

Critical Factors Impacting Sustainability of Continuous Improvement in Manufacturing Industries in Penang

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ABSTRAK

Kajian ini bertujuan untuk meninjau perhubungan antara enam pembolehubah terhadap usaha mengekalkan kemahiran pembangunan berterusan dalam industri pengeluaran di Pulau Pinang. Seterusnya, kajian ini juga mengesahkan impak pengukuran sendiri dalam organisasi terhadap hubungan pembolehubah dan usaha mengekalkan kemahiran pembangunan berterusan.

Data yang diperolehi melalui soal selidik ke atas pembolehubah yang diperkenalkan menyokong bahawa fokus strategik, pengurusan pembangunan berterusan dan proses pembelajaran/pengongsian pengetahuan mempunyai hubungan positif ke atas usaha mengekalkan kemahiran pembangunan berterusan dalam satu organisasi. Hasil regresi turut menunjukkan sokongan bahawa pengukuran sendiri dalam organisasi beraksi secara positif sebagai penguat di antara fokus strategik, proses pembelajaran/pengongsian pengetahuan dan usaha mengekalkan pembangunan berterusan.

Hasil kajian telah mencadangkan fokus strategik merupakan pembolehubah yang paling berkesan kepada usaha mengekalkan kemahiran pembangunan berterusan, tambahan pula, kajian ini turut memperkenalkan kesan pengukuran sendiri dalam organisasi terhadap keberkesanan untuk mengekalkan kemahiran pembangunan berterusan dalam organisasi pengeluaran.

ABSTRACT

The purpose of this research was to investigate the influence of six variables on sustainability of continuous improvement capabilities in the context of manufacturing industries in Penang. Then, the research also determined the impact of organizational self-assessment towards the relationship of the variables and sustainability of continuous improvement capabilities.

Data from the email survey on the variables introduced supported that strategic focus, management of continuous improvement and learning/knowledge sharing had a positive influence on sustainability of continuous improvement capabilities in an organization. The regression result evidenced that organizational self-assessment had a mediating effect on the relationship between strategic focus, learning/knowledge sharing and sustainability of continuous improvement capabilities.

The implications of this study highlighted that the most effective predictor for sustaining continuous improvement capabilities was strategic focus, in addition, this study provided insight into the mediating effect of organizational self-assessment towards the effectiveness of sustaining continuous improvement capabilities in the manufacturing industry.

Chapter 1

INTRODUCTION

1.1 Introduction

Intense competition has resulted in shorter and shorter life cycles of new products. The pressures on companies wishing to achieve business excellence are intense. Business excellence will, among other things, be achieved by companies which can react quickly to new market conditions and customer needs and constantly looking for creative solutions and continuous improvements in products and processes. Today's companies must continuously adapt, develop and innovate (Martensen & Dahlgaard, 1999).

Continuous improvement (CI) has become a very common practice in manufacturing industries throughout Malaysia. Many organizations have started CI practice in their daily functions such as process improvement, defect reduction and quality assurance. Concepts such as six sigma and lean manufacturing are very popular methods to implement CI. However, sustainability of CI is always the important and most difficult practice of all in the organization.

CI is a very critical tool in the manufacturing industries today to enhance customer satisfaction, to become the cost leader and also to remain competitive in the global world today. Companies such as Seagate, Agilent, Motorola and so on employ six sigma as the CI tool to improve product quality and also ensure customer satisfaction in their products and services. The reliability, timeliness, accuracy and perceived value of the products or services have become the keys to organizational success. The business environment has become turbulent, complex and even chaotic. At the same time business processes have evolved

towards nonroutine operations making project-type working increasingly common in every business (Haikonen, Savolainen & Järvinen, 2004). To meet these challenges organizations concentrate on their core competencies, outsourcing of less strategic activities, developing partnerships, and building networks essential to sustain business growth and success.

CI is defined as a collection of activities that constitute a process intended to achieve performance improvement. In manufacturing, these activities primarily involve simplification of production processes, chiefly through the elimination of waste. In service industries and the public sector, the focus is on simplification and improved customer service through greater empowerment of individual employees and correspondingly less bureaucracy. Strategic change can also be viewed as a process of logical incrementalism (Terziovski, 2002).

