

Diagnosing of Sustainable Competitive Advantage Using Six Sigma Methodology

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Abstract

In this paper six sigma method for diagnosing the sustainable competitive advantages in organizations was proposed. The study used a survey strategy "self-administered questionnaire", to collect the primary data. The sample of the targeted population consists of 40 Doctors in public hygienic institutions in Iraq, with various functions and from different managerial levels. The analysis shows that six sigma methods in the organization's operations should be taken into consideration with necessary adaptation. The research proposes an approach that enables a systematic analysis of six sigma in diagnosing the sustainable competitive advantages in service organizations through the use of a survey strategy, called "self-administered questionnaire".

Keywords: Six Sigma methodology DMAIC, Sustainable Competitive advantage, Six Sigma's belts

1. Introduction

"Six Sigma" method is one of the most recent quality improvement initiatives that has become more popular and accepted in many industries across the globe. Its use is increasingly wide spreading in many industries. Both service and manufacturing companies have adopted the methodology with many proponents of the approach claiming that it has developed beyond a quality control approach into a broader process improvement concept (AL-Mfraji & Almsafir, 2012). Six sigma popularity has led to an increasing level of interest from the academic community while the basic concept has its origins in industry, with a substantial rise in the number of academic papers published in recent years (Nonthaleerak & Hendry, 2006, 2008; Schroeder, Linderman, Liedtke, & Choo, 2008). There are a number of studies that focused on leadership commitment to the six sigma and discussed on the key issues such as; what would it bring to the organization and what are the business strategies, how it works and its methodologies, the Definition-Measurement-Analysis-Improve-Controls (DMAIC) steps to be taken, what tools to be used and the deliverables, mathematical formulation of six sigma and what is the use of simulation with six sigma, new six sigma, benefits of six sigma, costs of six sigma and critical success factors and the future of six sigma (Mehrerjedi, 2011).

The organizations that have been implementing six sigma choose investment in the systematic discovery to the opportunities to improve quality at reduced costs, improve performance efficiency and effectiveness and customer service. Six sigma is one of the more recent quality management innovations which many organizations have adopted (Braunscheidel, Hamister, Suresh, & Star, 2011). Six sigma initiatives are closely related to total quality management (TQM) initiatives (Arnheiter & Maleyeff, 2005; Goeke & Offodile, 2005; Thawani, 2004), considering that the quality management field, business processes and procedural thinking are central concepts that underpin six sigma (Antony, 2006; Bititci et al., 2011; Schroeder et al., 2008; Zu, Fredendall, & Douglas, 2008).

Many benefits of the successful implementation of six sigma to the business unit have been cited in literatures e.g. the customer satisfaction (Aboelmaged, 2011; S. Chen, Chen, & Hsia, 2005; Desai, 2006; Kuei, & Madu, 2003; M. Kumar, 2007; Rylander, 2006), as well as the adoption of six sigma methodologies impact on a firm's performance and competitive advantage (Braunscheidel et al., 2011). Six sigma offers research and experimentation methodologies that have significantly impacted the project effectiveness. Recently, there have been published empirical researches on the application and implementation of six sigma methodologies, with some recent notable works (Braunscheidel et al., 2011; Gutiérrez, Lloréns-Montes, & Sánchez, 2009; Linderman, Schroeder, Zaheer, & Choo, 2003; McAdam & Lafferty, 2004; Nonthaleerak & Hendry, 2008; Schroeder et al., 2008; Zu et al., 2008). The program that features by its approach, which is associated with the customer and which also emphasizes on decision making is based on quantitative data as it addresses the problems in the five stages of DMAIC. It has helped the project leader in the implementation of project, improving a current process or improving performance quality of an existing product/service which initially does not meet customers' expectation. In addition, the gradual project methodology which the program displays is a structured tool consisting of statistical and non-statistical techniques, organizational structure and improvement of projects carried out by project leaders who can link with the problem. The team strained on project management and statistical methods of experimentation are referred to as Black Belts (BB) and Green Belts (GB). BB and GB are both supported by the so-called Champion or Sponsor, who are mostly workers with adequate experience. The Champion reviews the team's progress to ensure that the BB and GB focus on the interests of the organization (Antony, 2006; de Mast, 2006). In health institutions, poor administrative awareness and absence of administrative systems in hospitals have reflected negatively on the performance of the health service in both public and private sector and this has indirect effect on customers' satisfaction. Therefore, the core idea for this study is to achieve sustainable competitive advantage and to focus on the success and leadership in improving processes and products to ensure quality of service in accordance with the principles of six sigma methodology (DMAIC), in the absence of integrated systematic approach for the preparation and development of the administrative organization of health institutions. The study will test the genuineness of this claim empirically, where the issues explored include the practitioners' difficulties and concerns when undertaking the six sigma projects through the methodology. Alternatively, it can only have the sincerity on theoretical basis, and this is what the current study intends to do. The research consists of three parts; first is the literature review, second is the review on the research methodology, followed by data analysis and discussion and thirdly, a list of conclusion and recommendations derived.

2. Literature Review

The following section provides a summary of the academic literature that is relevant to this study. It includes a section on six sigma from an academic perspective, Leadership of six sigma, six sigma's Belt and a section on Sustainable Competitive Advantage.

