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Lean Six Sigma Framework for the hospitality industry

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Abstract

Six Sigma is a data driven process improvement methodology used to achieve stable and predictable process results by reducing process variation and defects. Lean is a process improvement methodology used to deliver products. These approaches started in manufacturing organisations and gained popularity in service organisations, including hotels and lodging. Over time, organisations began to use the approaches in an integrated fashion and called it Lean Six Sigma. This paper explores the literature regarding these approaches and proposes a framework for the integrated Lean Six Sigma methodology and a template for the hospitality industry. The framework consists of four phases, initiation, data management, improvement and freezing. The principal means to achieve good Six-Sigma quality levels is to pro-actively eradicate the reasons of process related problems manifesting prior to them becoming huge shortcomings in a hotel operation. The emphasis of Six-Sigma is thus on seeking out prospects in processes with negative consequences that lead to defective quality.

Keywords: Six-Sigma, Lean systems, Lean Six Sigma, Lean Six Sigma framework

Introduction

Service quality is the core activity in the hospitality industry and its role in the success of the hospitality sector cannot be emphasised enough (Wilkins et al., 2007). It is in the nature of the hotel industry to continually improve and enhance the quality of services for business success. Obtaining Six Sigma status in a process is seen as a symbol of quality (Bruce, 2002) and is attractive to most organisations for the benefits it provides. For example, Monier-Vinard and Grant (2014) reported that benefits resulting from obtaining Six Sigma in a bank to improve cash management showed a reduction of errors, fewer delays, fewer complaints, reduced operational risk, reduction of rework and duplication, and a 13% productivity improvement. The United States military used a Six Sigma approach in product development to successfully design the next generation helicopter, saving them billions of dollars (Fulton, Bastian and Wilson, 2015).

Many organisations in a plethora of business areas, including those in the hospitality industry, are drawn to the innovation and novelty of Six Sigma as an improvement tool for all sorts of problems, whereas in reality this is not the case. This may happen when companies implement Six Sigma simply to keep up with the competition, or to impress shareholders by being able to use continuous process improvement terminology in company documentation. Organizations that deploy Six Sigma as a purely cosmetic change, or implement it without the resources it requires, are inviting failure. Another approach that is similar to Six Sigma is the creation of Lean processes to eliminate waste and increase value to the customer. Currently, Lean Management and Six Sigma are the most widely recognised continuous improvement initiatives available to organisations (Alsmadi and Khan, 2010) with similar challenges. Questions arise around whether these two approaches should they be implemented in parallel or whether they should be integrated. As such, the objective of this paper is to provide an integrated framework for the implementation of Lean Six Sigma. These methodologies become more challenging in the hospitality sector than the manufacturing sector due to the characteristics of intangibility, perishability, heterogeneity, simultaneity of production and consumption of the processes in the hospitality sector (Reisinger, 2001; Reid and Bojanic, 2009).

What is Six Sigma?

The concept of Six Sigma originated in Motorola Incorporated in the early 1980s with the aim of eliminating product defects, reducing quality costs and enhancing customer satisfaction (Kamar, 2014). Six Sigma has been defined as: a "business improvement strategy used to improve business profitability, reduce costs of poor quality and improve effectiveness and efficiency of operations so as to lead to or even exceed customer needs and expectations" (Antony and Banuelas, 2003); "methodology to reduce variation and produce the same results over a long period of time" (Lowenthal, 2002); "a powerful business strategy which can offer hospitality organisations an extremely powerful competitive advantage in terms of reducing operational costs, defect rate in core processes and deliver high quality service which would result in superior customer satisfaction" (Tan and Chakraborty, 2009); "the strategy for business transformation" (Pande and Holpp, 2002); and "philosophy, tools, and methods used to seek, find, and eliminate the causes of defects or mistakes in business processes by focusing on the outputs that are important to the customers (Antony and Fergusson, 2004; Snee, 2000).

Kumar and Bauber (2010) summarises Six Sigma as the methodology used to objectively identify the root causes of problems causing defects, by collecting and analysing data and reducing the variation, which in turn results in the occurrence of fewer defects and the production of higher quality goods and services. By controlling this variation, Six Sigma prevents defects from occurring, rather than simply detecting and correcting them. Birkinshaw and Mark (2015) describe it as a "data driven approach for eliminating defects in any process". Sherman and Luton describe it as "a powerful process improvement method that relies on a disciplined, data-driven, analytical approach to solving problems", and as "an organized and systematic method for strategic process improvements and new product and service development that relies on statistical methods and the scientific method to make dramatic reductions in customer defined defect rates" Linderman, Schroeder, Zaheer and Choo (2003).

