Applying the KAIZEN Philosophy for building the Business Success in Indian Small & Medium Manufacturing Enterprises

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ABSTRACT

The Kaizen management originated in the best Japanese management practices and is dedicated to the improvement of productivity, efficiency, quality and, in general, of business excellence. The KAIZEN methods are internationally acknowledged as methods of continuous improvement, through small steps, of the economical results of companies. The small improvements applied to key processes will generate the major multiplication of the company's profit, while constituting a secure way to obtain the clients' loyalty/fidelity. The KAIZEN management represents a solid, strategic instrument, with a view to reach and surpass the company's objectives. With Globalization, today's markets economy has posed new challenges to all manufacturing organizations irrespective of their size and infrastructure for effective use of continuous improvement strategies for sustaining their enhanced productivity. This study attempts to assess the performance of various continuous improvement strategies for strategic success by using AHP and VIKOR. Results of investigation demonstrated that customer relationship plays a most significant role in improving the performance of manufacturing organizations. The overall success rate of CI strategies for enhancing the performance of organization is about 73 percent.

Keywords: *KAIZEN, Globalization and Productivity etc.*

1 Introduction

Today's manufacturing environment is characterized by intensified competition, rapid market changes, increased product variety and short product life cycles. Fast and dramatic changes in customer expectations, competition, and technology are creating an increasingly uncertain environment. In order to be competitive, manufacturing enterprises need to respond rapidly to product demand changes. In the present turbulent times, survival and success of any organization increasingly depends on effective use of resources available in any organization [2]. Today's competitive market, in almost every category of products and services, is characterized by accelerating changes, innovation and massive amounts of new information. Simply stated, competitiveness of a firm refers to firstly management of capabilities to exploit its resources, competencies and knowledge, and secondly to manage change with the overall objectives of adapting better and faster than competition. Superior manufacturing performance of a firm leads to competitiveness. Business environment in the last decade has changed radically in India. With the advent of World Trade Organisation regime of globalisation and liberalised trade, the heavily protected Indian industry has had to face competition both from within as well as established companies practicing world-class techniques [3].

The global marketplace has led many organisations to implement new manufacturing programmes and organisational structures to enhance their competitive position. Among the many manufacturing programmes, KAIZEN, total quality management (TQM), just-in-time, total productive maintenance (TPM) are often referred to as components of 'world class manufacturing'. There are many generic performance management schemes regarding to organizational capability reinforcement such as TQM, TPM, continuous improvement, and many company- developed in-house performance improvement schemes like Toyota System. Now it is widely recognised that an effective way to overcome problems caused by recent globalization is capability reinforcement of these tools and/or schemes as strategic management weapons [11].

In today's global economy, the survival of organisations depends on their ability to rapidly innovate and improve but in today's fast-changing marketplace, slow and steady improvements in manufacturing systems do not guarantee sustained profitability and survival of an organization. Therefore, the organizations need to improve at a faster rate than their competitors if they are to become or remain leaders in their industry, hence they have adopted CI approaches because it not only promotes sustainable growth under any economic conditions through effects on process techno-innovation and organisational learning, but also impacts financial and non-financial factors also on which sustainability is based. CI helps sustainable increase of annual sales, profit and sales profitability and shows its effects on some of the factors such as quality, productivity, delivery, safety, moral, new product development system, knowledge creation, technology learning, process reform, customer satisfaction and employee satisfaction [1]. This paper attempts to access importance level of CI strategic implementation in an organizational system to provide a framework in the selection of competitive advantages under uncertainty using AHP and VIKOR, which will provide justification of CI strategic implementations in manufacturing organisations.

A. AHP and Research Methodology

The Analytical Hierarchy Process (AHP) is a decision-aiding method developed by Saaty in 1980. It aims at quantifying relative priorities for a given set of alter- natives on a ratio scale, based on the judgment of the decision-maker, and stresses the importance of the intuitive judgments of a decision-maker as well as the consistency of the comparison of alternatives in the decision-making process [6]. In applying the AHP to a decision problem one structures the problem in a hierarchy with a goal at the top and then criteria (and often sub criteria at several levels, for additional refinement) and alternatives of choice at the bottom. The criteria can be subjective or objective depending on the means of evaluating the contribution of the elements below them in the hierarchy. Furthermore, criteria are mutually exclusive and their priority or importance does not depend on the elements below them in the hierarchy. The number of alternatives should be reasonably small because there would then be a problem with improving the consistency of the judgments. It was observed that an individual cannot simultaneously compare more than seven objectives (plus or minus two) without maximum number to compare should be no more than seven. If the number of alternatives is more than seven, the rating mode of the AHP may be used. In the rating mode, in addition to the three general levels in a simple hierarchy of the objective, the criteria and the alternatives, an extra level above the alternatives consisting of intensities, which are refinements of becoming confused [7]. The AHP and its use of pair wise comparisons have inspired the creation of many other decision-making methods. Besides its wide acceptance, it also created some considerable criticism; both for theoretical and for practical reasons. Since the early days it became apparent that there are some problems with the way pairwise comparisons are used and the way the AHP evaluates alternatives. First, [8] observed that the AHP may reverse the ranking of the alternatives when an alternative identical to one of the already existing alternatives is introduced. In order to overcome this deficiency, Belton and Gear proposed that each column of the AHP decision matrix to be divided by the maximum entry of that column. Thus, they introduced a variant of the original AHP, called the revised-AHP. Later, [5] accepted the previous variant of the AHP and now it is called the Ideal Mode AHP. [9] used AHP in comparing options for management of high-level nuclear waste, a complex decision problem involving many factors of a technological, environmental, social and political nature. They argued that there are many alternatives being proposed for the disposal of waste but, because of the lack of data, it is not an easy task to find the best alternative. In large part, the decision depends on the judgments of experts.