2.1 Six Sigma

Sigma (σ) is a letter in the Greek alphabet that has become the statistical symbol and metric of process variation. Statisticians have used this symbol to indicate the standard deviation (Park, 2003). Standard deviation is a statistical way to describe how much variation exists in a set of data, a group of items, or a process. The term sigma is a measure indicating the deviation in the performance characteristic of a service from its mean performance (Antony, 2006). Six is the number of sigma measured in a process, when the variation around the target is such that only 3.4 outputs out of one million are defects under the assumption that the process average may drift over the long term by as much as 1.5 standard deviations. Park, (2003) defined six sigma as a new management strategy under leadership of top-level management to create quality innovation and total customer satisfaction. It is also a quality culture. It provides means of doing things right the first time and to work smarter by using data information. Sager & Winkelman, (2001) defined six sigma as a methodology focused on improving processes. For years six sigma was viewed simply as a process improvement tool (like total quality management) to help companies to improve their manufacturing operations and reduce product defects. Antony & Banuelas, (2002) noted that six sigma is a disciplined approach to define, measure, analyze, improve and control processes that result in variability and defect reduction. The six sigma of today speaks the language of management: bottom-line results. It institutionalizes a rigorous, disciplined, fact-based way to deliver more money to the bottom line through process improvement and process design projects selected by the top leadership and led by high potentials trained as Black Belts or Master Black Belts in six sigma that aims to create near-perfect processes, products, and services all aligned to delivering what the customer wants. Harry, (1998) defined six sigma to be "a strategic initiative to boost profitability, increase market share and improve customer satisfaction through statistical tools that can lead to break through quantum gains in quality" as quoted by (Park, 2003).

Antony, (2006) added that the basic goal of a six sigma methodology is to reduce variation within the tolerance or specification limits of a service performance characteristic. In order to improve the quality of a typical service, it is imperative to measure or quantify variation and then develop potential strategies to reduce variation. Gilbert, (2003) described six sigma as “a way of doing business” and as a sweeping “culture change” effort to position a company for greater customer satisfaction, profitability, and competitiveness“ through genuine focus on the customer, data and fact driven management, process focus, management, improvement proactive management boundary less collaboration and drive for perfection. Antony & Fergusson, (2004) emphasized that six sigma is a business improvement strategy that seeks to find and eliminate causes of defects or mistakes in business processes by focusing on outputs that are of critical importance to customers. Camgoz-Akdag, (2004) defined six sigma as the basis for a “best in class” philosophy and a long term business strategy that measures quality improvement. Six sigma means less than four (3.4) defects or errors experienced for every 1 million transactions that is, only one out of every 250,000 parts produced would not fully meet all aspects of the customer’s product specification. Simply put, “first time” six sigma performance is a commitment to perfection (Elliott, 2004). Six Sigma efforts target three main areas; (i) improving customer satisfaction, (ii) reducing cycle time and (iii) reducing defects (Pande & Holpp, 2002). In addition, Park (2003) stated that it is possible to define three broad levels of objectives: management innovation, statistical measurement and process evaluation, and Strategic improvement by problem solving. Finally, Improvements in these areas usually represent dramatic cost saving to businesses, as well as opportunities to retain customers, capture new markets, and build a reputation for top performing products and services.

2.2 Methodology of Six Sigma

Six sigma is a project to solve problems. Each project has a problem in the design or operation and is looking for a solution. The successful strategy under the guidance of six sigma leadership is to find solutions and improve the basic production lines to achieve competitive advantage for the organization. Six sigma has no strategic implications until it is given some by top management (de Mast, 2006). Six sigma can provide leaders with the strategy, methods and tools to change their organization (Camgoz-Akdag, 2004). There are many authors such as (Camgoz-Akdag, 2004; Stauffer, 2003; Thawani, 2004) that agreed in their studies with these points. They pointed out that a key leadership skill has been missing from leadership development. Lee, Wong, & Yeung (2011) pointed out in this regard that leadership ability plays a critical part in any quality improvement program, particularly the six sigma project that is always said to be a top-down quality revolution approach. For an organization having a strong and active top management to involve and to provide guidance in the quality improvement process, the six sigma program is more likely to be ready to achieve ultimate success for the project. This strategy paid executives toward the field of business, technology, manufacturing, quality, production and delivery system. Identifying the problem is a small amount compared to determining the causes leading to it. These reasons are often coated with inaccurate financial reports, and data is appropriate or cultural bias of the institution. There are two major improvement methodologies in applying the six sigma approach in different organizations. The first methodology, DMAIC, is used to improve already existing processes and can be divided into five phases; defining, measuring, analyzing, improving and controlling (Aboelmaged, 2011). Many studies have demonstrated successful cases of DMAIC application in a diversity of contexts such as healthcare (Dreachslin & Lee, 2007), and manufacturing process (Li, Al-Refaie, & Yang, 2008; Tong, Tsung, & Yen, 2004), thermal power plants (Kaushik & Khanduja, 2008), retailing (M. Kumar, Antony, & Cho, 2009) and financial services (S. Kumar, Wolfe, & Wolfe, 2008). In contrast, the second methodology, DMADV, is used for new processes or when the existing processes are unable to achieve business objectives. This methodology can also be divided into five phases; defining, measuring, analyzing, designing and verifying (Bañuelas & Antony, 2003). The focus will be on the first methodology, DMAIC, as it is one of the methods or approaches used in applications of six sigma to implement the successful strategy to get six sigma quality in continuous improvement of procedures and processes in organizations (Schoonover, 2002; de Mast, 2006).