Perhaps the most accurate definition is provided by Bruce (2002) as, "managing and helping to identify what is not unknown, emphasising what should be known, and taking the appropriate action to reduce the errors that cost time, money opportunities and customers". Tjahjono, Ball, Vitanov, Scorzafave, Nogueira, Calleja, Minguet, Narasimha, Rivas, Srivastava, Srivastava and Yadav (2010) concluded from their literature review that there are four possible streams of thought regarding Six Sigma: a set of statistical tools, an operational philosophy of management, a business culture and a scientific analytical methodology. In addition, they concluded that irrespective of the streams, the fundamental goals of Six Sigma are still: improving efficiency, profitability and process capability.

Statistical Six Sigma

According to Pande, Neuman and Cavanagh (2002), scientifically Six Sigma is a reference to a particular goal of reducing defects to near zero. Sigma is the symbol that scientists use to represent the standard deviation of a population. The standard deviation tells you the amount of variation within a group of items; the greater the variation is, the greater the standard deviation. The purpose of Six Sigma is to reduce variation to achieve really small standard deviations so that all products and services meet or exceed customer expectations. In other words Six Sigma is a measure of process performance.

Six Sigma is a statistical concept that measures a process in terms of defects (Bruce, 2002). More specifically the amount of variance in a process is measured in terms of the standard deviation, represented by the Greek symbol Sigma (δ). Table 1 below translates Sigma level with probability of errors.

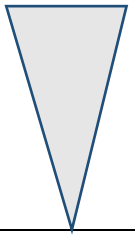
Sigma Level	Percentage error free (%)	Defects per million opportunities	Loss of customers, revenue, and market share
0	50.00	500 000	
1	69.10	691 462	
2	92.72	308 537	
3	99.87	66 807	
4	99.997	6 210	
5	99.9997	233	
6	99.999997	3.4	

Table 1: Sigma levels Source: Self Developed

At a Six Sigma level the process is almost perfect with minimum variations and minimum deviations, resulting in an optimum error rate of 3.4 defects in a million opportunities. At this level the market should be growing with satisfied customers, revenue increases and also an increase in employee satisfaction.

Six Sigma has its own formal organisational structure for different team roles borrowed from the martial arts terminology (Snee, 2004; Antony, Kumar, and Madu, 2005; Pande, Neuman, and Cavanagh, 2000; Harry and Schroeder, 1999; Adams, Gupta, and Wilson, 2003). The white belt member requires 40 hours of training and works in one cell area (Harry and Crawford, 2004). The yellow belt member takes up operations level roles in the project, in addition to their normal responsibilities (Harry and Crawford, 2004). The green belt member requires 80 hours of training and takes up a role in a project in addition to normal responsibilities, but conducts some of the statistical analyses (Harry and Crawford, 2005). Black belt members require 160 hours of training and are involved solely in long-term projects and conduct high level statistical and mathematical analyses (Harry and Crawford, 2005). The master black belt has several years of lean Six Sigma experience and is a mentor and trainer to all other members (Ingle and Roe, 2001).

What is not Six Sigma?

According to Bruce (2002) the following describes what Six Sigma is not:

Six Sigma is not another quality program. Six Sigma follows a problem-solving process and proves its value by connecting outcomes to the bottom-line.

Six Sigma is not theory. It's a practice used to define, measure, analyse, improve and control vital processes in order to improve the quality and to impact directly on bottom-line results.

Six Sigma is not a training program. It is a business strategy that changes the outlook and practices of everyone in the organisation, consequently, more time is spent on implementing Six Sigma than investing in training.

Six Sigma Challenges

Kokkranikal, Antony, Kosgi and Losekoot (2012) outlined the following challenges after their study on Six Sigma. These challenges include a lack of high quality credible data, a lack of methods for data analysis, a lack of time, lack of clarity regarding the projects, a lack of team consensus on problems, and resistance to change. Team members may consider work on a Six Sigma project as additional work above the normal work, lose enthusiasm, miss meetings, delay activities, and lose momentum, which may result in extending the project. Kokkranikal, Antony, Kosgi and Losekoot (2012) also found in their study that managerial staff are more resistant to change than operational staff because the latter could more easily identify with the benefits.