The implementation of CI in an organization is not simple and involves management support, training of CI concepts and also change in organizational culture that focuses on customer satisfaction. Once implemented, the company will reap the reward of better productivity and even gain competitive advantage over their rivals in the competitive business environment today. Sustainability of CI is a very critical besides the implementation of the concept.

Organizations find that sustaining the CI culture is very difficult. It is more towards changing the employee behavior and mindset about improvement as a part of their daily functions. Factors that influence sustainability of CI in the organization, especially manufacturing industries is very important in order to produce the best product at the lowest defect and highest customer satisfaction.

1.2 Problem Statement

Continuous improvement has been a growing trend in all manufacturing industries and has played an important role in sustaining the competitiveness of an organization. CI has been widely implemented in organizations throughout Malaysia. This can be shown in the number of organizations being awarded ISO 9001 certification which includes clauses of continuous improvement as a pre-requisite of certification.

Innovation is a complex process and of critical importance for organizational success yet not easily managed. As international competition intensifies and product life cycles shorten, the pressure to innovate heightens. Innovation has evolved from simple models of pushing new products onto the market to a sophisticated fifth generation models of systems integration and networking; a model where supplier, customer, competitor and other partners collaborate to speed the process of development while enhancing quality of output (Terziovski, 2002).

Though implementation has been commonly practiced, organizations find sustaining continuous improvement effort a challenge. Factors influencing the sustainability of CI will play a very critical role in making sure CI is sustained in the organizations business processes and even culture.

1.3 Research Objectives

To identify the sustainability of continuous improvement in Malaysia's manufacturing industries, the research objectives of this study are:

1. To determine the impact of strategic focus on sustainability of CI in an organization.

2. To determine the impact of CI development on sustainability of CI in an organization.
3. To determine the impact of integration of CI on sustainability of CI in an organization.
4. To determine the impact of management of CI on sustainability of CI in an organization.
5. To determine the impact of involvement/engagement on sustainability of CI in an organization.
6. To determine the impact of learning/knowledge sharing on sustainability of CI in an organization.
7. To determine whether organizational self-assessment will have an effect on the sustainability of CI.

1.4 Research Questions

Based on the objectives formulated in subsection 1.3, this study will help to answer the following questions:

1. What is the importance of strategic focus on sustainability of continuous improvement?
2. What is the importance of CI development on sustainability of continuous improvement?
3. What is the importance of integration of CI on sustainability of continuous improvement?
4. What is the importance of management of CI on sustainability of continuous improvement?
5. What is the importance of involvement/engagement on sustainability of continuous improvement?

6. What is the importance of learning/knowledge sharing on sustainability of continuous improvement?
7. How does organizational self-assessment influence sustainability of continuous improvement?

1.5 Definition of Key Terms

Below are a few main key terms used in the present study:

Continuous Improvement (Jager, Minnie, Jager, Welgemoed, Bessant & Francis, 2004)

- A broad front, combining extensive “do what we do better” improvements with periodic and radical “do what we do different” changes, which establish a distinctively different framework within which future “do better” improvements can be made.

Innovation (Conradsen & Lystlund, 2002)

- The process of creating solutions and includes both initial creativity and its successful implementation.

Innovation (Kuczmariski, 2003)

- A mindset, a pervasive attitude, or a way of thinking focused beyond the present into the future vision.

Strategic Focus (Bessant & Caffyn, 1997)

- Individuals and groups use the organization’s strategic goals and objectives to focus and prioritize their improvement activities.

Integration of Continuous Improvement (Bessant & Caffyn, 1997)

- Regular evaluation to ensure that the organization's structure, systems, procedures as well as the methods and mechanisms that are used to develop continuous improvement support and strengthen each other.

Commitment (Brewer, 1996)

- Willingness of persons to contribute efforts to the co-operative system.

Involvement (Bessant & Caffyn, 1997)

- Employees in the entire organization are proactively involved in continuous improvement.

Knowledge (Shin, Holden & Schmidt, 2001)

- Internally or externally available, structured, semi-structured or unstructured, as well as tacit or explicit.

Self Assessment (Benavent, Ros & Moreno-Luzon, 2004)

- Implies the performing of several activities in a defined time sequence and constitutes a cyclical process

Training Needs Analysis (Reed & Vakola, 2006)

- Analysis that underpin all training plans and budgets.

1.6 Significance of Study

This study is important to identify the factors that will help manufacturing industries in Malaysia to sustain continuous improvement in their business processes and eventually transform continuous improvement concept as the organizational culture.