Phase 1. Defining – includes defining the scope and goals of the improvement project and appreciating boundaries of that project in terms of customer requirements and the process that delivers these requirements (Lee et al., 2011). This helps to communicate with customers, stockholders employees and all that is relevant. The purpose of this Phase is: (1) better understanding of the problem under study; (2) Identifying inputs and outputs and various controls of the processes; (3) determining the responsibilities, work stages, goals and key points (Milestones) for follow-up; (3) identifying of the equipment team; (4) understanding the benefits expected from the project (Project Merits).

Phase 2. Measuring- The purpose of this phase is to measuring the current system and its process or performance from input, output and process and calculating the sigma capability for short and longer term

process capability (Lee et al., 2011). Also, it identifies the strengths and weaknesses and determines the gaps for improvement (Antony, 2006). This phase involves a valid measurement that is reliable to assist in the control of the goals that is previously defined in the first phase.

Phase 3. Analyzing-successful strategy at this stage provides certain statistical methods, as well as some tools that isolate critical information to explain the existing defects in products or services. At this stage, the practical problems turned into statistical problems. The objective from this phase is the analysis of the system or operations to define different methods to eliminate the gap between the current performances to the system or operations and the objective to be carried out. In addition, benchmarking the process outputs, products or services, against recognized benchmark standards of performance may also be carried out (Lee et al., 2011). The purpose of this phase is: (1) better and accurate identification for the project by collecting more data that reflect the real situation; (2) detection of truth sources to the variation through a better understanding of the causal relationships between variables; (3) reduce the number of variables that deal with them and the phase of improvement; (4) identify and manage high risk input; (5) at this stage, there is a search for the answer to two questions: Is the problem permanent or casual? Is it related to technology or the process itself?

Phase 4. Improving- involves generating the improvement solutions and solving problems to stop them from re-occurring so that the required financial and other performance goals are met (Antony, 2006; Lee et al., 2011). This successful strategy focuses on the diagnosis, testing and implementation of strategies or key variables that contribute to the problem. This phase covers a six sigma design from the beginning to the end and as well as the products and services to six sigma. The essential role at this stage is to try to bridge the gap between the current situation and the target situation of operations. The methods used in this step should be verified to make sure that the desired goal has been achieved completely and have recipe continuity. The purpose of this phase is to ensure the relationship between the variables, testing and application of fundamental solutions to the problem is in order, for effectiveness and especially flexibility.

Phase 5. Controlling – In this phase successful strategy ensures non-recurrence of errors and defects by monitoring processes continuously, and set the foundations to ensure the work by new standardize approach. The standardized approach will be documented in systems such as ISO 9000 and standards of performance will be established using techniques like SPC to continue the process of improvement in a way that holds the gains. The purpose of this phase is to ensure that what has been achieved will continue and sustained in the long term, as well as the documentation of all improvement efforts and new procedures to work. In addition, the cycle is repeated, if further performance short falls are identified.

2.3 Six Sigma's Belts

The term six sigma's belt was first introduced by the Motorola Corporation by one of its experts to describe employees who are trained and experienced in applying statistical techniques to business processes and procedures so that they can make major positive contributions to the bottom line. Black Belt are these employees who have extensive experience in the use of tools suitable to the area of business in which they are employed (Antony, 2006; Ingle & Roe, 2001). Master Black belt in many organizations is a coach, observer and adviser for the rest of those who are black belt. He or she is a true expert in the analytical tools of six sigma with a scientific background in engineering or science or a degree in business administration. Green Belt is the person coach on the six sigma's skills and almost at the level of black belt but he/she works as a team member or leader of six sigma team partially. The role of the Green Belt is to ensure the application of service operations such as new concepts, tools and design for six sigma included in the daily activities of the company and for six sigma applications (Ingle & Roe, 2001; Narasimhan, 2009). Champion/Sponsor is the process owner or manager-in-charge of the areas targeted for improvement. He or she is usually the chief executive that provides guidelines for project selection and gives full support to the Black Belt or projects and the teams working in the six sigma as the project progresses (Ingle & Roe, 2001; Narasimhan, 2009). Implementation leader is usually a position for the Executive Vice President of the company. The role of this person is to organize all the efforts of six sigma to get a range of skills and experience (Thomsett, 2005).

3. Sustainable Competitive Advantage

With increasing competition, competitive advantage tends to have shorter life (Al-Alak, & Najim, 2011). As the global competition becomes increasingly fierce, how to sustain competitive advantage or achieve sustainable competitive advantage starts obtaining more attention. Barney, (1991) noted that when an organization is implementing a value creating strategy not being simultaneously implemented by any current or potential rivals, it can be said that the organization has a competitive advantage. However, when other organizations are unable to copy the benefits of this strategy, then it confirm the organization has a sustainable competitive advantage. In

