expenditures into different FUs and energetic vectors, evaluating them considering their environmental impact, as a result, a profile of the most critical areas of the firm for the energy consumption.

Moreover, study [58] indicated that given small and medium-sized with low cost energy audits like in the evaluated local energy programme using the local authority energy consultants this seems to be a successful policy action towards SMEs manufacturers in terms of actual energy saved. Even though the companies have received energy audits that reduce the magnitude of the superficial information related barriers, there are still problems linked to these obstacles, such as difficulties in obtaining information, sector of technical skills and staff consciousness, and poor information quality as regards energy efficiency opportunities. This indicates a need for even more detailed and specific information, which could increase the adoption even further. Also, study [59], determined the major barriers of using energy in SMEs emerged are represented by: access to capital; lack or imperfect information on cost-efficient energy efficiency interventions; and the form of information. Moreover, it could be argued that the knowledge of personnel and management does not really represent a barrier to the implementation of energy efficiency interventions. It seems reasonable to assume that these findings are conservative and the effect of the awareness barriers has been underestimated.

According to Global Village Energy partnership [60], ***"Lower Energy cost:*** While the initial investment cost of renewable energy technologies may be high due to the initial cost of equipment such as wind turbines, solar panels, and geothermal energy equipment, the only running cost to the consumer relates to any required maintenance and operation".

3.8 Inventory Cost

Inventory is the stock of any item or resource used in an organization. According to previous studies, inventory management (IM) has been defined in various ways. IM implies the establishment of strategic objectives and positioning for inventories [61]and [62].

Inventory is the store for item and resource could be used in an organization. Generally, in manufacturing inventory contributes to part of a firm's product output. Inventories of manufacturing are naturally classified into (raw materials, component parts, supplies, and work-in-process, finished products). Moreover, the SMEs should be capable to achieve lower inventory cost per sales as well as higher Income Tax Return (ITR). If that is so those SMEs which pursue modern inventory practices should be able to achieve a lower inventory cost per sales and higher ITR. This study brought out that this has indeed been the case in the context of machine tool SMEs. The final analysis findings clearly that

better IM practices have positive influence whereas inventory cost per sales has a negative influence on ITR. All these enable us to infer that it is appropriate to encourage SMEs to adopt better IM practices could be due to that lower inventory cost per sales [63]. Therefore, the way of IM in improving the economic performance and production of SMEs is essential from an economic perspective; also production functions confirmed this with beta coefficients of inventory cost ranking first amongst all the inputs. Usage of the economic performance indicators adopted, seem to have a significant relationship with IM performance in the SMEs. Generally, it appears that SMEs which are IM-efficient are also likely to perform better on economic front and experience higher 'returns to scale'. Therefore, the SMEs must aim at enhancing their efficiency of inventory use, as it is expected to be associated with multiple benefits [61].

3.9 ICT Cost

ICT could be providing a wide diversity of benefits to different firms. More specifically, ICT could reduce costs, improve productivity and strengthen growth potential. Besides, the acceptance and implementation of ICT by firms can be improving business cooperation, relationships, quality and of knowledge. Consequently, SMEs with an innovative philosophy are a powerful strategic tool [64]. The commonness of the SMEs surveyed identified costs as the single biggest factor minatory future investment in ICT G. [65], also found that barriers to ICT acceptance were mostly related to costs and skills rather than to do with problems with the technology per se. Only a minority (about 25%) of firms reported technical problems sufficient to act as a barrier to future investments. Farther, [66] the improvement factor of the costs and capabilities of ICTs is changing the ways in which certain kinds of communications and organization could occur. Lowering the costs of coordinate between firms may encourage more market transactions, and at the same time, closer coordination across firm boundaries.

Furthermore, new capabilities for communication information are faster, cheaply, and more selectively. It Might be helping to generate a quickly changing organization with highly decentralized networks of shifting project teams [67]. Study [68], indicate to the most of small and medium enterprise are not adopting ICT if the benefits do not outweigh the costs of developing and maintaining the system. Also, Syed [69] Show the SMEs are concerned about the costs of establishing and maintaining ICT while they suffer from budget constraints and are less sure of the expected returns on the investment.