Pande, Neuman and Cavanagh (2002) describe the following challenges in the implementation of Six Sigma: They found that senior management often refuse to learn about Six Sigma. In addition, many managers do not really understand the key customers and guess when deciding where improvement is needed. Other challenges include, managers thinking that Six Sigma is a quick-fix, Six Sigma projects that are not linked to external customers, and too many uncontrolled projects leading to initial buy-in that soon dwindles.

The DMAIC process

Six Sigma is implemented through a five stage process: Define, Measure, Analyse, Improve and Control (DMAIC).

The define stage ensures that the problem and / or process selected, is linked to organisational priorities and has management support (Shankar, 2009). It is about defining the project and preparing for execution. The project must yield a significant improvement in quality and customer satisfaction, and an improvement in the bottom-line (Bruce, 2005). As such, it is important to identify the vital factors that need to be measured, analysed, and controlled to achieve projected results. The project should be selected using strategic criteria, auditing reports, cost of quality, failure reports, customer complaints, competitor tracking and other collected data pertaining to the problem. Further analyses can be conducted using a Pareto chart or table and value stream map (VSM) by conducting a supplier, input, process, output and customer (SIPOC) analyses.

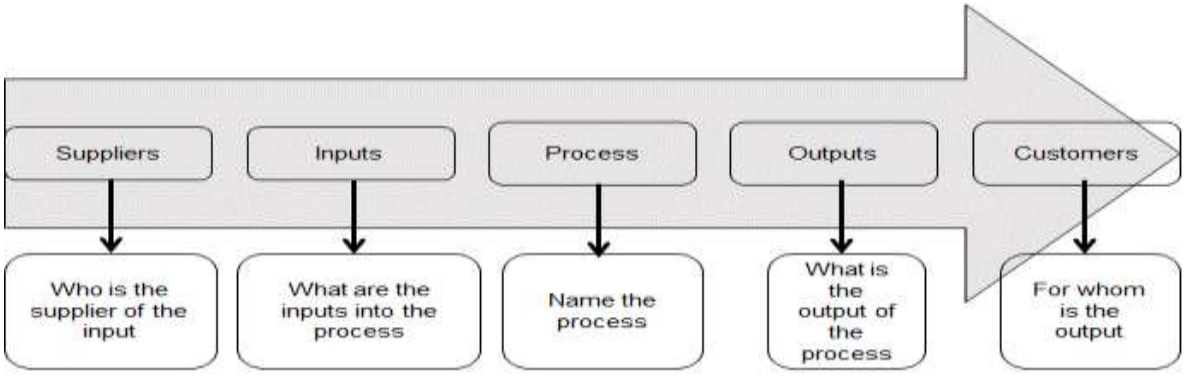


Figure 1: SIPOC diagram Source: Author's own

An example of a Pareto table is provided in Table 2 below. This table shows that addressing factors 5, 4 and 3 will achieve an 80% improvement.

Factors	Impact	Cumulative %
Factor 5	**33**	**33**
Factor 4	**25**	**58**
Factor 3	**22**	**80**
Factor 2	12	92
Factor 1	8	100
	100	

Table 2: Pareto Table Example Source: Author's own

The next important activity is to select the team members. Shankar (2009) advises that team members should include: subject matter experts, an outsider who can contribute from an external perspective, participants from different levels of the organisation, and trained Six Sigma participants. Bruce (2002) suggests that the key players should be: executive leaders to ensure commitment and promote buy-in throughout the organisation; champions to assist with promoting the project and removing barriers; a Master Black belt to serve as a mentor and guide; a Black Belt to be a full-time team participant; and Green Belts to assist the black belt on a part-time basis. The final output of this phase involves drawing up a charter document, which is an agreement between the management and the project team, and a

The purpose of the measure phase is to gather baseline information about the process that has to be improved (Shankar, 2009). More specifically, its purpose is to identify the characteristics (CTQ factors) of the process, determine the targets and specifications of the characteristic, validate a measurement system and collect base line data. Gauge studies are conducted to evaluate the measurement system. Bruce (2002) identifies the four essential criteria against which a measuring system should be evaluated; accuracy, repeatability, reproducibility and stability. Accuracy reflects on how precise the measurement is, repeatability reflects on obtaining the same results if the same measurement is conducted on the same item more than once, reproducibility reflects on obtaining same results irrespective of who does the measurement and irrespective of the equipment used, and stability refers to consistency of results over time (Pande, Neuman and Cavanagh, 2002). One of the outputs of this phase is to identify all the inputs and their impact on the process, normally in the form of the equation;

$Y = f(x_1) + f(x_2) + \ldots\ldots\ldots\ldots\ldots f(x_n);$ where Y is the output of the process and x_i each input.