2008, Barney distinguished between the two types of competitive advantage: temporary and sustainable competitive advantage. According to him, competitive advantage typically results in high profits, but these profits attract competition, and competition limits the duration of competitive advantage in most cases, therefore most competitive advantages are temporary. On the other hand, some competitive advantages are sustainable if competitors are unable to imitate the source of advantage or if no one conceives a better offering. Furthermore, Bani-Hani & AL-Hawary, (2009) refers to the sustainable competitive advantage as to create some barriers that make firm's performance imitation difficult. That is, since the competitive advantage is at the heart of firm's performance Porter, (1985), it should protect itself from being despoiled and assimilate new sources of technologies, skills and core competencies. Additionally, Halawi, Aronson, & McCarthy (2005) pointed out that sustainable competitive advantage is no longer rooted in physical assets and capital, but in effective channeling of intellectual capital. Worthy to note, (Coyne, 1986) assumed the types of capability gaps as sources of sustainable competitive advantage, which a firm could possess over competitor, such as functional/business system gaps, position gaps, regulatory/legal gaps, and cultural or organization/managerial quality gaps. Day & Wensley (1988) and Halawi, Aronson, & McCarthy (2005) focused on the elements involved in competitive advantage. Specifically, they identified two categorical sources of competitive advantage: superior skills (which are the distinctive capabilities of personnel that set them apart from the personnel of competing firms); and superior resources (which are the more tangible requirements for advantage that enable a firm to exercise its capabilities). In the present environment, the personnel truly understand customers' needs and are able to foster business-intimate relationships with them, and then they most certainly qualify as a sustainable competitive advantage (Srivastava, Anderson, & Ow, 1999).

Considering all those definitions, there are four points that can be extracted (Mahdi, Almsafir, & Yao, 2011): First, the subjects of sustaining competitive advantages are resources and skills. Some researchers have elaborated on the specific skills and resources that can contribute to a sustainable competitive advantage. Barney, (1991) stated that not all firm resources hold the potential of sustainable competitive advantages; instead, they must possess four attributes: rareness, value, inability to be imitated and inability to be substituted. Secondly, the process of sustaining competitive advantages is to transform resources and skills into competencies or capabilities. (Prahalad, & Hamel, (1990) suggested that firms should combine their resources and skills into core competencies, loosely defined as that which a firm does distinctively well in relation to competitors. (Bharadwaj & Varadarajan, 1993) discussed the specific combinations of skills and resources that are unique to service industries.

Thirdly, the objective of sustaining competitive advantages is to be better than or different from competitors or to prevent imitation from competitors. Coplin, (2002) pointed out that to sustain a competitive advantage, a company's own resources and capabilities must therefore be difficult to imitate, not easily substituted by other resources or capabilities, incapable of being rapidly developed elsewhere and firmly attached to the company that deploys or uses them.

The fourth point is to stand in a strategic point of view, to review the sustaining competitive advantages as a dynamic process. Pearce & Robinson, (1991) and Czinkota, Kotabe, & Mercer, (2005) agreed that sustainable competitive advantage is a sustainable strategy that set the organization apart from competitors, such as, price strategy, strategy-structure fit, communication strategy or cooperation between functional areas (Ramasodi, 2007). The enterprises build competitive advantage as continuum in mutual connection and form continuous corrugated track (Wei, Jinfu, & Jianfeng, 2010).

To sum up, the subjects of SCA are resources and skills. Resources also refer to what someone calls "physical resources" while skills are also referred to as intellectual resources. Both resources and skills can be regarded as the value capture part in the value chain viewpoint. The media of SCA is competency or capability. The vital issue is how to transform the subjects of SCA into the media, which is also interpreted as the value creation part in the value chain viewpoint. The objectives for SCA to be achieved can be in form of financial returns in the accounting viewpoint, capability gaps, and the value protection part in the value chain viewpoint or customer recognition from business operation field. Finally, the subject-media-objective process of SCA needs to be kept updated in order to adapt to the fast changing environment. It is what is mentioned in the literature for sustainable competitive advantage of the current study that has addressed the following dimensions:

3.1 Operational Efficiency and Effectiveness (OEE)

OEE is based on the view that, in the end, six sigma projects would be beneficial to the company that pays for them; benefits for the customer are instrumental rather than the ultimate objective. For this reason, product quality (and its components design and conformance quality) are a less obvious perspective than process quality

(six sigma projects improve processes rather than products), which consists of effectiveness and efficiency. For a process, being effective means that it delivers the right things, that is, things that represent value. The direct benefit of six sigma projects consists of their power to improve OEE. The economic potential of effectiveness is derived from the fact that more effective processes deliver more value. The economic potential of process efficiency is derived from its impact on cost-structure. But cashing these economic potentials in the form of increased profitability is not straight forward. As a result, competing on OEE alone is, generally speaking, a poor substitute for a competitive strategy, and increasing OEE by implementing six sigma does not automatically increase profitability. It is important to emphasize that OEE is important nevertheless. Even companies with a good strategy must constantly strive to increase their OEE, because any strategic advantage will be outweighed if the gap in OEE becomes too large. Thus, six sigma projects help avoid competitive disadvantage (Hayes & Pisano, 1994; Porter, 1998a; de Mast, 2006). In fact it is possible to use six sigma to gain strategic benefits, if all a company does is invest in six sigma training and conduct BB and GB projects. Six sigma brings with it capabilities and skills that management can use to build competencies that cannot so easily be bought on the market or copied by competitors. These competencies open strategic options which, when properly fit into a company's competitive strategy, may result in sustainable advantages (Hayes & Pisano, 1994; de Mast, 2006). Six sigma achieves a band of the strategic choices through triple Porter's three generic approaches for competitive strategy (Porter, 1998b): (1) overall cost leadership; (2) product differentiation; and (3) focus. Through this approach, it is noted that six sigma projects drive a strategy of cost-leadership by increasing efficiency, drive a strategy product differentiation by effectiveness.