Continuous improvement is important as it serves as an innovative tool for any organization to be able to gain competitiveness and even competitive advantage over their rivals. Organizations have invested a huge amount of human capital and modal into implementing continuous improvement, sustaining will be important to enable the business to grow in the competitive global market today.

Therefore it is very important to identify the factors that will influence the sustainability of continuous improvement effort in an organization.

1.7 Summary and Organization of Remaining Chapters

The study reported here aims to discover the continuous improvement factors and training needs analysis influencing sustainability of continuous improvement in manufacturing industries in Malaysia. Sustainability of continuous improvement is very important in remaining competitive in the business world today.

Chapter 1 introduces the background, problem statements, research objectives, definition of key items, and significance of the study. Chapter 2 states the review of the literatures and relevant past research studies that act as a basis for the purposed study. In this chapter, it also addresses the theoretical framework and hypotheses. This followed by chapter 3 which describes the methodology of the study, including research design, variables, sample

and population, procedures and instruments to collect data. The results will then be analyzed and explained in Chapter 4 and the conclusion of the research will be discussed in Chapter 5.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

The manufacturing sector globally has witnessed rather drastic changes in the latter part of the twentieth century. These changes have left their unmistakable marks on the different facets of the manufacturing organization. In the process, manufacturing, strategy, technology, relations-to-markets and customers, as well as performance measurement have been altered. Today's manufacturing organization can no longer view itself as a closed system focused on efficiency. Rather, it must operate as an open system in order to cope with the dynamics imposed on it by a demanding global business environment. In this context, it must operate as a customer-focused, yet technology-based open operational system. The effectiveness of the performance of such an open operational system is not judged solely based on its ability to convert inputs into outputs. More importantly, however, the effectiveness of performance of such system is dependent on whether the customers value the output and the extent to which such value can be translated into a distinct competitive advantage for the organization (Gomes, Yasin & Lisboa, 2005).

The focuses of this study are two folds: first, it studied the factors that are critical in sustaining continuous improvement (CI) in manufacturing industries in Malaysia. Secondly, the research studied the intermediating effect of training needs analysis on the organization performance through improvement and innovation.

The factors that are identified can further enhance the training needs analysis implementation in helping organization to sustain CI in the organizational practices. The

advantages of implementing CI in the business environment today had been well documented and methods to implement CI are aplenty in the market. This research is mainly focusing on the next stage of CI which is sustainability.

2.2 Literature Review

2.2.1 Sustainability of Continuous Improvement (CI)

Sustainability of CI or innovation efforts is critical in the success of a manufacturing organization today. Having differentiation through solely price alone will not ensure sustainable competitive advantage. However, by incorporated a sustainable innovation and creativity within the operation of the organization, the organization can sustain its competitive advantage and business.

The term sustainable considers the protection of the attributes and resources that allow an organization to outperform its rivals in the same industry or product market have to offer over some usually undefined period of time into the future for the organization to maintain its competitiveness. Within this context, sustainable can assume a number of meanings depending on the frame of reference through which it is viewed. It can be interpreted to mean enduring, defensible, bearable, tolerable, liveable, supportable, passable, acceptable, justifiable, negotiable and penetrable (Chaharbaghi & Lynch, 1999).

Sustainability can be view through a few factors such as (Escrig-Tena, 2004):

- (i) Durability
- (ii) Difficulty to imitate
- (iii) Lack of incentives or inertia by potential imitators

2.2.1.1 Durability

Organizations that follow a total quality management strategy learn because they incorporate patterns of continuous improvement and knowledge creation. This is made possible by following a structured process of resolving problems, as a result of the codification of knowledge and other ways of distributing knowledge, or by drawing on the lessons to be learned from processes of self-assessment. One important characteristic of knowledge created through this learning process is that it does not depreciate with time, as long as it is used and shared, so it has the characteristic of durability. Moreover, human resources practices in a continuous improvement and innovation initiative, such as training or cross-functional promotion, play an important role in sustaining competitive advantage through the socialisation of employees, which thus favours the longevity of the CI philosophy introduced in the organization.

If the goals of sustainability are to be achieved, leaders must reform, redesign, and restructure their organizations to minimize their negative impacts. Leaders must implement systems of operation in which each and every act is inherently sustainable and restorative. A leader must encourage the integration of sustainability principles with a solution that addresses both the values and the economic goals of the leader and the organization (Quinn & Dalton, 2009). The organization must achieve solutions that are both sustainable and economically profitable, this will ensure that the organization stays competitive and will gain competitive advantage through sustaining improvement efforts.