The other output from this is phase is to establish the process capability which is an indicator if the process is capable of meeting customer expectations (Bruce, 2002).

The crux of the analyse phase is to determine which input factors (determined in the measure phase) have a significant and critical impact on the production of defects (Shankar, 2009). Methods such as brainstorming, cause and effect diagrams, process analyses and statistical methods such as hypothesis testing, correlation and regression tests and analyses of variance tests are used in the analyses.

The first step in the improve phase is to model the process mathematically in terms of inputs and outputs and their relationships, so as to understand the behaviour of the process (Shankar, 2009). In other words the effects of the key variables on the critical to quality outcomes are quantified (Bruce, 2002). The variables can be modified to optimise the outcomes and subsequently the process.

The control phase is the final phase. During this phase controls are placed on the changes of significant variables that will improve the output (determined in the improve phase) (Shankar, 2009). Tools such as statistical control charts and mistake-proofing mechanisms are used. The process should operate a higher level of quality and productivity (Bruce, 2002).

Shankar (2009) describes the DMAIC process with the analogy of a patient visiting a hospital. At first the doctor asks the patient to describe the problem and the symptoms they are experiencing, and then clarifies the problem by asking questions (define phase). Next baseline data is collected using approved measurements such as blood tests, urine tests, x-rays etc. (measure phase). The data is then analysed to identify the critical causes of the problem (analyse phase). Appropriate medication and a treatment plan are prescribed (improve phase) and regular visits and check-ups after treatment ensures that the problem no longer exists (control phase).

Lean Thinking

Grzelczak and Lewandowska (2016) define waste as "muda" a Japanese word for "the opposite of value". Lean organisations focus on the elimination of waste in all forms and promote a smooth and efficient flow of materials and information throughout the value chain to obtain faster customer response, higher quality and lower costs (Evans and Collier, 2007). According to Vlachos and Bogdanovic (2013), Lean practices relate to waste reduction so that there is an increase to the customer. It is common to see definitions of the seven wastes that the Lean philosophy seeks to eliminate. Lean practices focus on the removal of obstacles (Waste) that can hinder the flow of work (Liker 2004). Such obstacles include overproduction, which is the largest source of waste, waiting time, materials that are waiting in queues to be processed, unnecessary transportation that does not generate added value to the product, unnecessary and / or inappropriate processing, unnecessary inventories, excessive motion, defects that result in reprocessing and / or wastage (Dennis, 2008), and more recently the misuse of intellectual capital (Womack and Jones, 2003). All are non-value adding activities. Within an organisational context, Lean can also be defined as doing "more with less" (Hampson, 1999; Ziskovsky and Ziskovsky, 2007; Radnor and Boaden, 2004).

The lean thinking philosophy originated in manufacturing and quickly moved to new areas such as services, trade and the public sector (Womack and Jones, 2005). Lean calls for: cultural change and commitment to adding value to customers, society, and associates; processes paying off over time; people and partners who are respected and developed; and problem-solving to drive organisational learning and focuses on work processes, quality, and efficiency (Fairbanks, 2007).

Lean Services

Nascimento and Francischini (2004) as reported by Leite and Vieira (2015), define a Lean service as a standardisable system of service operations comprising of activities that generate value for customers by meeting their expectations for quality and price.

Silvestro et al. (1992) indicated that there are three different categories in the service sector: professional service, service shops and mass service. Professional services, for example banks, have a high focus on people, contact time and process. Service shops, for example hotels or restaurants, have a medium focus on customisation and front office and back office. Mass services, for example, courier companies, pay low attention to equipment and customization.

In manufacturing operations, high costs and focuses are related to raw materials and equipment, but in service operations, manpower is one of the most relevant factors in the cost of doing the job. Since the human factor is prominent in service, Lean principles must also be applied to employees who are involved in the processes of delivering services (Bowen and Youngdahl, 1998; Swank, 2003; Sarkar, 2007; Bicheno, 2008).This is supported by Abdi, Shavarini, and Mohammad (2006) who describe the human element as a highly relevant variable in the services sector. This is also embedded in the "service laws". Maister (1985) proposed two "service laws" in terms of service delivery. The first law states that there will be happy customers if the service is better than their expectations. The second law states that customers' first impression influences the rest of the service consumption experience. These laws are focused on employees who deliver the service in a way that prioritises customers.