Basically, decision-makers have to decompose the goal of the decision process into its constituent parts, progressing from the general to the specific perspective. In its simplest form, this structure must include a goal, attribute and alternative levels ordered into a hierarchy. Each criterion would then be further divided into an appropriate level of detail, recognising that the more criteria included, the less important each individual criterion may become. Once the hierarchy has been structured, decision-makers judge the importance of each criterion in pair-wise comparisons. The judgement is performed from the perspective of the direct upper-level criterion. The final scoring is on a relative basis, comparing the importance of one decision alternative to another. AHP captures both subjective and objective evaluations, also providing a useful mechanism for checking the consistency of the decision-maker's evaluations. AHP is a subjective methodology where information and priority weights of elements can be obtained from decision-makers of the company using a direct questioning or a questionnaire method [10]

In the present study, three-level hierarchy model has been used to find out its measure its success possibility for CI strategic implementation. In KAIZEN ladder, the level 1 refers to the overall objective, level 2 is composed of the sub-objectives shown in and level 3 is formed by the alternatives, i.e., improved and not improved performance. The flow chart as shown in the Annexure has been adopted for fulfilling the objective of successful performance.

Experience is the toughest teacher because first you take the test and second you are taught the lesson." – Vernon Sanders Law. All over the world the Kaizen techniques have been particularly distinguished as the best methods of performance improvement within companies since the implementing costs were minimal. It is nowadays more than ever that the relationship between manager and employee is crucial and the Kaizen techniques have a major contribution to the reinforcement of this relationship since the achievements of a company are the result of the mixed efforts of each employee.

These methods bring together all the employees of the company ensuring the improvement of the communication process and the reinforcement of the feeling of membership. Presently, considering the global phenomenon, we can notice that, in the field of car industry, the products and services are comparable to one another, the life cycle of products is more and more reduced whereas the service intervals are more and more extended. Under these circumstances, the increase of service quality provided to clients has become a desideratum that the organization cannot get and improve the performance level without. The KAIZEN principles presume a practical approach and low costs of improvement.

The degree of preference or intensity of the decision maker in the choice of each pair-wise comparison used in this model is quantified on scale of 1-9. This scaling process can then be then translated in priority weight (scores) for comparison of alternatives. Even number (2, 4, 6, 8) can be used to represent compromises among the preference above. The suggest numbers used in this model to express degree of preference are shown in Table 1.

Definition	Intensity of importance
Equally important	1
Moderately more important	3
Strongly more important	5
Very strongly more	7
Extremely more important	9
Intermediate values	2,4,6,8

Step 2 Pair-wise comparison of different sub-objectives

The importance of ith sub-objective is compared with jth sub-objectives is calculated. The pair-wise comparison matrix for other sub-objectives is compared in a brainstorming session which consists of group of experts from different organizations and the academia and is depicted in Table 2.

	S.D	JIT	TQM	TPM	CR
S.D	1	3.3	1.616	2	4
JIT	0.303	1	3.7	2.316	1.416
TQM	0.618	0.27	1	1.7	1.798
TPM	0.5	0.431	0.588	1	2.666
CR	0.25	0.706	0.556	0.375	1
Total	2.671	5.707	7.46	7.391	10.88

Step 3 Normalized matrix of different sub-objectives

After a pair-wise comparison matrix is obtained, the next step is to divide each entry in column by

Step 1: Degree of preference

the sum of entries in column to get value of normalized matrix. The value of normalized matrix is shown in Table 4. The normalized value rij calculated by below mentioned formula:

$$r_{ij} = a_{ij} / \sum_{i=1}^{n} a_{ij}$$

Thus, the approximate priority weight (W_1, W_2,.W_j) for each attribute is obtained as shown in Table 3

$$W_j = 1/n \times \sum_{i=1}^{n} a_{ij}$$

	SD	JIT	TQM
SD	0.374	0.578	0.216
JIT	0.113	0.175	0.49
TQM	0.231	0.0473	0.134
TPM	0.187	0.0755	0.077
CR	0.093	0.123	0.074

	TPM	CR	Weight
SD	0.271	0.367	**0.3612**
JIT	0.313	0.130	**0.2442**
TQM	0.230	0.165	**0.1672**
TPM	0.135	0.245	**0.1439**
CR	0.0507	0.0919	**0.0865**