Imperfect transparency of the elements responsible for the success of CI is known as causal ambiguity. When referring to the culture of a firm, it can be difficult, if not impossible, to describe what elements of the culture make it possible to sustain greater performance. This

is described as causal ambiguity. Causal ambiguity exists when the link between the firm's competencies and a firm's sustained competitive advantage is not understood or understood only very imperfectly.

This same reasoning could be applicable to the introduction of a CI initiative since a holistic approach is needed for it to be effective. Its success requires a commitment with all its principles, and so it may be difficult to determine which of them are responsible for the success. Moreover, a CI initiative will fail unless the firm considers jointly some other not always explicit factors. Thus, CI requires a cooperation ethic, teamwork, commitment from management, an appropriate organizational structure and a participative management style. CI effectiveness does not rely only on the principles and practices that are considered, but also on these antecedent factors. CI success depends not only on adopting the CI attributes, but also on the preexistence of complementary factors apparently unrelated to CI, yet more difficult to imitate than CI itself.

Measurement of improvement achieved is also an important part of sustaining the improvements made. Self-assessment is a way of indicating what is important in the operations of an organization and motivates people to support the measures. If no measure exists, people in the cell will not know what the standard is and as other priorities occur, the performance achieved in the workplace will gradually degrade (Bateman, 2005). Performance measurement can help to identify potential problems that can occur and enable the development of solutions to the potential problems. In order to making the measures meaningful, the correct measurement tool shall be used to indicate the performance goals and gaps to let the operation level personnel understand the problems and work to improve the correct problem area.

Learning is seen as an engine to enable innovation in an organization. The level of learning will determine the sustainability of innovation. According to Sousa (2006), knowledge depth and knowledge diversity will determine the sustainability of innovation. Knowledge depth can be defined as the level of understanding and experience existing in an organization in a specific area depending on the industry the organization is operating in. The depth of knowledge held by the decision makers and innovators greatly impacts the outcomes of learning and creativity. The ability to make sense of emerging association and recognize the potential to create new value is strongly influenced by knowledge depth. Knowledge diversity can be defined as the spread of different knowledge areas existing in an organization. Greater knowledge diversity can be stimulated within the organization's workforce, but can also be achieved through external people and knowledge.

Learning can make innovation more durable and this same concept applies to CI as well. In CI, knowledge depth can be increased through market research to understand new features that can be introduced in an organization's current product portfolio and through total quality management. Knowledge diversity in terms of CI can be increased through encouraging involvement of customers and suppliers in product improvement. The improvement team members should be a mixed team of employees from different functions, ages, expertise, position and so on to enable more idea generation and through the interaction of all the members increase the knowledge diversity.

2.2.1.2 Difficulty to Imitate

Powell (1995) concludes that, in spite of the apparent diffusion of CI, we can assert that it is imperfectly imitable. Furthermore, commitment with CI can generate an inimitable

competitive advantage. This is because CI is capable of generating within the organization a set of routines and some performance standards that incorporate processes for improvement through the application of a particular collection of problem-solving heuristics and techniques, and the creation of knowledge (Escrig-Tena, 2003).

Sustainable competitive advantage comes into being through the dynamic interplay between a firm and its external environment. Certain resources such as human capital, experience and skill sets can be strategic, but only if they cannot be copied or replaced by external rivals. Equally, firms need not directly own strategic resources for example when developing manufacturing processes, resources that have competitive significance are often owned by suppliers. Similarly, all critical value creating processes stretch beyond the boundaries of the firm, involving actual and potential customers, and successful outcomes are only meaningful if they make the firm better and different (Lewis, 2000).