On the other hand, Advanced and efficient ICT systems are useful in cluster SMEs to track and coordinate the network of relations and to take advantage to an immediate and easy access to update information saving time and cost and improving the cluster innovation process [70]**.** According to [71], SMEs generally adopts information communication and technology systems and sustain the related costs to comply with customers' technical requirements. Investments in ICT applications by SMEs and large companies facilitating inter firm collaboration is a necessary condition to improve the whole industry integration. SMEs rely much more on informal information systems than larger firms. To find the relevant information that is needed for a rational decision is not costless especially as in SMEs usually there is only one decision maker the owner or manager whose personal resources the time, knowledge, and capabilities are limited. Otherwise, SMEs have the advantage of smaller internal coordination costs, as all decided by a few people [72]and [73].

A study by [74] stresses the different information and ICT needs for diverse types of small and medium enterprise. SMEs are smaller concluding that with a little working capital, which they describe as trundles rely mainly on informal information from known sources where personal relations. For these firm's ICTs are of minor relevance and only telephone can help to increase access to this type of information. Phones might help to extend social and business networks and in some cases substitute for journeys and business intermediaries access to telephone services should be given priority.

The sector of the information was found to decrease income and raise costs. ICTs can reduce the time and money costs of business processes and can improve the certainty and quality. These benefits occur mainly in a bigger size of farms (with an annual turnover of a few tens of thousands of USD) and specific sector of operation such as manufacturing exporters, where the Internet can be used as a marketing tool. However, for 90 % of the survey enterprises lack of finance and skills are the main constraints and they cannot afford to buy a computer or make efficient use of it in the short or even medium term [74]. With regard to the financial constraints of the most SMEs, as well as concerning the high start cost of ICT or very expensive software or ready-to-use online package, it is expected that SMEs mostly cannot afford to adopt ICT or reap benefits from it through effective use of ICT in short or medium period of time [75]and [76]. Added, Tan et al. (2009) whose discuss that despite IT costs in one of the major risks perceived by Malaysian SMEs, there are no significant associations between the high costs of ICT infrastructure and ICT adoption in these businesses.

Through the use of ICT transaction costs could be lowered and therefore the economies of scale in exporting can be reduced. Also, this could enable SMEs not only to stick to local markets but to expand regionally and internationally. Otherwise, many SMEs that are located in rural areas, serve the local market and are protected beside competition from bigger firms because of high transport and communication costs. Therefore, ICT maybe also increase competition for these enterprises, accordingly they either have to become more productive or to close down. Furthermore, energizing or modernizing the SME sector goes far beyond providing financial facilities/incentives to acquire or reduce costs associated with usage of ICTs.

3.10 Cost of Quality

Improving quality is considered by many to be the best way to enhance parent's satisfaction, to reduce products of manufacturing costs and to raise the passing percentage. Any serious attempt to improve quality must be taking into account the costs connected with achieving quality, while nowadays it only inadequate to meet customer requirements, it must be at the lowest possible cost as well. According to [77], quality costs are the costs sustained in the design, of operation and maintenance of a quality management, the cost of resources committed to continuous improvement, the costs of a system, product and all other necessary costs and non-value added activities required to achieve a quality product. Measuring these costs should be considered a critical issue for any institute who aims to achieve competitiveness in today's

markets. There are several methods that can be used to collect, classify and measure quality costs. Measuring and reporting these costs should be considered a critical issue for any institute who aims to achieve competitiveness in today's markets. There are several methods that can be used to collect, categorize and measure quality costs [78]and [79].

3.11 Product Design Cost

PDC stands for Product Design cost. Using this tool, it can enable for engineers and cost analyst while they are still in the design process the product cost. This will enable to set and track product cost as per functional features are developed in various design teams. It will be able to track the cost build up as design process happens. Figure, 4 as show the product design cost.

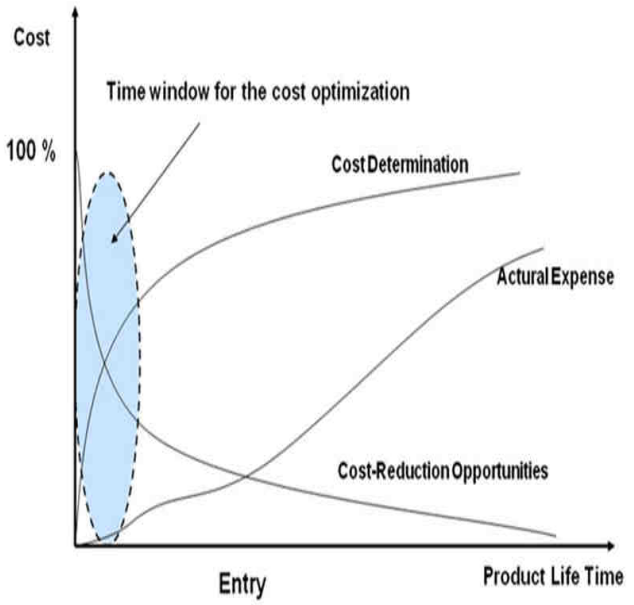

Figure:.4 Product Design Cost, [80].

