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Abstract

Purpose – The purpose of this paper is to provide an overview of the history and existing research on continuous improvement (CI).
Design/methodology/approach – Extensive review of the literature.
Findings – This paper provides an overview of CI, its inception, how it evolved into sophisticated methodologies used in organizations today, and existing research in this field in the literature.
Research limitations/implications – The literature on classification of CI has so far been very limited. The paper reviews a large number of papers in this field and presents the overview of various CI implementation practices demonstrated by manufacturing organizations globally. It also highlights the sophisticated CI methodologies suggested by various researchers and practitioners in the field of CI.
Practical implications – The literature on classification of CI has so far been very limited. The paper reviews a large number of papers in this field and presents the overview of various CI implementation practices demonstrated by manufacturing organizations globally. It also highlights the sophisticated CI methodologies suggested by various researchers and practitioners in the field of CI.
Originality/value – The paper contains a comprehensive listing of publications on the field in question and its classification. It will be useful to researchers, improvement professionals and others concerned with improvement to understand the significance of CI. It should be of value to practitioners of CI programmes and to academics who are interested in how CI has evolved, and where it is today. To the authors' knowledge, no recent papers have provided an historical perspective of CI.

Keywords Operations management, Continuous improvement, Manufacturing, Manufacturing strategy, Analytical hierarchy process, Industrial performance
Paper type Literature review

Introduction

Kaizen (Kai – do, change, Zen – well) is a kind of thinking and management, it is a philosophy being used not only in management field but also in the everyday life in Japan. It means gradual and continuous progress, increase of value, intensification, and improvement (Karkoszka and Szewieczet, 2007). It is translated in the west as ongoing, continuous improvement (CI) (Malik *et al.*, 2007). The phrase "CI" is associated with a variety of organizational developments including the adoption of "lean manufacturing" techniques, total quality management (TQM) employee involvement programmes, customer service initiatives, and waste reduction campaign. It is the "a company–wide process of focused and continuous incremental innovation" (Bhuyan and Baghel, 2005), "small incremental changes in productive processes or in working

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practices that permit an improvement in some indicator of performance (Garcia *et al.*, 2008). The main focus of CI on three key notations as indicated by Brunet and New (2003):

- Kaizen is continuous – which is used to signify both the embedded nature of the practice and also its place in a never-ending journey towards quality and efficiency.
- It is usually incremental in nature, in contrast to major management initiated technological innovation.
- It is participative, entailing the involvement and intelligence of the workforce, generative intrinsic psychological a quality and quality of work-life benefits for employees.

Ever since the industrial world began to experience tough global competition, the generic term continuous improvement has become the centre of discussions. Though globally CI is approved as a ladder for achieving excellence in quality to reach a superior level in the highly competitive market, there still exist differing views on the approaches involved in achieving it. Even as the industrial world witnesses strident campaigning by quality engineering experts and academicians over implementing successful CI, many skeptical observations are made by the manufacturers who attempted to implement CI activities in their firms at the expense of money and time (Dhillon, 1988). These manufacturing organizations are currently encountering a necessity to respond to rapidly changing customer needs, desires, and tastes. To compete in this continuously changing environment, these companies must seek out new methods allowing them to remain competitive and flexible simultaneously, enabling their companies to respond rapidly to new demands (Black, 1991). In order for these companies to remain competitive, retain their market share in this global economy, and satisfy both external and internal economy, and satisfy both external and internal customers, CI of manufacturing system processes has become necessary (Shingo, 1988). The manufacturing industry has experienced an unprecedented degree of change in the last three decades, involving drastic changes in management approaches, product and process technologies, customer expectations, supplier attitudes as well as competitive behaviour. In today's highly dynamic and rapidly changing environment, the global competition among organizations has lead to higher demands on the manufacturing organizations. The global marketplace has witnessed an increased pressure from customers and competitors in manufacturing as well as service sector. Organizations today are in a constant need to maintain a low cost of quality, reduce waste, trim production lines, and speed up manufacturing to achieve and maintain competitiveness. Much of this can be done through the implementation of CI, which we define as a culture of sustained improvement aimed at eliminating waste in all organizational systems and processes, and involving all organizational participants. CI can be evolutionary or revolutionary; in the former case, improvements take place as a result of regular, incremental changes, while in the latter case, major changes take place as a result of an innovative idea or technology, or simply as a result of accumulating incremental improvements. Improvement on any scale can be achieved through the use of a number of tools and techniques dedicated to searching for sources of problems, waste, and variation, and finding ways to minimize them.

Many researchers define CI more generally as a culture of sustained improvement targeting the elimination of waste in all systems and processes of an organization.

It involves everyone working together to make improvements without necessarily making huge capital investments. CI can occur through evolutionary improvement, in which case improvements are incremental, or though radical changes that take place as a result of an innovative idea or new technology. Often, major improvements take place over time as a result of numerous incremental improvements. On any scale, improvement is achieved through the use of a number of tools and techniques dedicated to searching for sources of problems, waste, and variation, and finding ways to minimize them. Over the past decades; CI has been studied from many perspectives. In this paper, objective is to present the history and the research conducted in this field. Through exhaustive review of literature, a brief description of existing research on CI has been provided in order to gain an understanding of how the use of CI has had an impact on organizations. Different principles of CI that are needed to achieve an ongoing cycle of incremental improvements, the important barriers in implementation of CI approach, need of CI in contemporary manufacturing scenario, types of Kaizen, Kaizen in terms of TQM, the CI methodologies and strategies that are helpful in implementing CI activities effectively through effective guidelines and the important benefits after successful implementation of CI strategies have been discussed briefly. This paper presents a review of the literature and attempts to identify the important and useful contributions in this field. The various concepts, case studies and surveys concerned to this field have been systematically reviewed.

History of Kaizen management approach

Robinson (1990) provided the historical background of CI programmes in the USA and Japan. They identify the first modern CI programme at National Cash Register in 1894 in Dayton, Ohio. This programme had several characteristics of today's programmes, including attending to the total labour-management relationship (e.g. by improving working conditions), encouraging and rewarding improvement suggestions, and developing employees by providing educational opportunities. In 1950s when management and government acknowledge that there is a problem in the current confrontational management system and a pending labour shortage. Japan has sought to resolve this problem through cooperation with the workforce. The groundwork was established in the labour contracts championed by the government and is taken up by most major companies, which has introduced lifetime employment and guidelines for gain sharing distribution of benefits for the company development. This contract remains the background for all Kaizen activities providing the necessary security to ensure confidence in the workforce (Brunet, 2000). Schroeder and Robinson (1991) also describe how a highly successful wartime programme, "Training within Industries", was imported into Japan from the USA in the late 1940s by US military occupation authorities. The aims of this undertaking were to rebuild Japanese industry quickly without a huge investment of capital and to prevent widespread starvation and unrest. CI-called Kaizen in Japan – subsequently gained popularity in Japan as a low investment, proven method of raising quality and productivity. The oil shock of 1973 gave added impetus to CI in Japanese industry. Meanwhile, US industrial dominance for approximately two decades following the Second World War resulted in business complacency, and CI programmes disappeared from most US industry. Since the early 1980s, however, CI programmes have been returning to US industry. This resurgence has been the result of direct Japanese investment in the USA, as well as the effort of US companies to compete successfully with their Japanese counterparts. First, it was

introduced and applied by Imai in 1986 to improve efficiency, productivity and competitiveness at Japanese Toyota Carmaker Company in response to increasing competition and the pressure of globalization. Since then, Kaizen has become a part of the Japanese manufacturing system and has contributed enormously to the manufacturing success (Ashmore, 2001).

Need for CI in contemporary manufacturing scenario

The involvement and participation of the employees in new production arrangements has been identified as a key aspect in the use of new methods of manufacturing such as just-in-time (JIT) production (Oliver and Wilkinson, 1992). In production systems such as Toyota's, this has been successfully carried out through Kaizen or CI activities. The process of CI, or Kaizen, was pioneered in manufacturing companies in Japan, primarily in response to (or alongside) the introduction of the JIT production system, which facilitates a constant reduction in waste. CI within a JIT environment has also been hailed as one of the cornerstones of Japanese manufacturing success (Imai, 1986). However, this is not necessarily a Japanese innovation; the process of actively encouraging employees to participate in the continuing incremental improvement of products and processes can be reportedly traced back at least to the Industrial Revolution (Schroeder and Robinson, 1991). Even so, although isolated pockets of CI can be found in postwar western manufacturing, it is clear that the majority (and most successful) application of this concept has, until recently, been in Japan. This is perhaps due to the pressure to conserve and use resources efficiently, in a country with relatively few natural resources. CI harnesses the participation of all the employees to improve production equipment's availability, performance, quality, reliability, and safety. CI endeavours to tap the "hidden capacity" of unreliable and ineffective improvement methods. CI capitalizes on proactive and progressive improvement methodologies and calls upon the knowledge and cooperation of operators, equipment vendors, engineering, and support personnel to optimize machine performance, thereby resulting in elimination of breakdowns, reduction of unscheduled and scheduled downtime, improved utilization, higher throughput, and better product quality. The principal features of CI are the pursuits of economic efficiency or profitability, maintenance prevention, improving maintainability, the use of improvement programmes, and total participation of all employees. The bottom-line achievements of successful CI implementation initiatives in an organization include lower operating costs, longer equipment life, and lower overall improvement costs. Thus CI can be described as a structured equipment-centric CI process that strives to optimize production effectiveness by identifying and eliminating waste and production efficiency losses throughout the production system life cycle through active team-based participation of employees across all levels of the operational hierarchy. The following aspects necessitate implementing CI in the contemporary manufacturing scenario:

- to become world class, satisfy global customers and achieve sustained organizational growth;
- need to change and remain competitive;
- need to critically monitor and regulate work-in-process (WIP) out of "Lean" production processes owing to synchronization of manufacturing processes;
- achieving enhanced manufacturing flexibility objectives;
- to improve organization's work culture and mind-set;

- to improve productivity and quality;
- tapping significant cost reduction opportunity regarding improvement-related expenses;
- minimizing investments in new technologies and maximizing return on investment ROI;
- ensuring appropriate manufacturing quality and production quantities in JIT manufacturing environment;
- realizing paramount reliability and flexibility requirements of the organizations;
- optimizing life cycle costs for realizing competitiveness in the global marketplace;
- regulating inventory levels and production lead-times for realizing optimal equipment available time or up-time;
- to obviate problems faced by organizations in form of external factors like tough competition, globalization, increase in raw material costs, and energy cost;
- obviating problems faced by organizations in form of internal factors like low productivity, high customer complaints, high defect rates, non-adherence to delivery time, increase in wages and salaries, lack of knowledge, skill of workers and high production system losses;
- ensuring more effective use of human resources, supporting personal growth and garnering of human resource competencies through adequate training and multi-skilling;
- to liquidate the unsolved tasks (breakdown, set-up time and defects);
- to make the job simpler and safer; and
- to work smarter and not harder (improve employee skill).

Moreover, CI implementation can also facilitate achieving the various organizational manufacturing priorities and goals as depicted in Table I.

In addition, CI implementation in an organization can also lead to realization of intangible benefits in the form of improved image of the organization, leading to the possibility of increased orders. With the achievement of zero breakdowns, zero accidents, and zero defects, operators get new confidence in their own abilities and the organizations also realize the importance of employee contributions towards the realization of manufacturing performance (Dossenbach, 2006). CI implementation also helps to foster motivation in the workforce, through adequate empowerment, training and felicitations, thereby enhancing the employee participation towards realization of organizational goals and objectives. Ideally, CI provides a framework for addressing the organizational objectives. The other benefits include favourable changes in the attitude of the operators, achieving goals by working in teams, sharing knowledge and experience and the workers getting a feeling of owning the incremental improvement.