CI implies the development of a collection of routines and abilities that determine a particular behaviour in the organization. These routines are the consequence of a learning and experimentation process within the organization itself, so they require a complex pattern of coordination between resources, are path-dependent, specific to the firm, and difficult to transfer. In other words, they possess the characteristics needed to make them difficult to imitate. On implementing CI, the organization can build a unique and dynamic corporate personality and bring about an organizational commitment of employees from any level; competitors will find it virtually impossible to duplicate this corporate personality and reaching a competitive advantage will be possible. Another way of arguing the inimitable character of CI is to analyse the extent to which it allows the appearance of the conditions

that ensure this inimitability, such as imperfect transferability, and impossibility of replication:

- (i) CI would be imperfectly transferable, since CI encourages the development of untradable abilities, developed by the organization and internalised into the collective behaviour. A clear example is customer loyalty because it is difficult to establish clear property rights on it. We can also find these connotations in the cooperation ethic (versus a conflictive one) that is defended in CI, or in the special attention to employees. CI is specific to each organization since CI principles and practices are valid in one organizational context, and the universalistic application of the same practices in a different context may not be effective.
- (ii) Benefits obtained with CI are difficult for other firms to replicate whereas CI success depends on a series of mutually related activities, and it is not completely possible to discern the real activities responsible for the success, as we have discussed when we analysed causal ambiguity.

In the competitive market today, the speed at which the uniqueness of the resources of an organization becomes accessible dictates the speed at which the competitive advantage of an organization diminishes (Chaharbaghi & Lynch, 1999). In rapidly moving competitive environments, sustaining competitive advantage such as CI capabilities involves creating safe havens from competition by continuously creating gaps through unique resources that cannot be easily bridged by the rivals in the similar industry or product market.

2.2.1.3 Lack of Incentives or Inertia by Potential Imitators

Inimitability is analysed from the perspective of the potential imitator. CI imitability is reduced since CI requires reforms in core organizational features and many organizations will

resist attempting core reforms on the grounds of risk aversion. A CI initiative demands deep reforms in key organizational characteristics, particularly leadership and culture. Faced with this requirement some firms may not be prepared to take on the risk these changes entail. Even in the case of a favourable attitude of the imitator, these reforms take time to develop and a firm would be unlikely to become successful in the short term.

Knowledge must be unique to the organization to provide competitive advantage because publicly available knowledge, although valuable for business performance can rarely allow the organization to achieve competitive advantage (Sharkie, 2003). For long run sustainability of competitive advantage, organizations need to adopt a creative approach which is in line with the CI methodology. Management should concentrate on the needs to revolve around knowledge creation and radical innovation to enable long run competitive advantage rather than concentrating on current short term advantage that could not be extended into the future.

The need for sustained innovation in order to ensure business survival has been well documented (Hamel, 2001). Unless organizations change what they offer (product/service innovation) and the ways in which they create and deliver that offering (process innovation) there is a high risk of business failure. Continuous innovation is needed across a broad front, combining extensive “do what we do better” improvements with periodic and radical “do what we do different” changes, which establish a distinctively different framework within which future “do better” improvements can be made (Jager, Minnie, Jager, Welgemoed, Bessant & Francis, 2004). CI has been main concept for an organization to be innovative and competitive in there area of business and is especially important for an already saturated manufacturing industry. CI has become a common practice in manufacturing industries to

improve their core competencies and further concepts such as Supply Chain Management (SCM), Lean Manufacturing (LM) and Six Sigma has been introduced.

Six sigma is basically a business process improvement methodology in which sigma represents a statistical measure of variability in the process. The Six Sigma strategy involves the use of statistical tools within a structured methodology for gaining knowledge needed to achieve better, faster and less expensive products and services than the competition. Six sigma encompasses of sets of statistical tools such as cause and effect analysis, failure mode and effect analysis (FMEA) to help an organization implement improvement and innovative ideas.

CI involves tools and also behavioral norms to enhance its sustainability. Sustainability always involves transformation of a new concept into the organizational culture. Thus, there are ten behavioral norms in ensure successful implementation of CI described in the CI capability model developed by Bessant and Caffyn (1997). The ten behavioral norms are shown in Table 2.1.

Table 2.1
Ten Behavioral Norms

	Behavioral Norm	Explanation
1	Understanding of the business	Employees demonstrate awareness and understanding of the organization's goals consideration
2	Strategic focus	Individuals and groups use the organization's strategic goals and objectives to focus and prioritize their improvement activities.
3	CI development	The activities implemented to support CI are monitored and developed.
4	Integration of CI	Regular evaluation ensures that the organization's structure, systems, procedures as well as the methods and mechanisms that are used to develop CI support and strengthen each other.
5	Management of CI	Managers on all levels demonstrate active engagement in CI.
6	Involvement/engagement	Employees in the entire organization are proactively involved in CI.
7	Intra-organizational cooperation	Work processes occur successfully across both internal and external boundaries, at all levels.
8	Learning	All learn from their own and other's positive and negative experiences.
9	Knowledge sharing	Individual and group learning is maintained and shared.
10	CI culture	Managers and workers are led by a shared set of cultural values that support CI in the daily work processes.