The Weather of developing a new product or working to fulfil numerous customers request for quote's, Product Design Cost allows the organization to simulate multiple costing scenarios to arrive at the best product solution before committing valuable resources. Product Design Cost is part of the Product Lifecycle Management (PLM) portfolio and answers the call for upfront cost calculations needed early in the production. PDC bridges the gap that existed in Product Cost Planning and Easy Cost Planning. PDC allows the selection of various cost components bill of overhead, routings, plants, and materials, locations that reside inside and outside firms to create multiple 'what if' costing ratios. The result being it gives key decision makers much needed visibility to analyse all of the available costing combinations to realize their intended strategic outcome [81].

Thus, the larger part (75%) of the product costs is committed during the product design process. Consequently, after the design process has been completed, most opportunities of cost reduction have passed. Because, it is necessary to have knowledge about the cost consequences of decisions during the planning phases of the product development cycle. In these planning phases many decisions have to be made. cost estimates in the product design process can be used to choose between design alternatives in order to make cost effective decisions [82].

3.12 Product Cost

The products cost sold could be used to find the gross profit during the period. The gross profit is defined as the difference between the sales and the cost of goods sold. The total sales can be obtained from the total price for the orders delivered during the period. Cost of product Manufactured: Cost of products manufactured is the cost of orders that were put in the finished product inventory during the period. This covered the cost of orders that were released for production in an earlier period however completed during the current period. This value is dependent on the manufacturing expenses for the period, including the overhead cost, and the work in process inventory at the starting and end of the period. Process element utilization for each of the resources is calculated at the end of the period [83]. Furthermore, [84] state that product costs are including all costs involved in acquiring or making a product. The costs consist of manufacturing overhead, direct labour, and direct materials. Product costs its units of product as the goods are purchased or manufactured and they remain attached as the goods go into inventory awaiting sale. Product costs are primarily assigned to an inventory account on the balance sheet. If the goods are sold, the costs are released from inventory as expenses typically called cost of goods sold and matched against sales revenue. Because product costs are primarily assigned to inventories, they are too recognized as inventor able costs. Costing includes the value of all inputs such as the cost of materials, labour, supply chain and inventory.

3.13 Location Cost

Manufacturing SMEs which are located in municipal areas gain more advantages in terms of transport costs, infrastructure, spillover effects, labour, and natural resources [85]. Location is an important factor, since the export decision by firms in different locations may be affected due to transport costs, infrastructure, spillover effects and natural resources [86]. Also, [87]. SMEs that seeing operating internationally have focused on the intersection of location-based competencies and location-specific advantages which are assumed to be derived from the firm's home country base. [88] which study suggests that firms need to pay attention to the benefits to be derived from lower costs. SMEs can utilize offshore manufacturing outsourcing to gain the advantages of foreign location specific advantages without having to afford the cost of operating and managing full-scale multinational operations. SMEs with their entrepreneurial capability and flexibility might be able to gather chances in advantage of emerging opportunities in international markets. [89], they show in end of study aspects of Foreign Direct Investment (FDI) are evident, as the firms internationalize in a way that maximizes control, minimizes costs and risk, and firm specific assets. Location-specific advantages emerge through various network relationships, and these advantages are both protected and managed as a key cost consideration. Also, [90], findings by study "The determinants of the location of foreign direct investment by Japanese small and medium-sized enterprises, that SMEs are very sensitive to local economic conditions in making their decision on Foreign Direct Investment (FDI) location, policy makers involved in hosting foreign SMEs might be improving not only hard infrastructure such as communication, transportation facilities but also soft infrastructure such as

reliable and well-functioning of policy system. During this study noted that, Asia and North America absorbed as much as 80–90 percent of overall FDI cases by Japanese SMEs. The change of geographical orientation of FDI by Japanese SMEs from North America to Asia in the early 1990s appears to reflect the change in SMEs' strategy, which put a greater emphasis on reducing production cost to be competitive in the international market.