Types of Kaizen

According to Imai (1997), Kaizen is of following type:

- individual vs team Kaizen;
- day–to-day vs special event Kaizen; and
- process level vs sub process level Kaizen.

Manufacturing priorities	CI considerations
Productivity	Reduced unplanned stoppages and breakdown improving equipment availability and productivity
	Provide customization with additional capacity, quick change-over and design of product
Quality	Reduce quality problems from unstable production
	Reduced in field failures through improved quality
	Provide customization with additional capacity, quick change-over and design of product
Cost	Life cycle costing
	Efficient improvement procedures
	Supports volume and mix flexibility
	Reduced quality and stoppage-related waste
Delivery	Support of CI efforts with dependable improvement
	Improves efficiency of delivery, speed. and reliability
	Improved line availability of skilled workers
Safety	Improved workplace environment
	Realizing zero accidents at workplace
	Eliminates hazardous situations
Morale	Significant improvement in Kaizen and suggestions
	Increase employees' knowledge of the process and product
	Improved problem-solving ability
	Increase in worker skills and knowledge
	Employee involvement and empowerment

Table I. Organizational manufacturing priorities and goals realized through CI

Individual vs team Kaizen

Mostly, in Kaizen a team approach is used however another method called "Teian Kaizen' or personal Kaizen" is also adopted. Kaizen in which the individual employees reveal improvement areas in their daily work activities and give ideas/suggestions about its improvement is known as Teian Kaizen. This method focuses only on the suggestion for change. Making change for improvement require approval at appropriate level. However, at Toyota motor company the employee suggesting the change is the one who always makes the change either individually or as team member.

Day-to-day vs special event Kaizen

Quality circles are illustration of a day-to-day Kaizen. In this method, a natural work team identify opportunities for improvement by observing work processes. Team meets at the end of the week for selection of a problem as a Kaizen event. They try to identify the sources, (root causes) of the problem and give their suggestions to eliminate these sources, Accepted suggestions or implemented to solve the selected problem. Improvements in work process are made during regular working hours without using over time. Special event Kaizen plans for future and then executes. Improvement process takes two to five days and takes place at the work site. Normally workers identify waste in the processes and eliminate this waste as a Kaizen event.

Process vs sub process level Kaizen

Mostly, Kaizen make improvements at the sub process level that is at component level work process. These sub process may includes the activities acquiring material

from suppliers, processing them into useful product and providing these products to the end user. Gemba Kaizen, referred to as Point Kaizen, is an example of sub process level Kaizen. On the other hand, there is Flow Kaizen or Kaikaku Kaizen, in which improvement activities takes places as radical change towards betterment at the value stream or business level.

Different Kaizen tools and techniques

The tools and technique presented in Table II are those identified as having a significant influence on achieving one, several or all the objectives. These objectives are minimizing change-over (set-up) times, zero defects, zero waste, zero delays, and zero breakdowns. Further details of P-M analysis can be found in Shirose (1990), of 5S's in Hirano and Talbot (1995), of SMED in Shingo (1985) and of eliminating minor stoppages, achieving any of the above objectives would indirectly contribute to a high overall equipment effectiveness (OEE) value. OEE is a performance measure expressed as a percentage and is the product of availability, performance, and quality (Nakajima, 1988). Kaizen practitioners use various tools during Kaizen implementation relevant to the area of application.

S. no.	Tool and technique	Description
1.	Single minute exchange of die (SMED)	Technique which refer to significant reductions in set-up times. In this technique main emphasis is given on reduction in set-up time, like "changeover of die, clamping and unclamping of work piece/die on the machine
2.	Total productive maintenance (TPM)	TPM enhance equipment efficiency through establishment of a preventive maintenance system of equipment throughout its working life. It involves and empowers every employee, from shop floor worker to top management to initiate preventive and corrective maintenance activities
3.	Kanban	Kanban is a specially designed box/container having a kanban card in it, which moves from workstation to store on requirement bases. This Kanban card is a green signal for store to forward material to workstation for processing. Toyota motor used Kanban system to reduce the work in process inventory
4.	P-M (phenomenon mechanism) analysis	Systematic analysis of chronic defects in order to reduce them
5.	5S's and autonomous quality maintenance	A disciplined approach to standardizing operating procedures, good housekeeping and effective maintenance. The 5 standards are discussed below: *Seiri* (sort out): it mean that at workplace all the irrelevant items /things should be sorted out/ removed *Seiton* (set in order): items should be arranged properly so that they can be identified and approached easily *Seiso (shine):* shine means cleaning the workplace till it is spic and span *Seiketsu* (standardize): this mean developing and maintaining standard work practices

(*continued*)

Table II.
Different Kaizen tools and their brief description

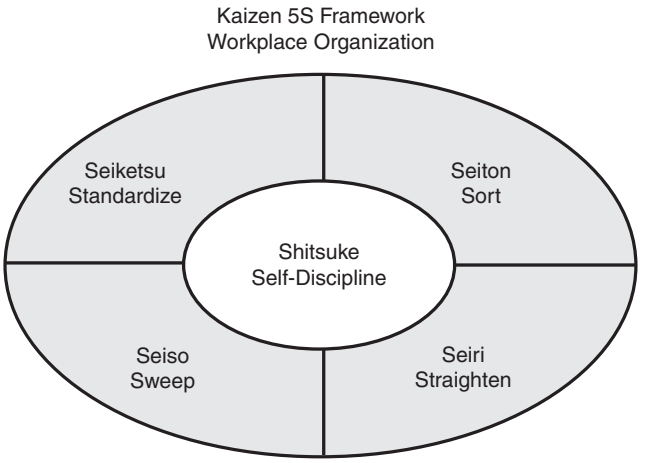
S. no.	Tool and technique	Description
		Shitsuke (sustain): sustaining the progress made. To ensure success in 5S, discipline must be maintained. Progress mad in above four points must be maintained
		
6.	Eliminating minor stoppages and speed losses	Reduction of intermittent stops during normal production to increase actual continuous cycle time to design specification
7.	Poka Yoke/Jidoka	It is mechanisms used to make mistake-proof an entire process; Poka-Yokes ensure that proper conditions exist before actually executing a process step. This prevents defects from occurring in the first place. Where this is not possible, Poka-Yokes detect and eliminate defects in the process. Stop the machine when ever problem occurred. This ensures the reliability of the process
8.	Standardised work	A work in which the successive activities have been properly structured so that it can be done efficiently, is called standardised work. The aim of standardised work is to bring the process under control by reducing variation. This in tern eradicates wastages and increases the productivity
9.	Value stream mapping	A value stream mapping is a flow diagram of all the activities required to bring a product from raw materials to delivery to the customer. The objective is to identify and get rid of the waste in the process
10.	7 W (waste)	Seven Ws are 7 commonly accepted wastes out of the manufacturing operations. They include waste from overproduction, waste of waiting time, transportation waste, inventory waste, over processing waste, waste of motion and waste from production defects

Table II.

Principles of CI

Customer-driven improvement is explicit to CI, as all efforts are made to improve the performance of the product and process. CI is an integrative philosophy of management for continuously improving the quality of products or services and processes to achieve customer satisfaction. Essentially, CI is primarily concerned with every aspect of the company's activities and is based on the principles described in Table III.

Principles	Description
Customer-driven organization	A company depends on its customers and therefore should understand current and future customer needs, meet customer requirements, and strive to exceed customer expectation
Leadership	Leaders establish unity of purpose, direction, and the internal environment of organization. Leaders should try to fully involve people in achieving the organization's goals and objectives
People participation	People are the foundations of any company. Their full involvement will enable knowledge and experience to be used for the benefit of the company. Education, training and the creation of opportunities for individual growth are aspects that should be taken into account. Typical developmental programmes that could be implemented are job rotation, financial incentive schemes and job training
Process approach	A desired result is achieved more effectively when related resources and activities are managed as a process
Systematic approach	Identifying, understanding and managing a system of inter-related processes for a given objective, will contribute to the effectiveness, efficiency and efficacy of the approach company's overall performance
Design improvement and prevention	This principle is primarily applicable at the project level, although the company's internal business processes should have a quality focus. At a project level: the project's management should place strong emphasis on design quality (this is only applicable for non-traditional procurement systems where the contractor has control of the delivery process) – as well as problems and waste prevention achieved through building quality into products, services, and production processes. Typically the costs of correcting problems at the design stage are much lower than later in the process
Factual decision making	Effective decisions and actions are based on the analysis of information and data. Information and data needed for quality improvement and quality assessments have numerous origins, such as the customer, project performance, competitive comparisons, subcontractors, suppliers, etc. Through detailed analysis of the information and data acquired, an evaluation to support decision making at various levels of the organisation will be able to take place
Partnership development	The organisation seeks to build internal and external partnerships to better accomplish their goals. Internal partnerships include agreements with unions. These agreements will predominantly occur at a project level with site management, for example, re-structuring of awards, improvement of site facilities and safety, etc. For external partnerships these will include subcontractors, suppliers, consultants, etc. An increasingly important kind of external relationship is that of a partnering and strategic alliance

Table III.
Principles of CI and its description

Barriers in implementing CI approach

The important barriers in successful implementation of CI approach demonstrated by various researchers are discussed in the Table IV.

Kaizen in terms of TQM

Relationship between TQM and Kaizen

TQM and Kaizen are interdependent. In the literature, Kaizen-CI has been broached as an important element of TQM. Kaizen is one of the reference points in the

S. no.	Barriers	Author(s)
1.	Poor planning	Rahim and Whalen (1994)
2.	Lack of management commitment	
3.	Resistance of the workforce	
4.	Lack of proper training	
5.	Teamwork complacency	
6.	Use of an off-the-shelf programme	
7.	Failure to change organizational philosophy	
8.	Lack of resources provided	
9.	Lack of effective measurement of quality improvement	
10.	Lack of management commitment	Ngai and Cheng (1997)
11.	Inadequate knowledge or understanding of CI	
12.	Inability to change organizational culture	
13.	Improper planning	
14.	Lack of continuous training and education	
15.	Inability to build a learning organization that provides for continuous improvement	
16.	Incompatible organizational structure and isolated individuals and departments	
17.	Insufficient resources	
18.	Inappropriate reward system	
19.	Use of a prepackaged programme	
20.	Ineffective measurement techniques	
21.	Short-term focus	
22.	Paying inadequate attention to customers	
23.	Inadequate use of empowerment and teamwork	
24.	Lack of a company-wide definition of continuous improvement	Salegna and Fazel (2000)
25.	Lack of a formalized strategic plan for change	
26.	Lack of a customer focus	
27.	Poor inter organizational communication	
28.	Lack of real employee empowerment	
29.	Lack of employee trust in senior management	
30.	View of quality programme as a quick fix	
31.	Drive for short-term financial results	
32.	Politics and turf issues	
33.	Lack of strong motivation	
34.	Lack of time to devote to improvement initiative	
35.	Lack of leadership	

Table IV.
Barriers in Implementation of CI approach

Deming's 14 points regarding TQM. Deming's point "Improve constantly and forever" infer the need for some sort of CI methodology such as Kaizen. So this makes Kaizen a subset of TQM (see Figure 1).

Kaizen means continuous process improvement (CPI). Some researcher considered continuous processes improvement is a natural evaluation of TQM and CI perspective. Both can be distinguishing as Kaizen focused on small and gradual improvements whereas TQM involve radical improvement of important and crucial process to get large effects (Davenport and Short, 1990). According to literature both concepts are complementary and share same philosophy. The best organization always applies both the concept together to get maximum benefits of CI. Implementation of only one concept will not be so fruitful. The difference between CI and CPI is given in Figure 2.