Source: Bessant and Caffyn (1996)

By looking at the behavioral norms, this research will show which factors are significant in influencing a sustainable CI capability in a manufacturing organization. The significant factors shall then be used as the evaluation needs in the training needs analysis (TNA) which will further enhance the sustainability of CI.

2.2.2 Strategic Focus

Following Berger (1997), we distinguish some core principles of CI by using the ideal characteristics of Imai's kaizen (Imai, 1986). The first principle is process orientation. Before results can be improved, it is the central tenet of CI that processes must be improved. Good results will follow automatically when processes are both understood and controlled. The orientation is towards the activities and work methods and not towards the outcomes (Leede & Looise, 1999).

The statement from Leede and Looise (1999) is actually consistent with the behavioral norm theory which states the importance of individuals and groups using the organizational goals to focus and prioritize their improvement activities. Only understood and controlled action will be useful to the organizational performance. Activities must be carried out as of the organizational goals which are on par with the overall organizational directives of future growth.

Customer-centered six sigma is a concept very relevant to strategic focus in sustaining continuous improvement effort in an organization. This is the beginning state of the overall transformation process. In the present global competitive environment, for example, better, faster, cheaper, and more environment-friendly are almost universal stakeholder requirements with only varying degrees of desirability. Recent empirical studies on supply chain quality management practices in Taiwan and Hong Kong also show that technical requirements for such an effort is the same irrespective of the environment. As a consequence, paying special attention to operational processes and supplier participation programs if stakeholders' needs along the supply chain are to be met. The efforts would lead to improved organizational performance (Kuei & Madu, 2003).

Seeking the next level of organizational excellence is management's responsibility. This effort requires a total view on strategic variables and operational planning. Some of the strategic variables that are necessary to introduce profound changes to reach this new frontier are introduced. Figure 2.1 presents such a transformation process, which assesses the present organizational state from the perspective of customers and service providers, and concludes with the adoption of organizational cultural change. In between, there are other components that may be combined to form a complete integrated process (Kuei & Madu, 2003).