Step 4: Do consistency checks

The relative weights, which would also present the Eigen values of criteria, should verify:

$$A \times W_i = \lambda_{max} \times W_i \quad i = 1; 2; \ldots; n$$

Where A represents the pair-wise comparison decision matrix and λ_{max} gives the highest Eigen value. Then consistency index (CI), which measures the inconsistencies of pair-wise comparisons is calculated as:

$$CI = \frac{(\lambda_{max} - n)}{(n-1)}$$

The last ratio that has to be calculated is CR. Generally, if CR is less than 0.1, the judgments are consistent and acceptable. The formulation of CR is:

$$CR = \frac{CI}{RI}$$

where random index (RI) denotes the average RI with the value obtained by different orders of the pair-wise comparison matrices. The values of consistency test are given in Table 6

Maximum Eigen Value	C.I	R.I	C.R
5.06107	**0.01526**	**1.12**	**0.0136**

Step 5: Priority weights for alternatives with respect to attribute

The chance of a successful CI strategic implementation increases if attribute present is strong. Priority weights for alternatives (improved and unimproved) are measured to show the preference of the alternative with respect to an attribute. Thus, if the presence of an attribute is strong in the organisation, it is more likely to be a success, compared to the presence of an attribute which is weak. Table 6 summarizes the result of evaluating the possible outcome of the implementation with respect to each of nine attributes.

		Improved performance	Not improved	Priority Weight
SD	Improved	1	3.3	0.7674
	Not Improved	0.3030	1	0.2326
JIT	Improved	1	3.64	0.7845
	Not Improved	0.275	1	0.2155
TQM	Improved	1	1.7	0.6296
	Not Improved	.5882	1	0.3704
TPM	Improved	1	2.626	0.7246
	Not Improved	0.38	1	0.2754
CR	Improved	1	1.366	0.5773
	Not Improved	0.732	1	0.4227

B. Compromise Ranking Method

The VIKOR (the Serbian name is 'Vlse Kriterijumska Optimizacija Kompromisno Resenje, which means multi-criteria optimization (MCO) and compromise solution) method was first established and later promoted by [12] . It focuses on ranking and selecting the best alternative from a finite set of alternatives with conflicting criteria, and on proposing the compromise solution (one or more). The compromise solution is a feasible solution, which is the closest to the ideal solution, and a compromise means an agreement established by mutual concessions made between the alternatives. The following multiple attribute merit for compromise ranking is developed from the Lp-metric used in the compromise programming method

$$L_{p,i}=\{\sum_{j=1}^{M}(w_j[(m_{ij})_{max}-m_{ij}] / [(m_{ij})_{max}-(m_{ij})_{min}])^p\}^{1/p} \text{--- (1)}$$

Where M is the number of criteria and N is the number of alternatives. The mij values (for i=1,2,…,N; j=1,2,…,M) denote the values of criteria for different alternatives. In the VIKOR method, $L_{1,i}$ and $L_{\infty,j}$ are used to formulate the ranking measures.

Step 1 Determine the value of E_i and F_i

$$E_i = L_{1,i} = \sum_{j=1}^{M} w_j[(m_{ij})_{max} - m_{ij}] / [(m_{ij})_{max} - (m_{ij})_{min}] \text{--- (2)}$$

$$F_i = L_{\infty,i} = Max^m \text{ of } \{ w_j[(m_{ij})_{max} - m_{ij}] / [(m_{ij})_{max} - (m_{ij})_{min}] \text{--(3)}$$

The values of Ei and Fi are shown in Table 7. Acceptable. Eq. (2) is only applicable to beneficial attributes (whose higher values are desirable). For non-beneficial attributes (whose lower values are preferable), the term $[(m_{ij})_{max}-m_{ij}]$ in Eq. (2), is to be replaced by $[m_{ij}-(m_{ij})_{min}]$. Hence, for non-beneficial attributes, Eq. (2) can be rewritten as: m $E_i = L_{1,i} = \sum w_j[m_{ij} - (m_{ij})_{min}] / [(m_{ij})_{max} - (m_{ij})_{min}]$--- (4)The weight evaluation for each alternative is multiplying the matrix of evaluation rating by vector of attribute weight and summing over the entire attribute. The prediction weight for

TPM or successful of TPM Decision Index of Improved Performance: 0.7674 *0.3612 + 0.7845*0.2442 + 0.6296*0.1672 + 0.7246*0.1439 + 0.5773*0.0865 = 0.72811

Thus, Decision Index of Performance not Improved = 1-0.73 = 0.27

This signifies the success rate of strategic implementation of CI approach is 73%.