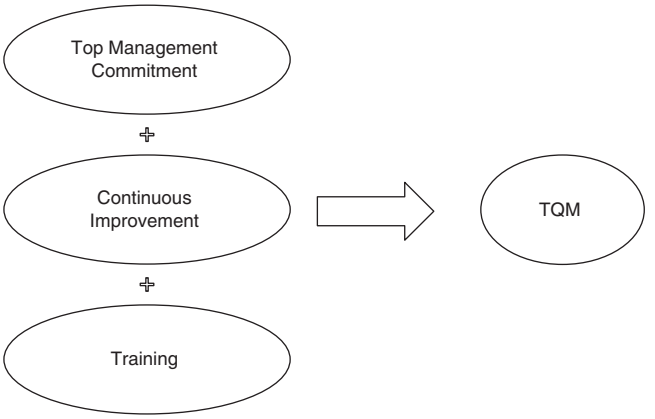


Figure 1.
Kaizen as a subset of TQM

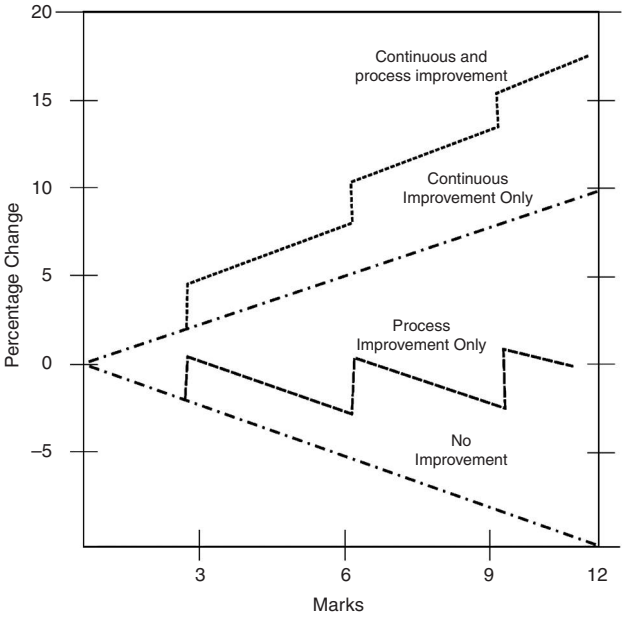


Figure 2.
Differences between continuous improvement and continuous process improvements

The Differences between TQM and Kaizen

TQM is a philosophy of what makes up a quality organization, and Kaizen is a methodology that one can apply to encourage improvements to existing processes. The main differences between the concepts of Kaizen and TQM are highlighted below in Table V.

Major guidelines for Kaizen implementation

The implementation of Kaizen strategy is primarily based on a number of guiding principles. Five major principles were particularly highlighted by Imai (1986, 1997).

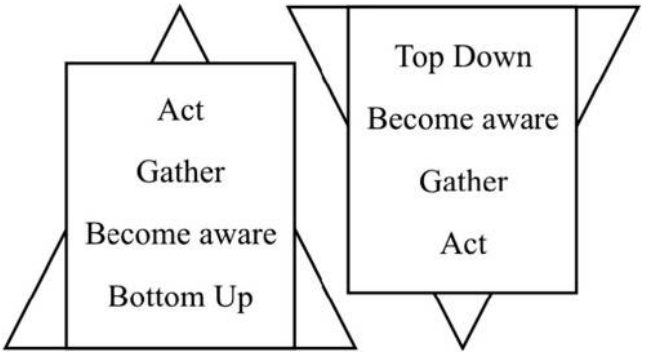
S. no.	Parameter	Difference
1.	Definitions	TQM is a management approach that aims at long-term success by focusing on customer satisfaction, based on the participation of all members of an organization through improvement of quality, processes, services, and the culture in which they work Whereas, term Kaizen is "to take apart and put back together in a better way". Kaizen is "small incremental but continual improvement" in order to improve process, quality and of course performance of the organization
2.	Focal point	Kaizen is a process-oriented concept. It focuses on the improvement of the process to get improved results in every sphere of life On the other hand, TQM is a product-oriented and customer-focus concept. It focuses on the quality of the product to satisfy the customer
3.	Scope	Kaizen can apply to encourage improvements to the existing processes. The scope of Kaizen is limited to selected project The scope of TQM is spread throughout the organization. It works on every process at every department of an organization all the time for achieving quality product and services
4.	Implementation method	Kaizen is implemented in the form of small incremental projects in a selected area in order to make changes in the work standard towards betterment. These small increment projects are known as Kaizen events. Kaizen event can be selected for each department of the organization separately also for each Kaizen event independent cross-functional team is selected which works on the improvement of one project at a time in focus area for a limited time frame. The workers or the team should work on one process at a time only Consequently, in TQM improvement is to be made on all the processes in all the business department of the organization involving all the persons at a time
5.	The approach	Kaizen concept follows bottom-up approach. The suggestions for improvement are put forward by the workers Whereas TQM concept follows both top-down and bottom-up approach, the need for improvement is suggested and introduced by top management as well as by the workers of the organization 
6.	Importance of resources	Kaizen focuses on the improvement within the available resources of the organization. It does not encourage large investment from the organizational resources for improvement Whereas, in TQM Investment has to be made to improve the quality of product or process like investment on new or updated machinery, e.g. automation, innovation, etc. TQM is little more expansive to implement as compared to Kaizen

Table V.
Difference between Kaizen and TQM

(*continued*)

S. no.	Parameter	Difference
7.	Involvement of people	Kaizen involve all stake holders at all level of the organization when asking suggestions for improvements of the organization, but it does not necessary that everyone in an organization should participate in the improvement project also. The people linked with a particular process on which improvement project is taking place are involved. e.g. cross-functional Kaizen team Whereas in TQM, whole organization including all employees at all levels are responsible and involved in improvement of quality of the product at all time
8.	Implementation mechanism	TQM focuses on simultaneous operations in all the processes. In TQM sustain and improvement goes parallel to each other. Another difference between the two concepts is that, in total quality management there is no discontinuity in the process of continuous improvement, the whole organization should always work on the improvement process On the other hand, Kaizen focus on small-scale improvements in steps. After every step, their lies a discontinuity for sustaining the improvement, afterwards the process continues toward the second step and so on. This is called continual improvement. Kaizen focuses on step-by-step improvement
9.	Improvement strategy	Kaizen strategy is made for small permanent improvements in processes However, TQM focuses on long-term improvements. TQM means organized Kaizen activities involving everyone in a company, managers and workers in a totally universal and integrated effort toward improving performance at every level
10.	Improvement through innovation	TQM involves continuous improvement of process through Kaizen and innovation Whereas Kaizen philosophy stresses on continual improvements in existing standards rather than innovation. This process leads to better utilization of R&D resources of a company and better productivity

Table V.

Processes and results

Kaizen strategy depends mainly on human efforts to improve results, and this requires process improvement. According to Imai, a process-oriented approach, referred to as the "plan-do-check-act" (PDCA) cycle is used for process improvement. Plan refers to setting a target for improvement; do is implementing the plan; check is the control for effective performance of the plan; and act refers to standardizing the new (improved) process and setting targets for a new improvement cycle. This cycle is described as "improving cycle".

As the resulting work process, following each cycle of improvement, becomes unstable due to the nature of change, a second cycle is, therefore, required to stabilize it. The second cycle is described as the "standardizing cycle", and referred to as "standardize-do-check-act" (SDCA) cycle. The main purpose of this cycle is to iron out abnormalities in the resulting work process and bring it back to harmony before moving to a new improving cycle. In other words, the standardizing cycle maintains current work processes, while the improving cycle improves them. The two cycles – PDCA and SDCA revolve regularly to spread a culture of CI as a standard practice within an organization as shown in Figure 3. This means an organization should never settle on a status quo.

Watson (1986) described that Kaizen strategy depends mainly on human efforts to improve results, and this requires process improvement. A process-oriented approach, referred to as the PDCA cycle is used for process improvement. The

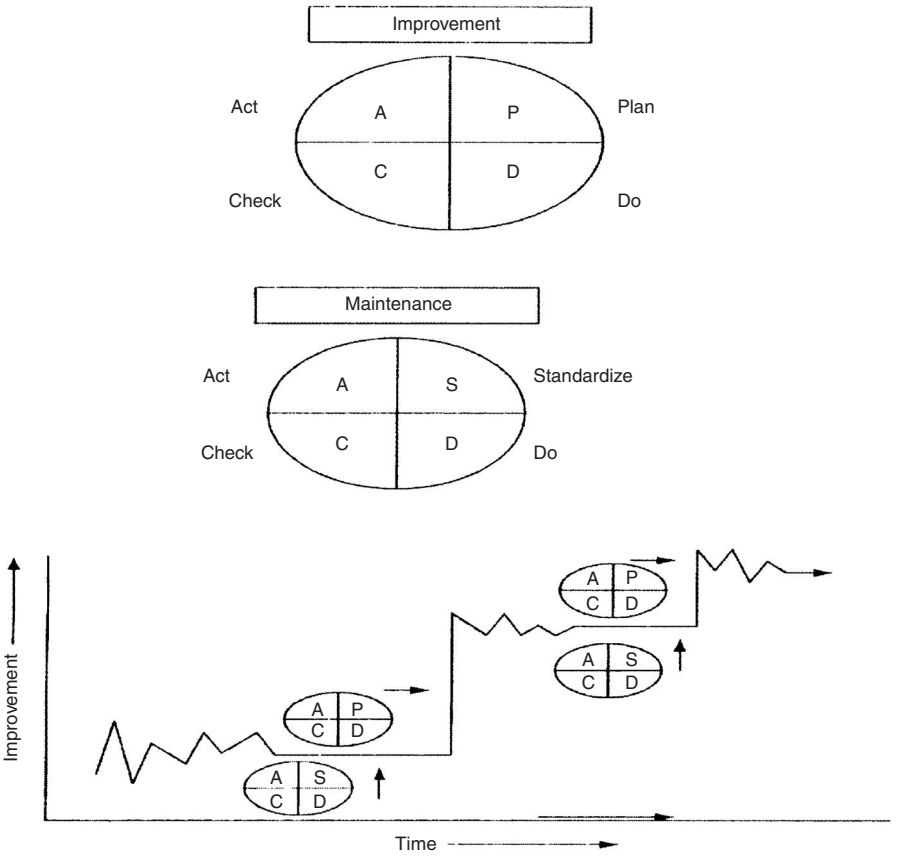


Figure 3.
Improving cycle; standardizing cycle and interaction of both cycles

origin of PDCA cycle or Deming cycle can be traced back to the eminent statistics expert Shewart in the 1920s. Shewart introduced the concept of plan, do, see. The late TQM guru Deming modified the Shewart cycle as: plan, do, study, and act. The Deming cycle is continuous quality improvement (CQI) model consisting out of a logical sequence of these four repetitive steps for CI and learning: PDCA. The PDCA cycle is also known as Deming cycle, the Deming wheel of CI spiral. In plan phase, objective is to plan for change, to analyze, and predict the results. In do phase, the plan is executed by taking small steps in controlled circumstances. In study/check phase the results are studied. Finally in act phase, organization takes action to improve the process. These concepts form the basis of virtuous cycle of improvement:

- Plan – study current situation and develop changes for improvement.
- Do – pilot measures on a trial basis.
- Check – examine effect of changes to see if the desired result is achieved.
- Action – standardize on a permanent basis.

The main purpose of this cycle is to iron out abnormalities in the resulting work process and bring it back to harmony before moving to a new improving cycle. In other

words, the standardizing cycle maintain current work processes, while the improving cycle improves them.