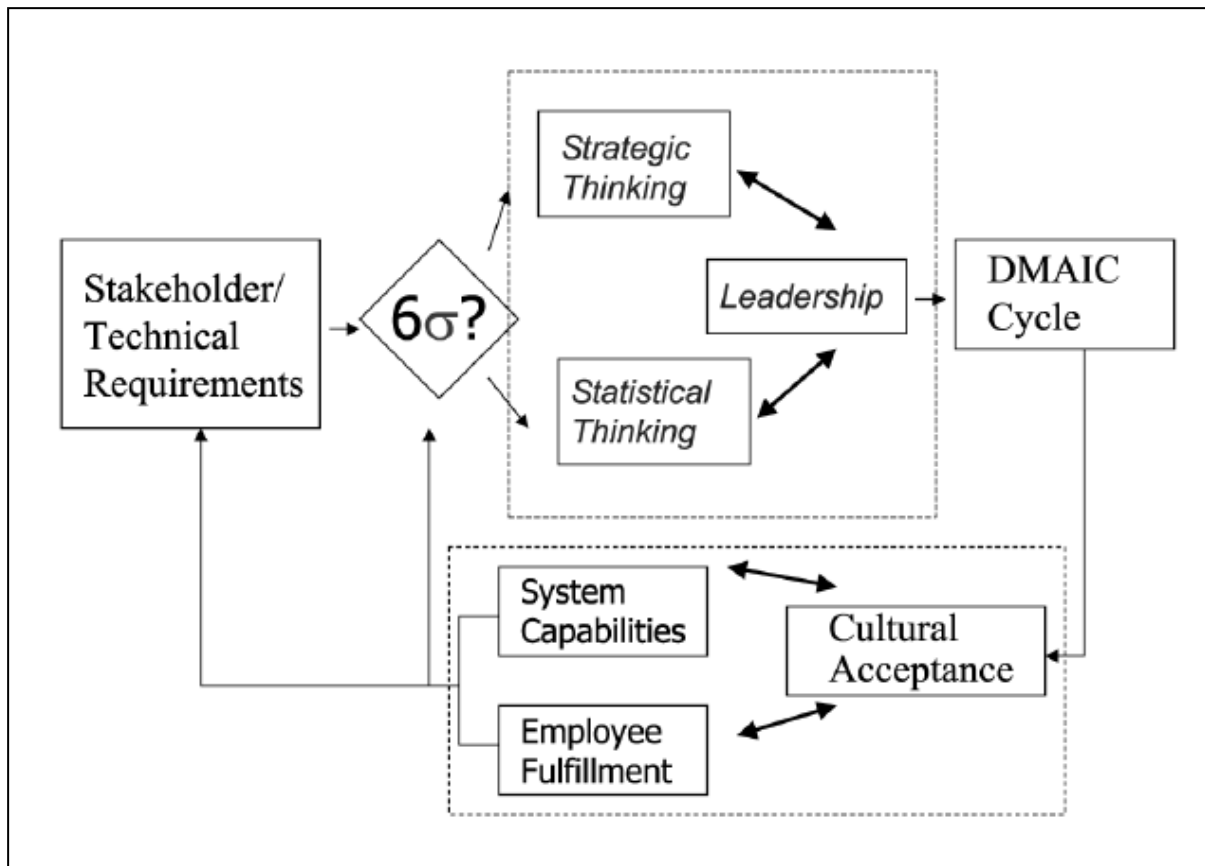


Figure 2.1. The Customer-centered Six Sigma Way.
 Source: Kuei and Madu (2003)

Leadership is a driving force for system change or transformation. It is the ability and capacity to influence and combine a system's social and technical components to accomplish what is important and to achieve just, meaningful results subsequently. The leaders' job is to articulate the vision, strategy, operating principles at the organizational level and also to identify the drivers of performance and follow through the flow of activities at the process level. Besides that, leaders are to learn from what has happened and to predict what will happen at the task level. The fulfillment of those responsibilities should be guided by and rooted in statistical thinking and strategic thinking (Kuei & Madu, 2003).

An organization that wants to work in a goal directed manner with the concepts of creativity and creative organizations can use Majaro's (1992) model for creative organizations. The model is illustrated in Figure 2.2. It is the management's job to create the creative organization, and it is their job to make an order of priority for the time to implement each of the eight principles. It is important to realise that some of the principles will have a huge influence on the organization (Martensen & Dahlgaard, 1999).

Improvement activities must be done by focused group as were implemented in some of the manufacturing industries to ensure that activities carried out are monitored and are consistent with the organizational goals. The main function of the focused group such as lean masters and six sigma black belts are to concentrate on improvement projects. These projects are consistent with the goals of the organization and will help the organization to enhance customer satisfaction by reducing defects or even coming out with break through improvements to the existing processes.