According to [91], by his study technologies such as advanced production machines and automatic warehousing are key approaches to cost effectiveness. In terms of location, moving the production base overseas to China or Indonesia has become a popular way to pursue lower manufacturing costs. Appropriate controls of production and material are also perceived to be effective to cost saving. [92] was study for the factor flouncing the operation location decisions of small firm. Findings in the case for the medium and larger firms with 62 percent of the former, and 100 percent of the latter seeking block size larger than 250 square meters. However, ANOVA tests were used to examine how firms of various sizes viewed importance of the location selection in flouncing variables as the size of the land purchase risk increased. Given the relationship between size of block purchased and cost, it was decided to measure risk as a function of the increase in a similar manner to various in flouncing factor regardless of their size and the size of the land purchase they were seeking.

3.14 Management Cost

Management cost direct expenditure on staff costs associated with letting, rent collection, and overheads such as property insurance. The costs of construction of a development usually the amount paid to the building contractor; this should not be confused with the total development cost also called total of plan cost that also includes the cost of purchase the land, and any on-costs of development. Moreover, **on-costs** are expenditure in addition to land acquisition and build costs, with professional fees, statutory fees, finance charges during the growth period, sales costs [93]. management cost helps mangers of manufacturing SMEs firms in decision making, cost, and budgeting with respect to product development. It is a method used for forecasting, and estimating the cost of a manufacturing activity or production output [94]and [95].

4. SUMMARY AND GAPS IDENTIFIED FROM THE LITERATURE

This paper has attempted to review the literature on different potential Cost Optimization for inputs of manufacturing SMEs related to its competitiveness and sustainable growth. Major areas considered in the framework for this study are (cost of land, cost of construction, cost of utilities, cost of labour and skilled labour, supply chain management cost, inventory cost, plant location cost, R&D cost and innovation, energy cost, ICT cost, cost of quality, operation of production management cost), emphasis was given on production and operations management issues. In this regard, more than 100 research papers were reviewed. The references corresponding to each particular area and major findings have been summarized in Table 1.

Table.1 Summary of review literature review

cost optimization	Reference(s)
Concept of Cost	Stewart, (1995); Liker and Choi, (2004); Fleischman and Parker, (1991); Holland and Light, (1999); J. M. Clark. (1923); Leftwich. (1960); Phan,(2004).
Cost Optimization	Jian S. Daie, et al. (2006); white paper. (2010); Gayretli and Abdalla. (1999); Chang TC, Wysk RA. (1985) Taiber JG (1994).
Costing Framework	Drake et al. (1999); Gerald. and David. 2003); Dennis A. and Michael A. (2000).
Effect of cost on SMEs Growth	Smallbone,et al. (1995); Hughes. (1991); Storey.(1993); Yanmei Zhu, et al., (2012); Mika Mungaya,et al. (2012); Karaev. et al. (2007); Tiwari and Buse. (2007).
Supply chain management cost; Optimal Cost Reduction Using of Innovative Capacity, Maintaining operational Supply Chain Coordination With optimal cost.	Cecil *et al,* (1992); Zaremba et al. (2003); Charleworth et al. (2013); Chang, and Huang, (2002); Major and Helen, (2003); Benita M, (1998); Ishii, et al. (1988); Liker and Choi, (2004); Jackson and Winkler, (2005); Williams, (1983).
Inventory Cos	Rajeev N. (2008); Wacker, (1996); Rajeev N. and Pillai, (2010); (Wacker, 1996).
Labour cost	F. Barber and K. Moores,(2011); Barth et al. (2005); Wally, (2003); Flinn (1984); Jeffrey. and Seung, (2002); Attaran, (1997); Shahidul and Shazali,(2011); Dimitrios M. Mihail, (2004);
Training Cost and Learning in SMEs	Matlay, 2004; Holden et al. (2006); Johnson, (2002): Taylor and Thorpe, (2004); Field, (1998).
Energy costs	(OECD 2004); Patrik Thollander, (2008); Park,C.W et al. (2009); Reddy,(1991);
R&D Cost and Innovation	Vossen, (1998); Acs and Audretsch (1987); Markham and Griffin (1998);Antonia,et al. (2009); Gassmann and Keupp. (2007); Koellinger (2008); Fleischman and Parker. (1991); Meyer (1982); Liker & Choi, (2004);
Location Cost	Etemad.(2004);Aggrey and Josmeph. (2010); Amornkitvikai, Y., et al. (2010); Gregorio et al. (2009); Chen. (1999); Urata and Kawai. (2000); Mzzarol and choo.(2003);
ICT Cost	Barba-Sánchez,et al. (2007); G. Dyerson, R. and Barnes, D.(2008);Sammut-Bonnii and McGee, (2002); Roberts,(2000); Syed Shah Alam. (20090); eBusiness Watch. (2005); Vatanasakdakul et al. (2004); Ghobakhloo et al. (2010); Thong. (2001); Tan et al. (2009); Duncombe and Heeks. (2001); Blili and Raymond. (1993);