Putting quality first

Another principle of Kaizen is improving performance along three dimensions: quality, cost, and delivery (QCD). Quality is usually among the most important criteria customers use to make the purchase. Very often, quality is customer-defined and referred to as the perceived characteristics and features of a product. This includes the quality of processes that go into it. Cost is usually looked at from the manufacturer's perspective, as the overall cost of making and selling a product. An important factor, here, is the elimination of waste in many aspects of work (i.e. production, inventory, repair, rejects, motion, processing, etc.). Delivery refers to delivering the required quantity of products in the right place at the right time. The company may offer better prices (through reduced cost) and attractive delivery terms. But this does not guarantee competitiveness if the quality of goods and services falls short of consumer expectations. Some cost-oriented managers do not resist the temptation of cutting cost at the expense of quality. This could work well in the short run, but would likely to jeopardize not only profitability, but also image and market position of the product in the long run. The point Kaizen tried to highlight in this regard was that organizational competitiveness would be improved only when QCD were already improved (Chan *et al.*, 2005) with quality being given top priority. Kaizen also indicated that management would need to develop cross-functional collaborations within the organization to create a momentum for CI in QCD.

Hard data vs hunches and feelings

The Kaizen methodology is viewed as a problem-solving process (Montabon, 2005). To solve a problem effectively and efficiently, relevant hard data must be gathered and made available for analysis – not just hunches and feelings. The methodology can be viewed this requirement as an imperative for CI.

The next process is the customer

The Kaizen methodology viewed the whole work in an organization as a series of interrelated processes; each has a supplier and a customer. The supplier provides the process with inputs (i.e. materials and/or information). The supplier can be another process within the organization or someone outside the organization. The customer is either someone in the organization (usually called internal customer) or the final customer out in the market (external customer). The customer receives (or deals with) the output of the process. Having this in mind, all individuals within an organization deal with customers – either internal or external ones. That is, the next process is always regarded as a customer. The model will gradually lead to a commitment that employees never provide inaccurate information or defective materials to those in the next process, particularly when the organization has a strong commitment to consumer satisfaction. In other words, Kaizen – through this principle – tried to establish a natural commitment to ongoing process improvement throughout the organization to ensure that external customers will always receive high-quality products. One study found that Kaizen was the reason for substantial improvement in process performance (Bradley and Willett, 2004).

Visual management

Abnormalities do occur in almost any workplace. Very often, they arise when a certain process is not fully under control, or totally out of control. In fact, if an abnormality in a

process is not detected in real time, it will be difficult to handle later. Visual management is another principle of Kaizen that allows problems to be visible to every one in the work process, so that a corrective action can be taken in real time, and that similar problems do not arise in the future. Visual management is an integral part of Kaizen and has three purposes:

(1) *Making problems visible*. Obviously, if management cannot spotlight a problem at the real time, nobody can solve it correctly. For example, customers in a service organization may make serious complaints about a poor service, indicating areas of deficiencies or abnormalities in the service process. The complaints should make the problem visible to the customer service department. If these complaints are not noted for management attention in real time, they will increase further, causing real damage to the business. Where visual management is practiced, such abnormalities can be made visible to management as soon as they arise and handled effectively in real time. This will also minimize chances for similar problems in the future.

(2) *Staying in touch with reality*. When process performance is made transparent, usually through documented performance (i.e. clear display of lists, records of performance, sales volume, production figures, recurrent problems, customer complaints, etc.), workers and managers stay in direct contact with the developments in the workplace to keep in touch with reality. Overall, this keeps processes under control and sends early warning signals as soon as an abnormality arises.

(3) *Setting targets*. The third purpose of visual management is setting targets for scheduled improvement levels. Members of the organization, then, become conscious of management expectations concerning improvements. For example, an employee may draw a straight line on a graph posted near to him/her showing targeted improvement jumps, which, in turn, gives him/her a sense of achievement.

Through visual management, Kaizen attempted to visualize performance problems between current realities and targeted performance levels and to remove barriers to CI. Toyota Motor Corp., for example, was able to leverage the power of the visual factory In Great Britain, a study showed that the Kaizen strategy, which was used by Reckitt Benckiser PlC, makers of Strepsils and Lemsip, provided guidelines to teams and individuals to be in line with the company's targets for CI (Dwyer, 2006).

Major principles and technical aspects

Main principles

- Principle 1. Kaizen is process-oriented, i.e. before results can be improved; processes must be improved, as opposed to result-orientation where outcomes are all that counts (Imai, 1986, pp. 16-17).

Kaizen does not state that results are of minor importance, but rather that management attention should be directed towards creating sound processes since it is assumed that good results will follow automatically. However, a good result lacking the control of the process is not sufficient inasmuch as results are caused by largely unknown factors. The principle has at least two practical consequences for the improvement process. First, management's main responsibility is to stimulate and support the effort of

organizational members to improve processes. In order to be improved, a process must be understood in detail, which in turn means that variability and interdependence in the separate activities and methods used to combine people, machines, material, and information have to be known and controlled. Monitoring and improving process variability at this level of detail requires that a majority of employees are actively involved. Consequently, management needs to support employees with adequate skills and training in simple process-oriented methods such as the "seven quality tools". In addition, focusing on processes, i.e. activities and work methods, instead of their often compounded outcomes facilitates the use of employee experience and common sense.

Second, process-orientation calls for evaluating criteria which can monitor and bring attention to the improvement process itself, while simultaneously acknowledging its outcome. The number of suggestions, implementation, and participant rates are used as prime criteria for evaluating the improvement process in terms of, e.g. employee efforts, supervisor, and first line manager support. This indicates that Kaizen serves as a management system for monitoring employee motivation, a feature partly overlooked in western CI applications (Berggren, 1994).

- Principle 2. Improving and maintaining standards, lasting improvements can only be achieved if innovations are combined with an ongoing effort to maintain and improve standard performance levels (Imai, 1986, pp. 6-7).

Kaizen is distinctive in its focus on small improvements of work standards as a result of an ongoing effort. Furthermore, "There can be no improvement where there are no standards" (Imai, 1986, p. 74) which in essence denotes the relation between Kaizen and maintaining standard procedures for all major operations (standard operating procedures (SOPs)). In fact, the Japanese Kaizen is argued to be inseparable from maintaining standards since this relation is one of the very foundations for claiming that small ongoing improvements can accumulate to an overall contribution to organizational performance. The reasons for highlighting standards can be traced to three general characteristics which are claimed to follow with the standardization of operating procedures:

(1) individual authorization and responsibility;

(2) enhanced learning through the transmittal, accumulation and deployment of experience from one individual to another, between individuals and the organization and from one part of the organization to another; and

(3) discipline.

One indication of the Kaizen (and perhaps Japanese) pragmatic view on standards is the claim that:

> The standard should be binding on everyone, and it is management's job to see that everyone works in accordance with the established standards. This is called discipline (Imai, 1986, p. 75).

To support the desired behaviours, the PDCA problem-solving format is used. In practice, this simple but very systematic format of a "wheel" of never-ending improvements has become the most frequently used symbol for Kaizen. The PDCA-loop seems to work as a standardization of the improvement process, a quite simple framework for using the different quality tools which make the improvement process

both visible and measurable while also serving as the main link between improvements and standardized routine work. This notion of separating the maintenance and the improvement of standards is a characteristic which also is reflected in the organizational forms of Japanese Kaizen.

The most common form for Kaizen – the permanent or temporary small group – does not integrate improvement as a part of the routine tasks. Improvement work is commonly distinguished from ordinary work in what Lillrank and Kano (1989) denotes a parallel structure, the quality control circles (QCC) hybrid organization. Briefly, the PDCA-cycle for improving work methods is used in a setting where workers' ideas can be tested without changing the rules of seniority and without competing with managers' attention to ordinary tasks. After a completed PDCA-cycle, the result is channelled back to the formal organization through the suggestion system and subsequently evaluated by line management. Provided that results are considered satisfactory, it is line management only which can formalize the improvement by altering the standards in the formal organization and thereby closing the PDCA-loop (see Figure 4).

- Principle 3. Kaizen is people-oriented and should involve everyone in the organization from top management to workers at the shop floor.

Two practical features can be derived from these principles. First, in order for everyone to be involved, there needs to be a form and content for ongoing improvements that make use of everyone's contribution in relation to, e.g. skill and hierarchical level. Furthermore:

> Kaizen is based on a belief in people's inherent desire for quality and worth and management has to believe that it is going to "pay" in the long run (Imai, 1986, p. 40).

According to Imai (1986), there are three types of Kaizen activities, each with its own form and focus in the overall improvement process. Management-oriented Kaizen concerns the gradual improvement of systems procedures such as planning and control, organization, decision-making processes, and information systems but also to some extent the improvement of machinery and equipment. Group-oriented Kaizen as a permanent approach is represented in QCC and other small group activities in which employees focus primarily on improving work methods, routines, and procedures. The temporary approach often involves teams of employees which

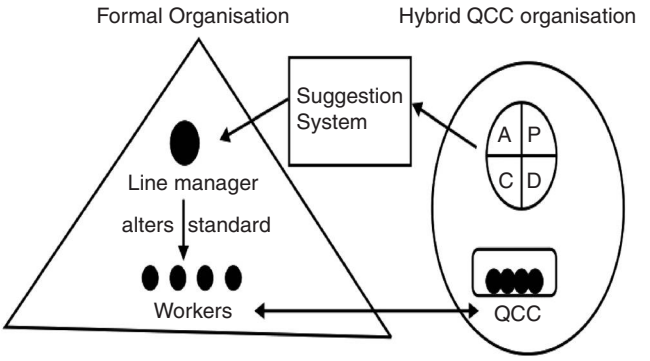


Figure 4.
Parallel structures

Source: Adapted from Lillrank and Kano (1989, p. 117)

are targeted on a special problem or a theme introduced by management. Individual-oriented Kaizen is the third form of improvement work which to a large extent can be equated with suggestion systems. The primary focus is to improve one's own work, i.e. on the spot improvements of work methods, routines and the use of resources. Second, the principle suggests that the motivation for Kaizen is predominantly intrinsic. The Japanese approach to motivation is quite pragmatic and avoids the obvious contradiction between volunteerism and the principle that everyone should be involved. Intrinsic needs for skill development, quality and worth combined with management acknowledgement for efforts and reward systems for results, are proposed to be sufficient motivation for workers to participate in improvement activities. In addition, it appears that the indisputable nature of manager seniority and discipline can force a majority of workers to participate in improvement activities. The linguistic and cultural problems of understanding and transferring the motivational aspects of Kaizen, might be found in the concept of "Jishusei" which is usually translated as volunteerism. While the Japanese concept emphasizes the autonomous nature of improvement work, a western interpretation would commonly equate volunteerism with the "free choice" of joining:

> Thus, "Jishusei" is not a matter of an individual being able to decide whether to join the activity or not; rather, it implies that the activity, once started, should be propelled by the energy of the members themselves, without constant oversight and interference from outside (Lillrank and Kano, 1989, p. 94).

Summing up the brief review of some core principles of Kaizen and the related management concepts based on Japanese experiences, it seems that the characteristics of Kaizen can be described at two different levels. The first-level concerns the management improvement concepts which indicate a mind-set for the required management behaviour, whereas the second level describes the practical outcomes for the workforce (see Table VI).

Core principles	Management improvement concepts	Practical outcomes
Process orientation	Process control through process support and evaluation methods	Training the workforce in simple and use existing skills and experience Efforts are emphasized and encouraged while results are rewarded
Small step improvement	Extensive use of standards (SOPs) as the base for improvement Separate the task of improving and the task of maintaining standards	Discipline required to maintain standards Focus on improving own work standards using a common problem-solving format – PDCA
People orientation	Active management support and involvement "Mandatory volunteerism", management policy to join but contributions based on volunteerism	Broad participation using permanent or temporary groups for problem solving in parallel structures (QCCs and to join but teams) Individual suggestion systems for training and motivation

Table VI.
Kaizen principles, management concepts and practical features

Technical aspects behind these principles

Currently, the combination of theories such as JIT and total quality control allied to many other complementary theories, such as visual management, total productive maintenance, time-based competition, reengineering and value-based management, represent what is known about best production methodology Kaizen. Koskela (1999) argues that most of these theories have originated around some core heuristic principles. CI is one of these principles. It consists of implementing practices that results in ongoing incremental action in ongoing incremental action aimed at improving production efficiency and efficacy.