3.2 Knowledge making (KM)

The meaning of the word "knowledge" is subject to a number of different interpretations. Yeh, (2011) deals with the knowledge concept as a force, in this direction pointed that knowledge powers the capability of professionals to be at their best, and to deliver value service to customers. Other writings have focused on the concept of knowledge to refer to it as intellectual capital and value-added, which if discovered and invested by the organization, it can be valuable and achieve competitive advantage (Al-Zayyat, Al-Khaldi, Tadros, & Al-Edwan, 2009; Endres, Chowdhury, & Alam, 2007; Mahdi et al., 2011; Othman, Yao, Mahdi, & Jing, 2011; Seidler-de Alwis & Hartmann, 2008).

While other definitions indicated that knowledge is information that has been processed in some meaningful ways merged with practice, perspective, expression and interpretation (Yao, Othman, Aballama, & Mahdi, 2011). It presents characterized approaches as well as dynamic, strategic and political plans and subject to change on which decision is based on, from the pioneers of this trend (Laihonen, 2006; Sunassee & Sewry, 2002; Williams, 2006). Knowledge as the Source of SCA and success of organization in investigating the sustainable competitive advantage do not depend primarily on the size of the budget or the products supporting technologies. It really depends on employee's attitudes, core competencies and skills (Al-Rfou, 2009; Thawani, 2004). Memon & Mangi, (2009) agreed that the strategic human resources management or the human capital is a mean of gaining competitive advantage through one of the most important asset: its people as its essential wealth, success and competitive advantage of the organization. Porter, (1985) assumptions to implement any one, or a combination of the four possible generic competitive advantage options: cost leadership, focused cost leadership, differentiation and focused differentiation, an organization would possibly need the following types of knowledge: (1) strategic knowledge to include knowledge of market environment, customer requests, customer and rivals behavior; and (2) operational knowledge to achieve managerial and operational processes associated with logistics such as procurement of raw materials and distribution of goods, and production, etc, to sustain competitive advantage, in other words, to utilize the knowledge of people to contribute to the organization (Buckman & NetLibrary, 2004; Sheikh, 2008).

This contribution to achieve sustainable competitive advantage to the organization by knowledge making could be brought about by six sigma, because six sigma is power to facilitate people at all levels of an organization to learn how their processes work and to put this new knowledge to effective use which is the core capability.

3.3 Cost of Poor Quality (COPQ)

Cost of Poor Quality (COPQ) is the monetary loss of products and processes that are not achieving their quality objectives (Gryna & Juran, 2001). Six sigma is classed among initiatives for quality improvement and total quality management. The benefits of quality improvement initiatives are argued from their potential to: (1) increase customer satisfaction by improving product quality; (2) Reduce production costs by lowering costs associated with poor quality (de Mast, 2006). COPQ is traditionally subdivided into three categories called PAF as prevention costs, appraisal costs and failure costs. COPQ and the PAF components are used in the literature to

establish a relationship between conformance levels and production costs. The failure costs refer to the difference between the real cost of producing the good or service and the costs in the absence of any failures, and these costs are the highest cost that was formed to achieve the quality when a company has reached 70-90% of the cost of overall quality. The failure costs can be classified into two types, namely:

- i. Internal failure costs: these costs are discovered before they are sent to the consumer.
- ii. External failure costs: is done through the receipt of the consumer of the product but quality are few.

Freiesleben, (2006) suggested that successful application of six sigma quality is positively correlated with better financial performance and profit generation. In the manufacturing context, six sigma has a positive impact on productivity and profitability as a result of reduction in process variability, inventory, maintenance time, and cost of poor quality. Service organizations adopting six sigma methodology will have improved service delivery as a result of accurate allocation of resources and reduced defects and variability in service processes (Antony, Kumar, & Madu, 2005; Kwak & Anbari, 2006).

4. Methodology

After the field survey of a sample of health institutions in Iraq, it has been identified that the problem they are experiencing are as follow: (1) high cost and low quality of health services; (2) deterioration of the relationship between the service providers and the beneficiaries; (3) high cost of modern technology in the diagnosis and treatment and; (4) unavailability of new directions for the health strategy. The study was conducted using a procedural scheme as showed in Figure (1), where it demonstrates the systematic steps to the impact of sigma strategies in order to achieve sustainable competitive advantage. The intellectual foundation which emerges in this process was derived from the ideas presented in the literature (Antony, 2006; Antony & Banuelas, 2002; Dreachslin & Lee, 2007; Harry, Michaels, Libretto, Bruce, & Productions, 1997; Hayes & Pisano, 1994; Kaushik & Khanduja, 2008; M. Kumar & Antony, 2009; S. Kumar et al., 2008; Li et al., 2008; Park, 2003; Porter, 1998a; Tong et al., 2004; de Mast, 2006).

Insert Figure 1 here

The scheme has been established based on hypotheses built on the basis of the nature of relations between the variables of the study and trends of influence. The achievement of its objectives as stated in the problem of the study. In line with the view suggested in the literature, thus the study hypothesized:

H1: there is significant correlation between Six Sigma and SCA.

H1a: there is significant correlation between Six Sigma and Operational Efficiency and effectiveness (OEE).

H1b: There is significant correlation between Six Sigma and Knowledge Making (KM).

H1c: there is significant correlation between Six Sigma and Cost of Poor Quality (COPQ).

H2: there is significant impact by Six Sigma on SCA.

H2a: there is significant impact by Six Sigma on Operational Efficiency and Effectiveness (OEE).

H2b: there is significant impact by Six Sigma on Knowledge Making (KM).

H2c: there is significant impact by Six Sigma on Cost of Poor Quality (COPQ).