	Müller-Falke, D. (2001); Lazoi, et al. (2011).
Cost of Quility	Dale and Plunkett. (1995); Schiffauerova and Thomson , (2006);
Product Cost	Herrmann, et al. (2003): Hayes et al. (1988).
Product Design Cost	(http://www.altavia.com);I.F. Weustink. (2000).
Transportation Cost	Browne et al. (1995); Preissl and Solimene, (2003); Borndorfer *et al*. (1998); Borndorfer, (1998): Hlayel and Alia, (2012).
Management Cost	Matipa, W. M. (2008); Haapala,et al. (2013); Berk, J. (2010).

Most of the works by these researchers were focused on a specific outcome such as quality management, technology management, competitive priorities, market condition, strategy development, leadership issues, constraints and challenges for them. On the basis of this extensive literature review of manufacturing SMEs, the following gaps are identified:

• There has been a lack of empirical research on optimization cost of inputs for competitiveness and sustainable growth. Even in developed countries, most of the fields related to competitiveness and sustainability have been devoted to large-scale manufacturing enterprises in the perspective of the economy. In addition, these studies have not tried to analyse and optimize cost the inputs with regard to production and sustainability aspect.

• Holistic approach was not taken to study the optimization cost of inputs in order to achieve competitiveness and sustainable growth. Most of the studies have considered the relationship of a particular strategic issue with certain financial parameters only, not with overall performance or growth with regard to production and operations management. Different dimensions of the input variables have not been explored in available studies; and lack in identifying major optimisation cost of production parameters.

• For continuous improvement of various processes and performance measures, manufacturing SMEs need to benchmark themselves with available standards. Simple and systematic empirically tested frameworks for benchmarking of SMEs processes and performance are lacking in the current and past literature. Most of the frameworks have followed holistic approach; rather they have focused on specific cost of input variables Researchers have suggested for benchmarking but not prioritized them. Prioritization will help manufacturing SMEs in successful implementation of benchmarking.

• Major emerging areas of research for SMEs development and growth strategy are extended synchronous optimisation cost of supply chain , utilization of combined resources , product distributed network manufacturing, integration of SMEs in developing economies with developed economies, R&D and knowledge management, TQM implementation and its effect on performance, ineffective government policies' implementation to improve SMEs capabilities and competencies, decision support system for making investments in IT and Advanced Manufacturing Technologies Strategies (AMTS). Nevertheless, much work is not available for cost optimization of inputs variable for achieving sustainable development.

• Most of the growth and performance measurement model of SMEs does not have predictive power for future performance and do not specify the causes of failure and corrective actions. In that regards, gaps are observed between existing performance models and optimization cost of manufacturing SMEs inputs practices adopted by organisations.

5. Concluding Remarks

It has been observed that all over the world, SMEs are considered as major source for economic growth; and manufacturing SMEs is at the leading edge. In the past, manufacturing SMEs have not paid due attention to developing its effective strategies for identifying and using potential of optimisation cost inputs in the perspective of production and operations management. The reviewed literature reveals that most of the strategies have been formulated for short-term goals as most of them are localized in their functions in terms of economic and social development concept. On the business front, they face many constraints due to their limited resources and lack of innovation in management capability and manufacturing capacity development. Major problems are related with optima cost of product design, supply chain network development, production management capability development, inventory, labour skilled, energy, training infrastructure and capacity of ICT. Manufacturing SMEs also do not follow comprehensive framework to develop their productions and operations strategies and quantify their competitiveness. The present paper has tried to identify potential optimisation cost inputs related to manufacturing operations of SMEs. On the basis of gaps identified, further study need to be carried out to develop a holistic approach for strategy development in input-output analysis. This framework should also enable them to benchmark their processes and performance for continuous improvement and sustainability.

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