According to Werner (1994), one of the basic premises of these Kaizen principles is not to accept established knowledge as the ultimate truth. This premise implies that nothing is static-it is always subject to review so it can always be improved, whether it is a machine, a process, a system, or a human activity (Shingo, 1988). Even if an activity is being carried out well, question should always be asked about the possibilities for improving it.

The principle is commonly associated with the PDCA cycle, also referred to as the "Deming Wheel or Cycle". When CI is in place, the PDCA cycle is repeated over and over again. Each phase of this cycle has an important role to sustain ongoing improvement in production as explained below (Vondererembse, 1996):

- Plan: to identify problems or opportunities for improving and developing a plan to make changes.
- Do: to implement the plan, documenting, and changes made.
- Check: to analyze the revised process to see if goals have been achieved.
- Act: to standardize, document, and disseminate the results. If these goals are not achieved, determine why not and proceed accordingly.

Most of what is discussed today regarding CI comes from interpretation of the Japanese practice called Kaizen. CI is driven by knowledge and problem-solving activities (Schroeder, 1993). Thus it depends on people's ownership of the problem in order to maintain the flux of improvement. Indeed experience in practice have shown that when the people actually do the job have control of CI activities the consolidation of quality programmes is more likely to be successful. It is also more natural and likely that they will achieve a durable self-driven improvement process when their actions are taken step-by-step, gradually introduced as a collective system for a entire company. The challenge of building CI into production systems is to devise ways of establishing win-win relationships throughout the entire organization. In this sense, it requires sharing the benefits of eventual reduction in waste and increase in value with everyone involved (Starkey and Mackinlay, 1993). Important lesson from the best Japanese practices in the application of the CI principles is their relentless attitude towards the solution of problem in production. Japanese managers have found that seeking improvement for improvement's sake is the surest way to strengthen a company's overall competitiveness in the medium and long terms (Monden, 1998).

Relevant literature

After Second World War, most Japanese companies had to start literally from the ground up. Everyday brought new challenges to managers and workers alike and for simply staying in business; it required unending progress. As a result, Kaizen

had become a part of life. It was a fortune that experts like Deming and Juran had introduced the various tools that helped to elevate this Kaizen concept to new heights to Japan in the late 1950s and early 1960s (Yung, 1996). The relevant literature is classified into the three different categories:

(1) literature related to conceptual framework;

(2) literature related to case studies; and

(3) literature related to surveys/empirical research.

Literature related to conceptual framework

Martin (1993) described that TQM represents a new overall approach with a new label to achieving service pertinence and improvement, but there is already a sound base of good management practice on which to build its implementation, create beneficial change and head for Kaizen. TQM demands their consistent application within a coherent framework to achieve overall improvement alongside a culture shift in the way the organization and its staff operate.

Bessant *et al.* (1994) argued that there are many critical factors for successful CI including:

- Strategy: CI must be incorporated into the organization's strategy. CI activities also need to be well planned having targets, milestones and a communication system in mind.
- Supportive culture: CI values must be encouraged by the organization. The idea that everyone has something to contribute must be part of the organizational culture.
- Infrastructure: adopting organizational structures, which promote efficient communication and decentralized decision making.
- Process: adopting learning or problem-solving processes.
- Tools: the availability of problem-solving tools is of great benefit in assisting employees implement CI.

Dixon (1994) described that the idea of CI and learning are involved in the implementation of six-sigma (SS) projects through the DMAIC-cycle. The cycle includes basically searching for improvement opportunities which requires commitment to learning. The increasing need for performance improvement tends to invalidate existing answers in an organization and requires continuous learning. Knowledge is attained through learning; learning generates improvements that can lead to learning and again to further improvements. Organizational learning occurs on a continuous basis. It functions as a dynamic mechanism for improvements. And the organization's capabilities to learn more quickly are likely to enhance and sustain competitiveness.

Harrington (1995) described that, for any organization to keep pace with the fast-changing environment, it needs to take full advantage of both CI and breakthrough improvement. Organizations which are just starting their improvement process activities should first direct their efforts to CI, establishing a working base. Then they should expand their improvement effort to include breakthrough improvement. As they start to apply breakthrough improvement to their critical business processes, they should consider using all three breakthrough improvement approaches namely process benchmarking, process redesign, and new process design.

Seaker and Waller (1996) described that companies will use techniques or programmes such as TQM, empowerment, reengineering, and CI to enhance quality and productivity for the purpose of reaping higher profits. These contemporary management tools attempt to bring out the latent talents of employees. Human capital in the form of knowledge, creativity, and experience is expected to be tapped so that business operations can be improved. However, in order to be successful with any of these techniques it is vital that the employees be enabled to articulate their ideas and inquiries. This is basic and crucial to the successful application of contemporary management techniques. Such articulation, this paper argued, can be brought to bear through brainstorming – what we will call question and solution brainstorming.

Bessant and Caffyn (1997) identified the main abilities associated to CI. They represent the behaviour pattern that should be present in the organization, which is defined as follows: organizational ability (capacity or ability to adopt a particular approach for CI; constitutive behaviour (behaviour routines established by employees who reinforce the CI approach); and facilitators (procedures and techniques used to improve CI efforts).

Berger (1997) proposed to delineate a set of core principles from the Kaizen concept and illustrate the contingent nature of the design and organization of CI processes, especially with respect to product/process standardization and work design. Given differences in the overall degree of standardization related to product design and process choice, two types of standards to reduce variability at operator work process level should be considered: indirect system standards, e.g. for skills, organization, information, and communication; and direct SOPs.It is proposed that two team-based organizational designs for CI (organic CI and wide focus CI) are functionally equivalent to the Japanese Kaizen model, particularly when combining indirect system standards of skills with a group task design and low degree of product/process standardization. The author described that CI concept is process and people oriented, and also helpful in improving and maintaining standards.

Boer *et al.* (1999) discussed that according to both CI and learning theories, adequate organizational arrangements and mechanisms can facilitate the transfer of individual learning into organizational learning. However, little is known about the conditions under which these arrangements and mechanisms are successful. Current research aims to provide more insight into the character of these arrangements and mechanisms, and into the conditions under which they are successful.

Leede and Looise (1999a,1999b) reviewed some existing organizational designs for CI on these three essential characteristics of CI. As an alternative to the shortcomings of current organizational designs for CI we present the mini-company concept, related to the socio technical concept of the self-managing team. The mini-company concept incorporates the three key issues: it has a self-propelling capacity for CI, involving everyone on the shop floor. A constant and market-oriented source for improvement is found in the clients and suppliers of the mini-company. Results of an in-depth casestudy are presented, showing some strong effects of the mini-company concept.

Savolainen (1999) stated that implementing CI activities can be considered an organizational renewal process, which is reached by introducing new behaviour and ideologies, especially regarding managerial practices. CI consists of a thorough organizational process focused and supported by an approach towards incremental improvement. It is considered an important managerial strategy for the company to

develop its competitive capacities to cope with turbulence and uncertainties of external environments.

Bessant *et al.* (2001) defined five evolution stages in CI practices in organizations. These stages range from 1-5, and the first one (pre-improvement) occurs when the organization introduces the concept of CI without influencing organizational performance. In the fifth level (overall CI), the whole organization is involved in improving activities of incremental and radical innovations. At this stage, sharing knowledge and experiences also takes place making it a model of organizational learning.

Bolton and Heap (2002) suggested that CI is an unworkable approach to organizational transformation; that discontinuity is essential to ensure that gains are consolidated and locked into baseline performance. There is a variety of routes to organizational transformation; all must start with an understanding of where the organization wishes to be at all end of the programme. However, critically the approach is based on a view that long-term improvement requires periods of consolidation that discontinuity must be explicitly brought into the process.

Doolen *et al.* (2003) described the variables that are used to measure the impact of Kaizen activities on human resource. These variables includes attitude towards Kaizen events, skills gained from event participation, understanding the need for Kaizen, impact of these event on employee, impact of these events on the work area, and the overall impression of the relative successfulness of these events.

Davadasan *et al.* (2003) described that Failure prevention is recognized as one of the major enablers of attaining CI in TQM projects. Theoreticians have been propagating the employability of failure mode and effects analysis (FMEA) as the technique for identifying and rectifying failures in achieving CQI. However, FMEA does not facilitate holistic failure prevention and suffers from certain deficiencies. Hence a modified and improved technique named as total failure mode and effects analysis (TFMEA) has been proposed in this paper. Its design details, implementation procedure and practicality are presented in the paper. The paper is concluded by suggesting that future researchers can work towards developing change management strategies for successfully implementing TFMEA in organizations.

Jorgensen *et al.* (2003) described that innumerable accounts of successful implementation of Kaizen in Japan during more than 40 years has led to the expectation that CI might offer companies a means to gain and maintain a competitive advantage in the turbulent 1980s and 1990s. However, the majority of CI initiatives within the USA and Europe died within a few years. While explanations as to why these efforts have not been successful can be found in the literature, methods for rejuvenating stagnant CI programmes are still lacking. In this paper, experiences from a longitudinal action research project with a middle management group are presented to illustrate how a process of facilitated self-assessment was used to identify and address barriers to CI implementation. Through this process, a better understanding of CI implementation issues was gained and CI implementation within the company revitalized.

Leem and Kim (2004) described that in order to achieve competitive business goals; every enterprise needs to evaluate the current level of information systems performance and their utilization. The evaluation measures the technical capacity and operational capability of enterprise information systems and diagnoses their effectiveness in business goals and efficiency in resources. An integrated evaluation system is developed based on the CI model of information systems performance.

The system has been applied to performance measurement of information systems with a huge set of data from Korean industries and proven reliable and practical.

Witell *et al.* (2005) described that CI has become an important strategy in improving organizational performance. Unfortunately, product development is often excluded in CI programmes due to the special characteristics of product development activities. The overall purpose of this paper is to contribute to a better understanding of CI in the context of product development. A central aspect in this context is that many organizations find it difficult to improve and learn if work is carried out in the form of projects. In this paper, a quality perspective on CI is introduced and its usefulness is tested empirically through three case studies in Swedish organizations. The focus is on the improvement programmes used and the quality principles displayed in a product development context. The results indicated that the three investigated organizations have multiple improvement programmes, but that some configurations of improvement programmes seem to be more successful than others.

Marin-Garcia *et al.* (2008) considered CI as one of the foundations of production systems based on the models of TQM, Lean Production and World Class Manufacturing. Although, often associated with these models, the CI process can be implemented as an independent programme that produces cumulative improvements in the organizational performance indicators. Therefore, CI is an important strategic tool to increase competitiveness in organizations.

Smadi (2009) revisited the Japanese model of CI (Kaizen) in order to evaluate its contribution to competitiveness in organizations and also recommend possible future research directions. The paper examines a vast body of research, which looked at the model from different perspectives, and critically explores its potential benefits and drawbacks in organizations. The paper concluded that, if properly implemented, Kaizen model can substantially contribute to CI and, thus, drive organizations for high competitiveness without a need for major investment. The findings suggested that the implementation of Kaizen calls for a development of a suitable culture within an organization that encourages creativity and promotes the theme of never settling on a status quo.

Literature related to case studies

Augsdorfer and Harding (1995) emphasized that, for a company seeking to implement a CI strategy, research has pointed to two pertinent policy suggestions. First, it is possible to take the essence of a CI philosophy (i.e. one where the emphasis is on creating an improvement-based learning culture in the company) and apply it in any environment, however underdeveloped in terms of the tools of quality management it may be. But the key to success lies in the second factor for success. It was suggested that in order for a CI programme to be sustainable it has to be viewed as long term and company wide. The tools and infrastructure of quality management have to be supported by strategy, culture, and process in a way that allows the organization to learn and, hence, improve itself.