In this study there are three kinds of statistical analyses that were carried out on the data obtained from the respondent. First, descriptive analysis was used to analyze the background of the respondent; secondly, correlation analysis was used to analyze the relationship between six sigma and Sustainable Competitive Advantage (SCA); and thirdly, regression analysis for investigation of the impact of six sigma on Sustainable Competitive Advantage (SCA).

4.1 Questionnaire Design

The data for this study were collected via a questionnaire survey. Most of the measurement items in the questionnaire were based on previous studies. Content validity was ensured through an extensive literature review of published material in academic and practitioner journals, and by discussion with several experts and scholars in this field. The questionnaire was comprised of four parts: health institutions profiles of respondents (part I); procedural definitions to the study variables (part II); Six sigma methodology DMAIC (part III); and dimensions of sustainable competitive advantage (part IV). The present study adopted an existing five-point Likert scale, where 1 represented "strongly disagree" and 5 represented "strongly agree." All items in the questionnaire adopted the same five-point Likert scale.

4.2 Data Collection

The sample for this study was chosen based on random sample of (40) doctors in health institution. The survey was distributed directly to the 40 doctors, and a total of 30 questionnaires were returned or (90 percent). 10 of the 40 returned questionnaires were discarded because of incomplete information. There were 30 usable responses in total, for an overall response rate of 75%. Research analytical methods included exploratory factor analysis, reliability and validity. The analyses made use of SPSS (version 18) program for Windows to carry out the dissipative statistical analysis.

5. Findings

5.1 Descriptive Analysis

For the responding descriptive analysis there were 26 (87 percent) male respondents, while 4 (13 percent) of the respondent are female. As for the scientific qualified 12 (40 percent) respondent attained PhD level, 4 (13 percent) master level and 14 (47 percent) bachelor levels.

5.2 Reliability Analysis

Reliability analysis was carried out for each variable: six sigma and the Sustainable Competitive Advantage (SCA). The results score ranged from .605 to .911 as show in table 1. The results are normally within acceptable limit for social studies.

Insert Table 1 here

5.3 Normality Distribution Analysis

Table 2 shows the descriptive statistics for the sample of the study showing the mean, standard deviation, maximum, minimum, skewness and kurtosis. The descriptive statistics represent all the independent variables which are Definition-Measurement-Analysis-Improve-Controls (DMAIC) used to examine the impact of six sigma on the dependent variable Operational Efficiency and Effectiveness (OEE), Knowledge Making (KM) and Cost of Poor Quality (COPQ) used to examine the Sustainable Competitive Advantage (SCA).

The normality of the data was assessed using the skewness and kurtosis statistics derived from the descriptive statistics which should have a range of -1 and +1. If the range belongs to the above range, then the distribution is normally distributed and therefore there is a need for transforming the data to normal distribution in order to perform the necessity statistical tests.

Insert Table 2 here

5.4 Correlation Analysis

This part of the study is to seek the correlation between the variables dimensions, through an appropriate statistical analysis. In here, Spearman's Rank Correlation Coefficient has been used to determine the relationship between study variables. In addition, it identifies significant opposites the potential value of the error from first type, and it is the amount at which the probability of the uncertainty value is at significance (0.05) and (0.01) to determine the moral differences between the study variables.

5.4.1 Testing hypothesis

H1: there is significant correlation between Six Sigma and SCA.

H1a: there is significant correlation between Six Sigma and (OEE).

Statistical results the correlation between six sigma methodology and dimensions diagnosis of sustainable competitive advantage are shown in table 3. Spearman's Rank Correlation Coefficient value on the relationship between six sigma methodology and Operational Efficiency and Effectiveness (OEE) was 0.815** at a significance smaller than 0.01. It is a significant positive correlation. This means six sigma methodology have strong significant correlation with efficiency and effectiveness (OEE) and the opposite is true. This in turn supports the sub-hypothesis mentioned above.

H1b: There is significant correlation between Six Sigma and (KM).

Table 3 shows the statistical results of the correlation between six sigma methodology and dimensions diagnosis of sustainable competitive advantage. Spearman's Rank Correlation Coefficient value about the relationship between six sigma methodology and knowledge making (KM) was 0.930**, at significance smaller than 0.01. It is significant positive correlation. This means six sigma methodology have strong significant correlation with knowledge making (KM) and the opposite is true. This in turn supports the sub-hypothesis mentioned above.

H1c: there is significant correlation between Six Sigma and (COPQ).

Table 3 shows the statistical results of the correlation between six sigma methodology and dimensions diagnosis of sustainable competitive advantage Spearman's Rank Correlation Coefficient value on the relationship between six sigma methodology and Cost of Poor Quality (COPQ) was 0.667**, at significance smaller than 0.01. It is significant positive correlation. This means that six sigma methodology has a strong significant correlation with Cost of Poor Quality (COPQ) and the opposite is true. This in-turn supports the sub-hypothesis mentioned above.

Insert Table 3 here

Verification validity of the content of sub-hypotheses (**H1a**), (**H1b**) and (**H1c**) for the first main hypothesis through the Spearman's Rank Correlation Coefficient value between six sigma methodology was 0.878** at significance smaller than 0.01. It is significant positive correlation. This shows that six sigma methodology has strong significant correlation relations with dimensions diagnosis of sustainable competitive advantage. This in turn verifies the validity of the first main hypothesis.