TABLE 7 VALUES OF E_I AND F_I

ESD= 0.8472	FSD=0.3612
EJIT= 0.6898	FJIT= 0.2442
ETQM= 0.24522	FTQM= 0.16722
ETPM= 0.3069	FTPM= 0.1439
ECR= 0.24932	FCR= 0.08662

Step 2 Calculate Pi values as follows:

$$P_i=v\{(E_i-E_{i-min})/(E_{i-max}-E_{i-min})\}+(1-v)((F_i-F_{i-min})/(F_{i-max}-F_{i-min})\}$$

Where E_i-max and E_i-min are the maximum and minimum values of Ei, respectively, and F_i-max and F_i-min are the maximum and minimum values of Fi, respectively. v is introduced as weight of the strategy of 'the majority of attributes' (or 'the maximum group utility'). The value of v lies between 0 and 1. Normally, the value of v is taken as 0.5. The best alternative is the one having the minimum Pi value. The values of P_i and ranking of sub-objectives are shown in Table. 8

TABLE 8 VALUES OF Pi AND RANK OF ATTRIBUTES

Values of Pi	Rank
PSD = 1	5
PJIT = 0.6558	4
PTQM= 0.1468	2
PTPM = 0.616	3
PCR = 0.009	1

Conclusions

In this paper only five attributes have been examined to provide a direction for effective strategic implementation of CI approach. On the basis of above discussions, it is proved that all the five parameters are important for the improved performance of manufacturing industry although in varying degrees that can be evidenced by AHP and VIKOR methodology. From the results, it is evident that CI strategic implementation can bring in commendable reforms and improvement in terms of realization of manufacturing excellence in the manufacturing organizations. Customer relationship plays a significant role in improving the performance of the organization and success rate of strategic implementation of CI approach is about 73 percent.

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Annexure: Flow chart for methodology used

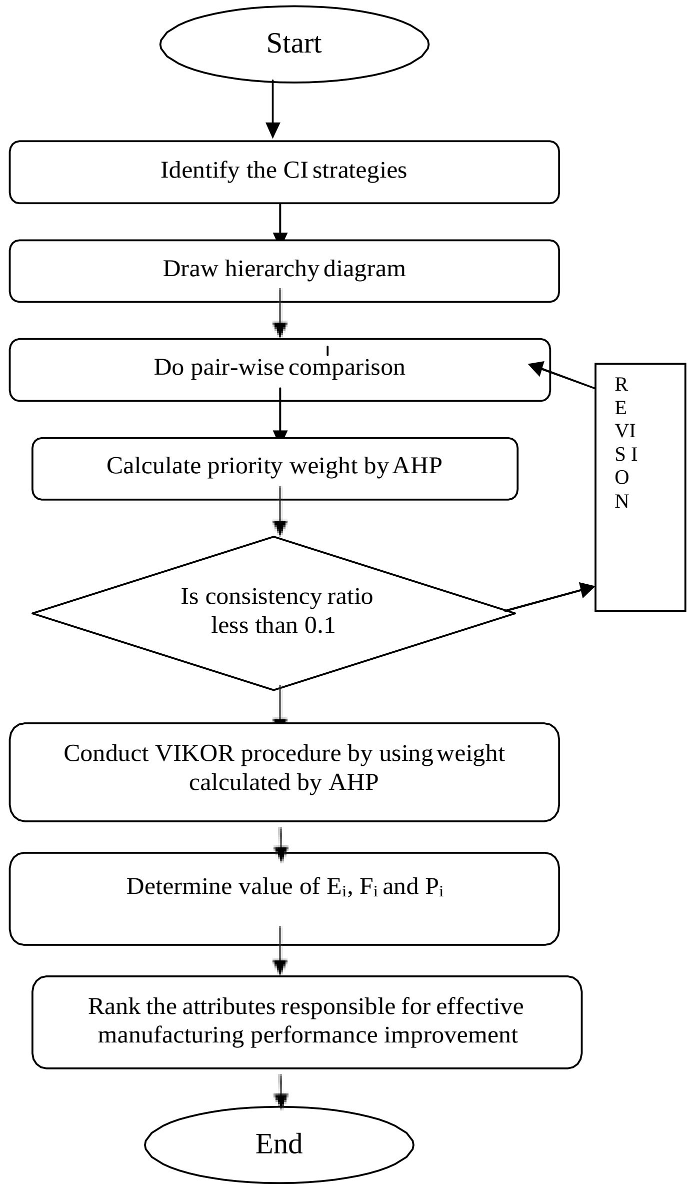

Fig. 2. Flow

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