Davenport *et al.* (1996) reported that in an organization new product development (NPD) process is not easily reengineered. NPD change initiatives may have significantly different characteristics from those present in successful administrative and operational reengineering and CI projects. First, it is often the case that the process is poorly understood and documented. Second since knowledge work is a large component of NDP; much relevant knowledge may be implicit rather than explicit.

Third, because of the strategic importance of NPD, it is risky to change a process that is producing acceptable outcomes.

Jha *et al.* (1996) examined the nature of CI, including its history and definition. Then the authors discussed CI in relation to other types of improvement programmes, including adoption of new technology and in relation to other ongoing organizational processes and functions. Having introduced these concepts, the North American experience with CI is described. The success factors for CI as identified in the literature are also outlined next. Then we evaluate the literature, drawing implications for practice, and identifying some open research questions. The final discussion provided the closing remarks about the alignment of organizational attributes and activities for effectiveness in CI programmes.

Oakley (1996) described a CI model, developed by Deming and applied by the author. The model showed how organizations can align their performance with customers' expectations. The author focused on some of the key areas of concern for the communicator when implementing a CI programme including internal and external performance, team participation, and performance enhancement.

Elmuti and Kathawala (1997) provided an overview of benchmarking process and its implications for CI and competitive advantage. In addition, the perceived benefits, costs, and the process of implementation of benchmarking are explored. The ethical and legal implications for the introduction and implementation of benchmarking process have been discussed. It is concluded that benchmarking has become a popular adopted procedure and is used to gain competitive advantage. Over time the procedures used to benchmark have been improved and modified. Many companies are becoming interested in benchmarking for the CI it allows. Benchmarking is growing in appeal to organizations due to the cost savings achieved in executing operations. It also supports the organizations' budgeting, strategic planning, and capital planning.

Watson (1998) discussed the application of CI techniques used by Tracor Aerospace Company. The author considered elements such as leadership, strategic planning, and customer and market focus. Data and information are collected continuously, measuring, and monitoring all aspects of the business. In conclusion, Tracor team members are very proud of their accomplishments and are dedicated to continuing and improving all our methods. We truly aspire to be world class in managing our business, to be viewed as the number one supplier for selected defense products, systems, and commercial derivatives by offering proven, low-risk technical solutions combined with the best understanding of our customers' problems, just as our vision statement says. Manufacturing processes can be managed using data and statistical process control (SPC) and are continuously improved to ensure that results meet all goals and expectations.

Bond (1999) studied both Kaizen and reengineering programmes in a leading international company indicated that the process life cycle has four characteristic stages. A newly designed process commonly suffers from a variety of teething problems during the initial post commissioning phase. Once these have been eradicated achieving smooth product flow becomes important in accordance with JIT philosophy. A stable process may be improved by applying a Kaizen CI programme. A dramatic step-change in performance may be achieved by radical reengineering. It is suggested that each of these phases has its own characteristics which should be taken into account when determining performance metrics and designing approaches to process monitoring and control. Explicitly recognizing the stage a process has reached in

the life cycle provides guidance for practitioners effectively to direct and manage a programme of performance improvement.

Bessant and Francis (1999) described that for developing CI capability, organizations need to move to a level of development in which strategic goals are communicated and deployed and where improvement activity is guided by a process of monitoring and measurement against these strategic objectives. Policy deployment of this kind is more prevalent in Japanese examples and in a handful of cases in western firms. Implementing it poses significant challenges and requires a different and additional toolkit of enabling resources. This paper reports on the experience of policy deployment in Japan and in western enterprises and explores some of the implementation issues raised. The paper had briefly outlined some of the characteristics of organizations deploying CI for strategic advantage.

Gieskes *et al.* (1999) described a methodology, called CUTE, after the ESPRIT-project CUTE (Continuous Improvement using Information Technology towards Excellence) which aimed at the development of a software-aided tool to support companies, in particular small and medium-sized enterprises (SMEs) with the development of a sustained CI process. CUTE is based on a variety of hitherto mostly separate disciplines, in particular organization design, operations management, innovation management, and information technology. The methodology guided the user through a number of steps in which causes of poor performance are revealed, ways to develop improvement suggestions are generated, and the company's capabilities to further develop and implement those suggestions are assessed. Through the ongoing development, implementation, and evaluation of improvements both the company's performance and its CI capabilities are improved continuously. A first test of the methodology showed that CUTE helps users to increase their understanding of their operations and performance, and that the methodology provides a stimulus for starting focused improvement activities.

Kerrin (1999) presented the illustration of the utility of Bessant and Caffyn's framework for the development of CI capability, by assessing the structure of CI within one case study organization. The structure of the CI programme and examples of CI activities provide evidence of the link to top-down strategic business targets. The discussion suggested that the organization has moved to a "goal oriented CI" where there is formal deployment of strategic goals through the structure of the CI activities and the relationship with business activities. Practical and theoretical implications of using this framework are considered. The evidence presented suggested that in relation to the six behaviours put forward by Bessant and Caffyn, the case company would appear to have created structures for a CI system which links strategically to organizational targets. Evidence presented here demonstrated how the CI activities affected the set targets.

Alstrup (2000) introduced the CI concept in three small enterprises with employees with little manufacturing background. The approach adopted was carefully tuned to the actual situation and conditions in the firms. A key element in the approach was that facilitating the learning process of both the employees and the management was regarded as core to the continuity of the CI activities. The research suggested that, in order to create a climate of confidence, consultants hired as external coaches to support CI activities must, on the one hand, respect the owner-manager's need of sovereignty and the short-term, "flexible", style of the small enterprise. Results indicated that it is possible to use the concept of CI in small enterprises with unskilled workers if the special conditions (short-term thinking, opposition to theory, need of sovereignty, etc.)

are understood and respected by the consultant. A linear, logical concept, such as CI, may be a good approach but the consultant must realize that the activities will develop in many different ways.

Elsey and Fujiwara (2000) conducted a study which takes the Japanese concept of Kaizen, that is, CQI, as a means of looking behind the Toyota Production System (TPS), to examine in some detail the work of Kaizen and technology transfer instructors in overseas transplants. Special attention is paid to their role as learning facilitators. The research provided the insights into how these workers prepare for their overseas transplant assignments, the methods they use to instruct other workers and the kinds of problems they experience in relating to and communicating with foreign employees of Toyota. The findings showed the commitment the technology transfer instructors have to doing their work well and living by example the corporate culture and values of Toyota. These workers recognized the special challenge of communicating effectively as learning facilitators across different national cultures and languages and make practical suggestions for improvements in this regard.

Harrison (2000) described the deployment of new wave practices in two different case-environments, using the Japanese "human ware" model to investigate the integration of technical and social aspects. By comparing results from two units of analysis in each case, it was possible to make conclusions about the nature of the trade-offs at stake, and about the impact of other policies on CI in particular. It was concluded that deployment of fresh approaches to organizational and human aspects has been a feature of many descriptions of the implementation of "new wave" manufacturing strategies.

Dooley and Johnson (2001) revealed that organizations are changing their NPD process in order to introduce improvement to innovation performance. The purpose of this study was twofold. First, we wish to characterize the change process to examine whether the approach taken represents reengineering or CQI. Second, we wish to compare the process of change to an ideal model of change and see how closely practice followed theory. Case studies of six companies were developed from interview of executives, reengineering team members and other organizational members. It was concluded that NPD change efforts can be characterized by elements of both reengineering and CQI.

Tennant *et al.* (2002) presented the development of a CI process for the customer relations department at Severn Trent water in the UK. In company research was carried out to identify the main barriers to CI in the areas of leadership, training, communication, motivation, teamwork, and change management. The study concluded that the company should develop an organizational culture and management style to support CI of daily working processes, and that change should be managed against the achievement of appropriate quality triages. A CI process was developed based on a structured problem-solving model incorporating the application of established quality tools, to be applied by problem-solving teams for the customer relation department. It was recommended that the team members should be trained in the problem-solving process and the related quality tools and techniques.

Dabhilkar and Bengtsson (2004) Illustrated that how strategic CI capabilities were developed in three Swedish manufacturing companies that have implemented the Balanced Scorecard (BSC). A multiple case study was conducted; each company followed a unique team-based CI strategy. Result indicated that how the use of BSC was adapted to the specific characteristics that each of the CI strategies entail. Furthermore, result showed that it could be difficult to sustain the capability that was developed. However, also finds that certain mechanisms in the management control

system, as well as the presence of an advanced work organization, may help in sustaining the strategic CI capability.

Ehie and Sheu (2005) investigated the potential of combining SS and theory of constraints (TOC) to improve production system performance. Based on the literature, this paper proposed an integrated TOC/SS framework and applies this framework to an axle manufacturing company to improve its gear-cutting operation. The results of the case study indicated that the company benefited tremendously from its emphasis on global improvement guided by the TOC concept. Managers were able to select a CI project that had greater impact on bottom-line performance. On the other hand, SS provided various statistical tools and engineering techniques (such as value analysis, Pareto diagram, and control charts) for defining the specific process to be improved, analyzing the root causes, and designing actions for making improvement.

Ljungstrom (2005) aimed at evaluating and developing a model created to start-up the implementation of CI and work development (WD). The model was evaluated through action research at two different Swedish companies. The study indicated that companies using the model can be successful in the start-up of CI and WD and that the model creates opportunities to go further in both CI and WD issues. The study emphasizes the idea that facilitators are important for starting up and initiating a change in behaviour. The results also indicate the need for structural changes and a more profound competence in WD and coaching among managers to further develop a successful combination of CI and WD. The results also indicated that the model facilitates the start-up and implementation CI and WD and that it creates opportunities to go further with both the CI and WD.

Bhuyan *et al.* (2006) presented a case study of developing CI methodology in an aerospace company that is successfully being used by other companies in various industries. A case study was undertaken at a medium-sized aerospace company for over a span of one year. Data was collected through in-depth interviews, attendance at formal and informal meetings, observation, and company documentation. The paper provided an overview of a CI methodology known as Achieving Competitive Excellence (ACEe), which aims to achieve world-class quality in products and processes. The paper described in detail the tools and techniques needed to implement and maintain the methodology. It was found that the company is very successful in addressing a wide range of aspects in the organization, always with the viewpoint that the customer is number one. This methodology is successful to the point that it is being used by other companies in various industries.

Savolainen and Haikonen (2007) examined the dynamics of organizational learning and CI in the context to SS implementation in business organizations operating in multicultural environments. A specific research question is:

RQ1. Does learning mechanisms and CI practices support each other and how, and what type of learning can be identified in the improvement of business processes?

The question is linked to one of the fundamental issues currently discussed in the field of organizational learning; how do organizations get "from here to there", in other words, what is the dynamics of the processes of learning and how progressive learning is achieved. A case study of a few Finnish companies was made and a procedural implementation model is applied. The findings suggested that the learning process is characterized by measurement, detection and correction of errors, and cost reduction.

In SS implementation, learning is a single-loop type of learning. It is an incremental change process which reminds a technical variant of the learning organization. CI occurs through procedural practices (the DMAIC-cycle) which form a structure for sustaining learning.

Jung *et al.* (2009) explored the relationship between competitive strategy, TQM, and continuous improvement of international project management (CIIPM). Based on a literature review, a theoretical model and five hypotheses are developed. A cross-sectional data set collected from 268 international project managers based in four countries is used to test the theoretical model. The results from the statistical analysis suggested that competitive strategy does not directly influence the CIIPM performance, but it influences through the mediation of TQM practices. The results also suggested that "human resource-based" TQM elements have stronger influence towards CIIPM performance than "technology-based" TQM elements. TQM elements fully mediate the relationship between competitive strategy and CIIPM. This implies that organizations need an innovative management methodology, such as the TQM practice, in order to achieve competitive strategy materializing towards international project management performance. Further, the findings suggest that it is the soft TQM elements (i.e. top management's leadership, compensation, training, and empowerment) that impact the CIIPM more significantly.