5.5 Regression

The analytical study has been used of simple linear regression method to measure the impact between the independent variables and the dependent variable. After measuring the impact, it is proven by the adjusted coefficient of determination R^2 , which shows the percentage explained by the independent variable changes in the dependent variable. Thus, the value of R^2 is located between 0 and 1, means $1 > R^2 > 0$, whenever the value of R^2 become big, the interpretation strength of the regression equation become big. Fitness test (F) was made to analyze variance for measuring the significance model of simple linear regression to measure the degree of appreciates (Fitness) as dependent model while the value of indexed (F) is 2.39. In addition, adoption of the statistical indicator supported note that the value of (F) spread sheet is, as well as the adoption of the statistical indict or Beta Coefficient (B) or called by the amount of tendency regression model to determine the amount of change (impact) in the dependent variable unit when the value of the independent variable was changed by one unit. If the tendency significant degree is less than 0.05, means $P < 0.05$, that is evidence of the impact of the independent variable in the dependent variable and the opposite is true. Therefore, this section includes the impact between the variables of the study according to the study hypotheses, as follows Table 4.

5.5.1 Testing hypothesis

Insert Table 4 here

H2: there is significant impact by Six Sigma on SCA.

H2a: there is significant impact by Six Sigma on (OEE).

Table (4) showed the relations between six sigma methodology and Operational Efficiency and Effectiveness (OEE) were acceptable. As indicated in the (F) test, the calculated (F) value 118.815 is the largest of the indexed value (F) at significance less than 0.01. As the result of the value of the adjusted coefficient (interpretation) R^2 is 0.802. It means that the six sigma methodology explained and interpreted 80.2% from the gained changes in the respondent variable (dependent) of the efficiency and effectiveness (OEE). In addition, it has been pointed from the value of the Beta coefficient (B) that the six sigma methodology as an explanatory variable (independent) significant effect on the efficiency and effectiveness (OEE) as respondent variable (dependent) was 0.900 at significance less than 0.01. This refers to the change of one unit in the six sigma methodology followed by an increase of 0.900 in the efficiency and effectiveness (OEE). This achieves sub-hypothesis mentioned in the above.

H2b: there is significant impact by Six Sigma on (KM).

Statistical results in table (4) illustrate that relations between six sigma methodology and knowledge making (KM) were acceptable. As indicated in the test (F) has the value (F) calculated 146.718 is the largest of the indexed value (F) at significance less than 0.01. As the result, value of the adjusted coefficient (interpretation) R^2 is 0.834. This means that the six sigma methodology explain and interpret 83.4% from the gained changes in the respondent variable (dependent) to the knowledge making (KM). In addition, it also has been pointed from the value of the Beta coefficient (B) that the six sigma methodology as an explanatory variable (independent) has significant effect on the knowledge making (KM) as respondent variable (dependent) was 0.916 at significance less than 0.01. In other word, the change of one unit in the six sigma methodology followed by an increase of 0.916 in the knowledge making (KM). This achieves sub-hypothesis mentioned in the above.

H2c: there is significant impact by Six Sigma on (COPQ).

Statistical results demonstrate in table (4) that relations between six sigma methodology and Cost of Poor

Quality (COPQ) were acceptable. As indicated in the test, (F) has the calculated value of 58.607; it is the largest of the indexed value (F) indexed at significance less than 0.01. As the result, value of the adjusted coefficient (interpretation) R^2 is 0.665. This means that the six sigma methodology explain and interpret 66.5% from the gained changes in the respondent variable (dependent) of the Cost of Poor Quality (COPQ). In addition, has been pointed from the value of the Beta coefficient (B) that the six sigma methodology as an explanatory variable (independent) significant effect on the Cost of Poor Quality (COPQ) as respondent variable (dependent) was 0.823 at significance less than 0.01. This means that the change of one unit in the six sigma methodology is followed by an increase of 0.823 in the Cost of Poor Quality (COPQ). This achieves sub-hypothesis mentioned in the above.

After verification from validity of the content of sub-hypotheses (**H2a**), **H2b** and **H2c** verify the authenticity of the content of the second main hypothesis. The results of test value (F) achieve calculated value is 42.475 at significance less than 0.01. Which indicate that relations mode between six sigma methodology and sustainable competitive advantaged was acceptable. The adjusted coefficient (interpretation) R^2 achieve value is 0.589, in the other word, six sigma methodology explain and interpret 58% from the gained changes in the respondent variable (dependent) of the sustainable competitive advantaged. As has been pointed from the value of the Beta coefficient (B) there is significant impact to the six sigma methodology as an explanatory variable (independent) in the sustainable competitive advantaged as respondent variable (dependent) was 0.776 at significance less than 0.01. This in-turn verifies validity the second main hypothesis.

6. Conclusions

The term six sigma and consequently the six sigma methodology are characterized as modernity. Research is still in early stages at all level of the organizations under consideration. After the field survey of a sample of health institutions, it has been shown that there are a set of trends that health institutions are keeping and these are high cost and low quality of health services, deterioration of the relationship between the service providers and the beneficiaries, high cost of modern technology in the diagnosis and treatment and unavailability of new directions for the health strategy. The researchers determined the nature of the six sigma differently where some of them considered process, and some of them promise a strategy, mechanism, technique or method to handle a specific problem. This variation is a source from scientific richest and high interest obtained by this term. Moreover, there is limited knowledge of doctors' research samples in this term on both conceptual and practical dimensions. Furthermore, the levels of the dimensions of the application of six sigma methodology in the health institutions under consideration are somewhat close and its mean over the hypothetical mean slightly differs. There are significant correlation relationships between dimensions diagnosis of sustainable competitive advantage, which also reflects the harmony, homogeneity and integration of these dimensions. In addition, there is a great six sigma methodology in the diagnosis dimensions of sustainable competitive advantage, efficiency and effectiveness (OEE), making knowledge (KM), and Cost of Poor Quality (COPQ).