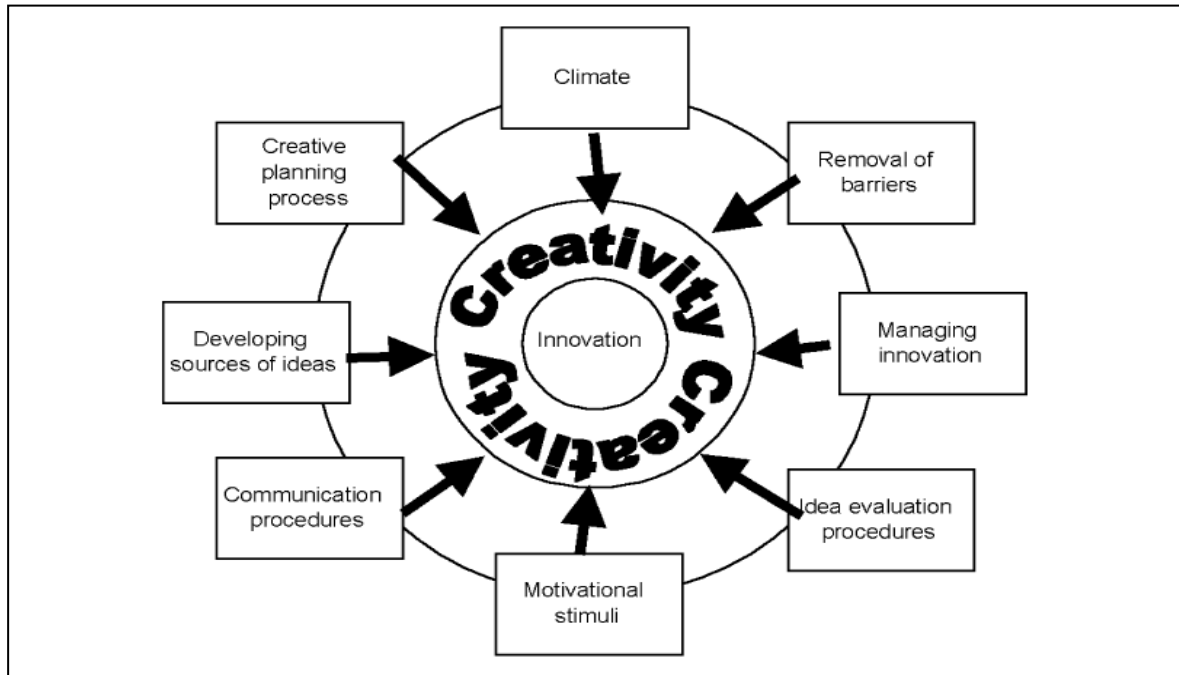


Figure 2.2. Majaro's Model for Creative Organization.
 Source: Martensen and Dahlgaard (1999)

2.2.3 Continuous Improvement Development

The CI development involves monitoring activities implemented to support CI and this includes the development of monitoring process to make it more effective. CI activities are critical to ensure success of the organization, hence having a good monitoring system of CI is equally important. CI monitoring can ensure that CI activities are carried out according and also aligned to the organizational goals. This will also be a very important behavioral norm in maintaining CI as a daily process in the workstations and in turn will ensure sustainability of CI in the organizational functions.

CI must be a part of the management of all the firm's processes, activities and operations. This precept embodies the desire to improve and control results, "doing things right the first time", which also reflects the desire to learn and experiment. In order to do so, extensive gathering of information, systems analysis and feedback are required to isolate

problems and direct employees' attention towards those that have been detected. The most effective means of improvement involves following a systematic procedure of planning, execution and evaluation. In order to accomplish this, it is essential to standardise the functioning of the processes, use different improvement tools, obtain indicators of performance, and gather information through benchmarking and self-assessment (Escrig-Tena, 2004).

As a recent methodology of process improvement, Six Sigma has permeated business life. It is worth exploring as, a method of CI capability development because it has the potential to reveal the kinds of learning mechanisms for which researchers currently tend to search (Haikonen, Savolainen & Järvinen, 2004). Six Sigma is a commonly used statistical improvement method in most of the manufacturing industries today. Six Sigma consists of systematic methodology of how improvement activities can be carried out. Six Sigma methodology comprises of five steps in its process improvement. The steps are define, measure, analyze, improve and control (DMAIC). DMAIC calls for the identification of specific customer or stakeholder needs. Measure represents the identification of measurable, meaningful indicators and operation planning or implementation on a smaller scale whereas analyze represents the evaluation and determination of the critical success factors of the products or processes and the most likely causes of defects. The improve stage will follow that represents the opportunities and actions for getting the product or process better and removing the causes of the defects. Last but not least the control represents the implementation on a full scale. These step by step processes can well be referred to as an operational cycle.

Due to the changes brought about by the new realities and demands of the marketplace, manufacturing performance measurement is becoming an illusive multifaceted construct. Manufacturing executives not only have to understand the different facets of manufacturing performance, but they also must be able to design a manufacturing performance measurement system (PMS) capable of measuring these different facets.

The performance measurement literature underscores some relevant characteristics of performance measures and measurement systems, as summarized below (Gomes, Yasin & Lisboa, 2005):

- (i) Must reflect relevant non-financial information, based on key success factors of each organization
- (ii) Should be implemented as means of articulating strategy and monitoring organization results
- (iii) Should be based on organizational objectives, critical success factors and customer needs and monitoring both financial and non-financial aspects
- (iv) Must accordingly change dynamically with the strategy
- (v) Must meet the needs of specific situations in relevant manufacturing operations and should be long-term oriented, as well as simple to understand and implement
- (vi) Must make a link to the reward systems
- (vii) Financial and non-financial measures must be aligned, and used within a strategic framework
- (viii) Should stimulate the continuous improvement processes
- (ix) Must be easy to understand and to use
- (x) Must be clearly defined, and have a very explicit purpose