Literature related to surveys/empirical research

Chang (1995) discussed a recent survey of companies which shows that, although 73 per cent of the respondents had implemented total quality initiatives, 63 per cent of these initiatives were failing. It was suggested that many organizations are trying to implement too many quality improvement activities too fast without taking the time to develop systematic, long-term implementation of strategies. The author also provided the guidelines on critical success factors for CI and their impact on management, empowerment, learning, and training.

Chapman and Hyland (1997) examined the results of work being done by a team of Australian researchers on CI in Australia. The research is part of a co-ordinated international effort involving the UK-based Continuous Improvement Research for Competitive Advantage (CIRCA) project and the European Continuous Improvement Network (EuroCINet). The paper reports on CI activities in 385 responding units located across the major manufacturing states in Australia. Result indicated that CI is a long-term process that facilitates ongoing change in manufacturing organizations throughout the world. Those companies which had the courage and foresight to implement CI strategies will be better prepared to deal with threats from competitors both domestic and overseas. CI had proven to be a highly effective process for achieving these and other goals.

Caffyn (1999) described that during the 1990s, a growing number of firms have been encouraging CI in all aspects of working life, and some impressive results have been achieved. However, the process of implementing CI is long and challenging. Companies need to know what progress they have made, and the outcome of any interventions, in order to consolidate and further develop CI. The CIRCA CI self-assessment tool is a research-based tool which helps users to make an objective assessment of CI in their company. It is designed to be used by any organization regardless of size, industry, length of time working with CI, and the particular approach taken. Since then further development and testing of the tool has taken place in the UK and abroad, and future plans include an electronic version. Thus the CI self-assessment tool has both

strengths and limitations. However, if it makes users stop and think about where they are with CI and where they are going, then it is worthwhile. Work in the future will continue to improve the tool and increase its usefulness and accessibility for firms.

Jha *et al.* (1999) summarized the results of a survey of how Canadian firms are implementing CI programmes, where CI is defined as a set of activities intended to achieve ongoing improvement in customer satisfaction, productivity, and quality. The paper first summarizes and compares certain market and organizational characteristics of survey respondents from the auto and auto parts, electronics, metals and metal-processing, and food-processing industries. Next, the study examines the extent to which specific CI practices are being implemented within each industry. Conclusions were presented, based on statistical analysis, on similarities and contrasts among the four industries in the extent to which they implement particular CI practices. Finally, the authors seek to provide insights into why each industry establishes its CI practices at specific levels, by relating the adoption of CI practices to the market and organizational characteristics of firms in that industry.

Hyland *et al.* (2000b) examined five small to medium manufacturers and uses a mapping tool that measures the extent of learning within the firms. If firms using CI are to fully benefit from the learning process then they must have a strategy in place that ensures knowledge is captured and the workforce is willing to transfer knowledge throughout the organization. It was concluded that the effectiveness of a CI programme in an organization is related to the level of integration between the CI process and the learning within the organization. CI requires a long-term commitment to a course of action and the development of a set of beliefs.

Terziovski and Sohal (2000) identified tools that were frequently used by Australian companies. The results show a preference for using simpler techniques to identify and solve problems such as checklists, the seven basic quality tools and process mapping tools. The most advanced problem of solving techniques (QFD and FMEA) or soft techniques (related to people and improvement groups) were not statistically significant.

Gonsalves (2002) performed a survey about the effect of ERP and CI on the performance in 500 manufacturing companies. The author concluded that CI implementation has positive influence on business process reengineering (BPR) execution. Integrated CI and BPR have positive effects on the company's performance.

Terziovski and Power (2007) tested the strength CI in finding out the relationship between motivation for seeking ISO 9000 certification, quality culture, management responsibility, and the perceived benefits derived from ISO 9000 certification. The research involved the development and application of a survey instrument applied to a sample of 1,500 ISO 9000 certified organizations. The response rate was 27 per cent (400 responses). The data were analyzed using SPSS for Windows, multivariate functions. Amongst the major findings is organizations that seek ISO 9000 certification with a proactive approach driven by a CI strategy are more likely to derive significant business benefits as a result. The authors also found that organizations can effectively use ISO certification as a means of promoting and facilitating a quality culture, where the quality auditor is an important player in the CI.

Sim and Rogers (2009) focused his survey on a 500 manufacturing plant located in the eastern USA. A survey was distributed to both salaried and unionized hourly employees. The purpose of this survey is to understand why implementing CI strategies can be difficult at times. It also addresses the problem of resistance to change within even those firms whose CEO is most fully committed to implementation of CI

programmes. Results from the survey indicated that the problem lies primarily with an aging and high seniority hourly workforce and a lack of committed leadership at this research site. For example, salaried employees consistently provided higher positive ratings of CI initiatives. In addition, higher seniority was directly correlated with negative ratings. Finally, the study found that employees do not feel valued when they contribute to the improvement processes and that 100 per cent of the hourly male employees disagreed that "The Company considers the employees as the most important asset and will do what ever they can to keep their people".

Jaca *et al.* (2012) have aimed at evaluating the importance of the factors reported in the literature as enablers of CI programmes and to determine the perception of managers of different companies in the Basque Country and Navarre (Spain) regarding the relevance of these factors to their improvement programmes. In total, 15 elements have been considered to be key issues for the sustainability of CI programmes. Semi-structured interviews were conducted with 36 companies in order to assess how the companies value the factors and how the factors are applied and measured. The findings regarding the application and evaluation of such factors had revealed that companies are focused on the agents associated with the achievement of results. Other factors, such as management commitment or the promotion of team working, are highly scored and applied, but few companies evaluate them or take actions to improve their application. The paper has analyzed the application of some factors considered to be enablers or key factors for the sustainability of CI systems. Furthermore, it examines the mechanisms or indicators which are used by some companies to measure the application of those factors.

Oprime *et al.* (2012) have identified and analyzed the critical factors in the development of CI activities in 46 Brazilian companies. Conceptual models of the relationship between practices and results have been tested to identify the critical factors using a survey conducted in 46 industrial companies. Non-parametric tests have been used to test the hypotheses developed based on the literature. These critical factors are related to actions that encourage employees to participate in CI activities and incentive mechanisms to be able to apply identification techniques and tools successfully, as well as find solution to problems. The results indicated the importance of staff training in problem solution tools, incentives for suggestions, face-to-face communication and regular shop floor visits such as critical factors for the success of CI activities. Operational practices of CI contribute to company performance in relation to improvements in productivity, quality, lead time, cost, customer satisfaction and development of employees' skills to solve problems.

Sophisticated Kaizen methodologies

Over the decades, as the need to continuously improve on a larger scale within the organization became an imperative, a number of CI methodologies have developed based on a basic concept of quality or process improvement, or both, in order to reduce waste, simplify the production line and improve quality. CI methodologies have evolved from traditional manufacturing focused systems that concentrate on the production line to reduce waste and improve product quality, into hybrid methodologies that focus on all aspects of an organization, whether service or manufacturing. Modern CI methodologies (also called CI programmes) target a wide range of aspects in the organization and offer varying benefits. The best known of them are: lean manufacturing, SS, the BSC, and lean SS.

Lean manufacturing

Henry Ford systemized lean manufacturing during the early nineteenth century when he established the concept of mass production in his factories. The Japanese adopted lean manufacturing and improved it. This methodology is a systematic approach to identifying and eliminating waste through CI by following the product at the pull of the customer in pursuit of perfection.

In the 1950s, the Toyota Motor Company first implemented quality circles within the production process itself. As the Second World War came to an end, Ohno, former executive vice president of Toyota, was given the task of developing an efficient production system for the manufacture of automobiles in Japan. Learning a great deal from Henry Ford's assembly lines, and customizing a production process to suit the needs of the Japanese markets, which called for lower volumes of cars, Ohno pioneered and developed the world renowned TPS, also known as lean manufacturing and now used throughout the world (Womack *et al.*, 1990). The methodology is designed to maintain a continuous flow of products in factories in order to flexibly adjust to changes in demand. The basis of such a flow is called JIT production, where, through systematic techniques designed to minimize scrap and inventory, and essentially, all forms of waste, quality and productivity are increased, and costs are decreased.

The aim of lean manufacturing is the elimination of waste in every area of production and includes customer relations, product design, supplier networks, and factory management. Womack and Jones (1996) described lean thinking as the "antidote" to muda, the Japanese term for waste. Its goal is to incorporate less human effort, less inventory, less time to develop products, and less space in order to become highly responsive to customer demand while producing top quality products in the most efficient and economical manner possible. Waste is defined as anything for which the customer is not willing to pay. Lean manufacturing, if applied correctly, results in the ability of an organization to learn. Mistakes in the organization are not generally repeated because this in itself is a form of waste that the lean philosophy seeks to eliminate (Robinson, 1990). The lean toolbox is used to eliminate anything that does not add value to a process. According to the US $5 million study done by Womack and Jones, the Japanese manufacturers were twice as effective as their USA and other western counterparts. They determined that the three principles of lean manufacturing are: improve flow of material and information across business function; focus on pull by the customer; commitment of organizations to CI (Womack *et al.*, 1990; Womack and Jones, 1996).

SS

More recently, SS began to gain popularity in the USA in 1986, when Motorola Inc. introduced it as a means of measuring process quality using SPC. Motorola went about on a mission to improve its services and products considerably in a span of five years, and to achieve its goal, the SS programme was launched in 1987. SS has been defined as "an organized and systematic method for strategic process improvement and new product and service development that relies on statistical methods and the scientific method to make dramatic reductions in the customer defined defect rates" (Linderman *et al.*, 2003). Minimizing defects to the level of accepting close to zero was at the heart of the methodology, and focuses on reducing variation in all the processes of the organization. To achieve this, the DMAIC model was developed, i.e. define opportunities, measure performance, analyze opportunities,

improve performance, and control performance. SS provides quality measurement that can be used throughout an organization – not only in manufacturing but also in design, administrative, and service areas. Motorola achieved amazing results through the application of SS, from 1987 to 1997, achieving a total savings of US$14 billion while sales enjoyed a fivefold growth during the same period (Klefsjo¨ *et al.*, 2001). Investing in SS programmes is increasingly considered a mission-critical best practice, even among mid-sized and smaller firms. After the evolution of lean manufacturing, other pioneers have used the six-sigma process to achieve their company's unprecedented goal of a hundred-fold improvement in quality within five years.

BSC

In the early 1990s, Robert Kaplan and David Norton developed a methodology that translates the objectives of the organizations into measures, goals and initiatives in four different perspectives, namely financial, customer, internal business process and learning and growth. This methodology came to be known as the BSC. A BSC is generally used to clarify and update the business strategy, link the objectives of the organization to the annual budgets, allow organizational change, and increase the understanding of the company vision and mission statements across the organization. A BSC can be used to translate an organization's mission and vision statements into a broad set of objectives and performance measures that can be quantified and appraised, and measures whether management is achieving desired results. About 50 per cent of the Fortune 1,000 companies have a BSC system in place (Kaplan and Norton, 1996). Niven (2002) refers to the BSC as a combination of a measurement system, a strategic management system, and a communication tool:

- Measurement system. The BSC helps the organization translate its vision and strategy through the objectives and measures defined rather than stressing on financial measures which provide little guidance. According to Gaplin (1997) "measurable goals and objectives" is one of the most important factors to a successful strategy.
- Strategic management system. The BSC helps organizations align short-term actions with their strategy and thus removes barriers towards organizations strategic implementation in the long term.
- Communication tool. The BSC describes the organizations strategy clarifies and brings it to the average employee. Employees, once aware of the organizations strategies, can contribute towards the overall goal.

Deming believed that traditional quality assurance methods, such as product inspection after manufacture, were inefficient at finding the source of variations, which occurred throughout the production process. The author pointed out that all business processes had to be considered and that they all needed feedback loops in order to improve. The BSC considers feedback not only in process outputs, but also in business strategy outputs. Rather than improving the performance of existing processes, the emphasis needs to be placed on processes that must be executed successfully for an organization's strategy to succeed. A BSC consists of managerial tools used for performance evaluation and the types of feedback it considers provide the guidance needed to continuously improve.