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Table 1. Reliability Analysis

Variables Factors		Cronbach's Alpha	Number Of Items
I.V	six sigma	.898	27
D.V	Efficiency and Effectiveness (OEE)	.828	14
	Knowledge Making (KM)	.911	6
	Cost of Poor Quality (COPQ)	.605	8

Table 2. Statistics

Statistics	six sigma	Operational Efficiency and Effectiveness (OEE)	Knowledge Making (KM)	Cost of Poor Quality (COPQ)
Valid	30	30	30	30
Missing	0	0	0	0
Mean	98.07	47.37	19.57	28.23
Std. Deviation	15.045	8.560	5.488	3.471
Skewness	.051	-.363	-.301	.171
Std. Error of Skewness	.427	.427	.427	.427
Kurtosis	-.305	1.067	.329	.902
Std. Error of Kurtosis	.833	.833	.833	.833
Minimum	71	23	6	20
Maximum	129	63	30	36

Table 3. The Correlation between Dependent and Independent Variables

Variables		Dimensions diagnosis of sustainable competitive advantage			Total diagnosis of (OEE), (KM) and (COPQ)	
		(OEE)	(KM)	(COPQ)		
Six sigma Methodology	D	0.634** 0.000	0.626** 0.000	0.568** 0.001	0.922** 0.001	Rs Sig
	M	0.350* 0.058	0.399* 0.029	0.577** 0.001	0.817** 0.000	Rs Sig
	A	0.498** 0.005	0.561** 0.001	0.483** 0.007	0.782** 0.000	Rs Sig
	I	0.592** 0.001	0.615** 0.000	0.686** 0.000	0.759** 0.000	Rs Sig
	C	0.466* 0.009	0.468** 0.009	0.539** 0.002	0.714** 0.001	Rs Sig
	Total Six sigma DMAIC	0.815** 0.000	0.930** 0.000	0.667** 0.000	0.678** 0.000	Rs Sig

**significant < 0.01, * significant< 0.05

Table 4. Regression Analysis

Model	Adjusted R Square	Std. Error of the Estimate	F	Sig.	Unstandardized Coefficients		Standardized Coefficients	
					B	Std. Error	Beta	Sig.
OEE	.802	.37858	118.815**	.000	-.383- 1.104	.370 .101	.900**	.000
KM	.834	.38551	146.718**	.000	-1.122- 1.249	.377 .103	.916**	.000
COPQ	.665	.31634	58.607**	.000	1.505 .648	.310 .085	.823**	.000
SCA	.589	.40959	42.475**	.000	1.064 1.064	.401 .401	.776**	.000

**significant < 0.01, * significant< 0.05.

Predictors: (Constant), Six Sigma

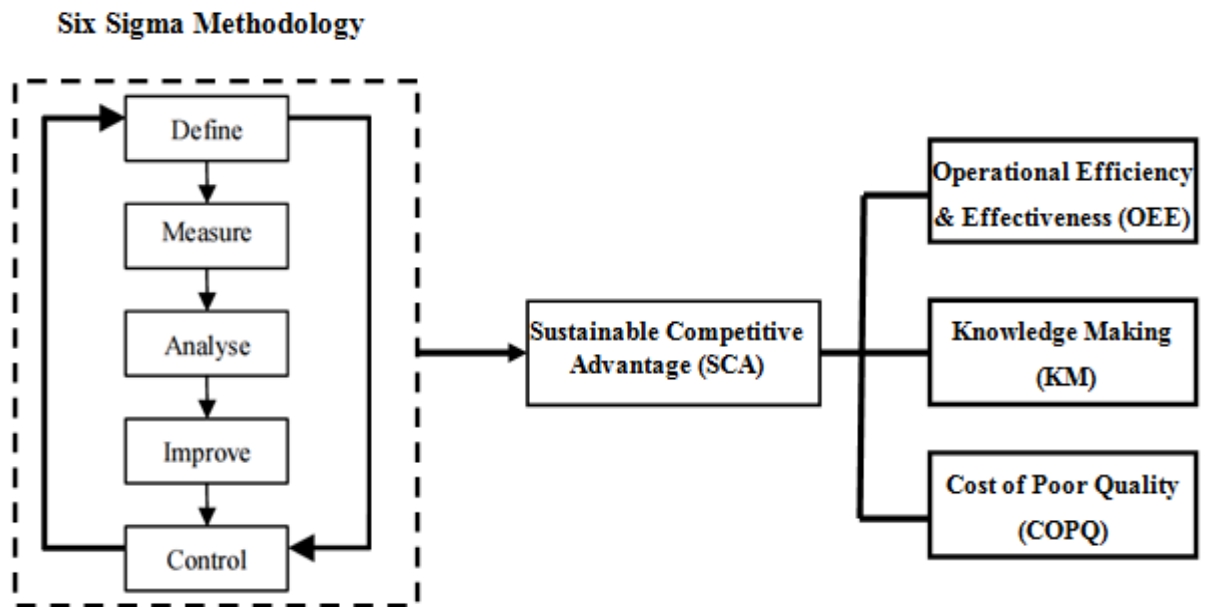


Figure 1. A Procedural Scheme of Study