Hybrid methodology

While individual CI programmes help to improve organizational operations in many aspects, they are not necessarily effective at solving all issues. To overcome the weaknesses of one programme or another, more recently, a number of companies have merged different CI initiatives together, resulting in a combined CI programme that is more far reaching than any one individually. Lean SS is the most well-known hybrid methodology, a combination of SS and lean manufacturing. The evolution of this hybrid has taken place since maintaining high production rates and high quality, or producing less waste, simply does not address enough areas that require improvement. For example, lean cannot bring a process under statistical control and SS alone cannot dramatically improve process speed or reduce invested capital. So the benefits of both SS and lean manufacturing were combined. As another example, CI was being used as the primary quality initiative by the manufacturing organizations, but with CI there is no clear way of prioritizing which quality project should receive the highest priority, and projects are carried out irrespective of the cost to the corporation. This was one of the reasons for the advent of SS. SS is quite explicit about the financial benefits expected from each and every effort. According to SS, each and every black belt and champion are expected to contribute between $100,000 and $250,000 of incremental profit every year (George, 2002).

Lean SS

After the apparent benefits of lean and SS were brought to the attention of the business world, there were a number of big conglomerates that had implemented both lean and SS to attain business excellence. To get a bigger share of the market, they developed a new methodology called lean SS. Since lean SS is a relatively new methodology, and as such, has not been studied in great detail. Some organizations have been using both methodologies in parallel to each other for years, while some have focused on just lean SS as a single methodology for improvement. Lean manufacturing and SS individually cannot achieve the required improvements at the rate at which lean SS can. Lean SS maximizes shareholders value by achieving the fastest rate of improvement in customer satisfaction, cost, quality, process speed, and invested capital (George, 2002). Using a combination of lean and SS, greater value to the customer can be provided. While lean seeks to eliminate waste, SS seeks to reduce variation. By combining the two, waste is first removed, which then allows for variations to be spotted more easily. Lean SS also addresses important issues that are overlooked by SS and lean manufacturing individually: the steps in the process that should be first tackled; the order in which they should be applied and to what extent and the ways in which significant improvements can be made in terms of cost, quality, and lead times. The fusion of the two helps organizations maximize their potential for improvement.

Benefits of strategic implementing CI approach

CI strategy is a world-class approach, which involves everyone in the organization, working to increase equipment effectiveness. CI implementation in an organization can ensure higher productivity, better quality, fewer breakdowns, lower costs, reliable deliveries, motivating working environments, enhanced safety, and improved morale of the employees (Tripathi, 2005). The ultimate benefits that can be obtained by implementing CI are enhanced productivity and profitability of the organizations. CI

aims to increase the availability of existing equipment in a given situation, reducing in that way the need for further capital investment. Instrumental to its success is the investment in human resources, which further results in better hardware utilization, higher product quality, and reduced labour costs (Bohoris *et al.*, 1995).

The literature documents dramatic tangible operational improvements resulting from successful CI implementation programmes. Companies practicing CI strategies invariably achieve startling results, particularly in reducing equipment breakdowns, minimizing idling and minor stops (indispensable in unmanned plants), lessening quality defects and claims, boosting productivity, trimming labour and costs, shrinking inventory, cutting accidents, and promoting employee involvement (Suzuki, 1994). When the breakdowns and defects are eliminated, many benefits are presented: equipment productivity improvement, cost reduction, quality improvement, and inventory reduction, etc. The CI strategies help increase up-time of equipment, reduce machinery set-up time, enhance quality, and lower costs. Through this approach, improvement becomes an integral part of the team. The ultimate benefits obtained by implementing CI are increased profitability and improved productivity. After successful CI strategic implementation, some cases show that companies achieved 15-30 per cent reduction in maintenance cost, while others revealed a 90 per cent reduction in process defects and 40-50 per cent increase in labour productivity (Nakajima, 1988). Also, some Japanese companies that have applied major CI programmes have seen a general increase in equipment productivity of 40-50 per cent (Willmott, 1994). Chowdhury (1995) reports that organizations with CI culture have experienced benefits to the extent of 80 per cent reduction in defect rate, 90 per cent reduction in routine breakdowns and 50 per cent increase in production output. Ahuja and Khamba (2007) have conducted a case study in the Indian Manufacturing Industry and revealed that there has been significant improvement in OEE of all the production facilities as a result of strategic initiatives. The benefits realized through effective implementation of CI Strategies includes OEE improvement: 14-45 per cent, inventory reduction: 45-58 per cent, improvement in plant output: 22-41 per cent, reduction in customer rejections: 50-75 per cent, reduction in accidents: 90-98 per cent, reduction in maintenance cost: 18-45 per cent, reduction in defects and rework: 65-80 per cent, reduction in breakdowns: 65-78 per cent, reduction in energy costs: 8-27 per cent, increase in employee suggestions: 32-65 per cent, and total savings resulting from effective implementation of Kaizen themes as a result of significantly enhanced participation across the organization: Rs. 80 million. The outstanding results of CI implementation have led many firms facing competitive pressures to adopt CI (McKone *et al.*, 1999). Several Japanese companies with rich experience in implementing CI programmes have realized significant improvements including: a 50 per cent rise in equipment availability and a 90 per cent decline in process defects, 75 per cent decline in customer complaints, 30 per cent decline in maintenance costs, and 50 per cent reduction in maintenance inventories (Windle, 1993). Koelsch (1993) has reported that companies that adopt CI are seeking 50 per cent reductions in breakdown labour rates, 70 per cent reductions in lost production, 50-90 per cent reductions in setups, 25-40 per cent increases in capacity, 50 per cent increases in labour productivity, and 60 per cent reductions in costs per maintenance unit. Tennessee Eastman expanded its capacity by 8 per cent and estimated savings of $11 million per year from CI. Nissan Motor reduced the number of breakdowns by 80 per cent, cut inventory by 55 per cent, reduced defects by 85 per cent, and decreased work hours by 50 per cent within the first three years of CI implementation (Suzuki, 1992). Nippondenso decreased the percentage of

maintenance time spent on breakdowns from 57.6 to 15.3 per cent after two years (Teresko, 1992). Moreover, successful CI implementation programmes have contributed towards realization of intangible benefits such as CI of workforce skills and knowledge, clarification of the roles and responsibilities for employees, a system for continuously maintaining and controlling equipment and manual work, an enhanced quality of work life, an improved participation rate, and reduced absenteeism caused by stress, and more open communication within and among workplaces (Suzuki, 1994; Carannante, 1995). Greater job satisfaction can translate into higher productivity and quality, and ultimately contributes to lower manufacturing costs (Hamrick, 1994). Companies need to consider the human aspect of CI in combination with the technical and financial impacts.

Future prospective

There is considerable scope for further research within the broad area of Kaizen strategies, particularly on system-wide benefits and customer-perspective benefits. This research would benefit from utilizing a number of research methodologies from modelling to quantitative and qualitative approaches. There are areas of potential research in taking a system-wide perspective of the Kaizen activities. Kaizen activities are important aspect of any firm's overall CI programme and it is therefore vital to address the problems preventing successful implementation. Consequently, there is a need for further research within the field to identify the benefits attained by the small incremental activities and the factors affecting those benefits. In order of priority of implementation of such techniques, Kaizen first requires a commitment to the introduction and practice of CI strategies throughout the organization and the minimization or, preferably, total elimination of all processes and workplace. Organizations that want to survive in today's highly competitive business environment must address the need for diverse product range with state-of-the-art product features, coupled with high quality, lower costs, and more effective. The culture also requires every single member of the organization to take responsibility and act accordingly, when required, on their own initiative to ensure that products are of required quality and that factors that can impede production or quality are eliminated immediately at source. Everyone must strive to fulfill the principle, "Right first time"; they must also put away past dogma regarding fixed job descriptions as being "cast in stone", and must be prepared to exercise maximum flexibility in their work activities and duties as required. To achieve these objectives, companies must make financial resources available for the education and training of all members of staff, as regards Kaizen principles. Again, all members of staff, individually, have a major responsibility to take maximum advantage of these small incremental improvement activities. Kaizen is not an easy option to implement fully; in particular, it requires the adoption of many new critical elements, such as *Andon, Jidoka, JIT, Muri* and *Poka Yoke*. A further problem which emerges from a study of the literature is that there is no general consensus among practitioners and researchers regarding a particular recommended route to Kaizen implementation. Research in this field has been mainly focused on defining the nature of CI, its tools, organizational issues required to support CI initiatives, its applicability to various types of organizations, implementation issues, and critical success factors. The literature extols the many virtues of CI, but researchers have found that a more critical analysis of CI is required as is a more rigorous theoretical basis for conducting research in the field.

To achieve excellence in the every sphere of the world is not a fortnightly process. If it is not taken care of, the competencies gained by the organization might fade away with the passage of time. The organization must consistently send a strong message to employees that openness, trust, teamwork, CI, and learning are the core values of the company. To improve the utilization level, a positive attitude throughout the organization must be evident. The manufacturing organizations must prepare for covering a broad range of issues, including: innovative thinking; developing teams and effective leadership; access to knowledge and expertise and specific skills such as 5S, SMED, SPC, FMEA for attaining long-term core competencies and market leadership. The proper selection of different Kaizen improvement activities is a great challenge for firms to survive in this globally competitive market. For successful implementation of Kaizen strategies, managements need to focus on different aspects of organizational functioning such as development of competitive strategy, organization culture, employees training, vendor development, integration of departments, etc. In addition to this, management needs to understand structural relationship between different improvement activities, which will help in developing strategies for effective implementation of Kaizen management approach. CI programmes can be applied to different types of work environments. Managers need to evaluate the product design, process choice, and the degree of standardization involved in the organization, and can then decide upon the appropriate methods to use to best implement improvement practices. Managers can evaluate the usefulness of CI programmes by monitoring a set of routines and behaviours that are seen as being essential to organizations of all types for CI implementation. It is clear that CI does not come without hardships and struggles; without the active involvement of everyone in the organization, and the required.

Conclusions

In this paper, we have traced the literature of CI from its early roots in manufacturing, to the more sophisticated methodologies that can be used in any organization, and that comprise an extensive toolbox for continuous performance improvement. The literature, while extolling the many virtues of CI programmes, also makes it clear that achieving the expected results of modern day CI programmes is quite challenging as it involves organizational changes on many levels. It is also generally agreed that CI and quality management programmes go hand in hand as they seek to achieve excellence through manufacturing improvement. From the literature survey described here, it can be seen that there is a general consensus that CI approach is a very effective manufacturing philosophy. These management approaches like CI are universal in nature and encompass all aspects of manufacturing. CI programmes have evolved from traditional manufacturing focused systems that concentrate on the production line to reduce waste and improve the product quality, into comprehensive, systematic methodologies that is focused on the entire organization. More recently, large organizations are developing their own CI methodologies to fit their specific needs by encompassing the various tools and techniques of individual methodologies. This signals the need for hybrid methodologies like small incremental changes. While CI has evolved over the decades, the basic underlying factor driving this change has been the endless pursuit of organizations to improve. The literature highlighted the contributions of various CI implementation initiatives for accruing strategic benefits for meeting the challenges posed by global competition. CI has emerged as a key competitive strategy for manufacturing organizations in the global marketplace. An effective CI implementation programme can focus on addressing the organization's

improvement-related problems, with a view to optimize equipment performance. CI has become a new management paradigm in all types of organizations. In recent years, many organizations have demonstrated that significant improvements in business can be achieved through CI. CI concepts and philosophy can be effectively employed to realize fundamental improvements of manufacturing performance in the organization, thereby leading the organizations successfully in the highly competitive environment.

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