There are various definitions of a Lean service. Womack and Jones (2005) defines Lean services where the processes work together, as not wasting customers' time, providing exactly what is wanted, exactly where and when wanted. Bowen and Youngdahl (1998) and Swank's (2003) definitions emphasises: ensuring that value-added processes flow; implementing a customer-driven system; eliminating losses in the value chain of activities, from development

to delivery; increasing customer focus and involvement throughout the whole process; and empowering employees and teams. Sánchez and Pérez (2004) add the factors of flexible information systems and continual quality improvement, and Ahlstrom's (2004) definition includes multi-functional teams. The most recent definition proposed by Jones (2006), focuses on what creates and what does not create value from the customers' perspectives; identifying all the steps needed to design, order and produce the service along the flow, to focus on losses that do not add value; ensure that activities that create value, flow without interruptions; do only what is driven by the consumer; and strive for perfection and continuously improving services. Leite and Vieira (2015) provide the following examples as lean services:

"Supermarkets build branches (stores) where customers are and connect them through distribution strategically located centres. This increases speed and agility on the product distribution. It is easy to see that these retailers are using large supermarkets (megastores) located out of downtowns, regular supermarkets in neighbourhoods, small markets are spread for all city, and on-line markets for internet sales."

In terms of low cost/low fare airlines:

> "The focus is to reduce aircraft time on ground. For this, customers are partially involved in some activities to reduce this time, for example, just before landing, the crew requests all passengers to collect their trash and magazines. Besides reducing ground time it help reduce expenses with cleaning. Another lean logistics strategy at airports is the boarding time. Passengers located at different portions of the aircraft are called at different time intervals."

In terms of hospitals:

> "Lean is applied to reduce the waiting time. There are rules and procedures specific to different types of patients and procedures, such as for first aid, surgery, tomography, X-ray, lesions, and etc."

Leite and Vieira (2015) conducted a literature review on tools used to develop lean systems. These include the following examples as lean services: Flow Production, Just in Time, Set up reduction, Value chain orientation, Heijunka, Multi task, Layout Improvements , Takt Time , Value stream map, Consumption map, Training, Problem solution, Inventory reduction, Kanban, Continuous improvement, Vertical Information, Pull System, Zero Defects, Wastes reduction, Preventive maintenance, Standardisation and 5 S, Poke-Yoke, Automation, and Visual Management.

Table 3 provides the associated methodologies for the use of the tools by consulting the book Operations Management authored by Stevenson (2012).

Tools	Associated Methodologies
Flow Production	Forecasting techniques Service Design Concurrent Engineering Service blueprinting Process reliability Capacity planning Constraint management Process selection Process technology Process capability
Just in Time	Supplier management Batch size

	Scheduling
Set up reduction	Scheduling Operations Research Techniques
Value chain orientation	Balance in price and quality Maximising value to customers
Heijunka	Balancing the workload in terms of volume and variety to achieve a smooth flow of work
Multi task	Work culture Training
Layout Improvements	Fixed position layouts Cellular layouts Combination layouts Office layouts Retail layouts Storage layouts Self-service layouts Ergonomics
Takt Time	Managing service delivery time Capacity Management
Value stream map	Accurate data Material and information flow Waiting line theory
Consumption map	Customer behaviour patterns
Training,	Training plans Motivation Learning curves
Problem solution	Problems to be resolved without delay Quality circles
Inventory reduction	Location planning Supply chain optimisation Transportation model Stock taking Inventory organisation Enterprise Resource Planning (ERP) Lead time management Procurement Economic Order Quantity (EOQ) Purchasing interfaces
Kanban	Container size and frequency
Continuous Improvement	Kano Model Work design and measurement Total Quality Management Quality awards Plan-do-study-act cycle Quality tools Benchmarking
Vertical Information	E-Business
Pull System	Activate processes on customer demand
Zero Defects	Quality Culture
Wastes reduction	Reduce transactional processing
Preventive maintenance	Inspections Statistical process control

	House keeping Servicing Breakdown and replacement strategy
Standardisation and 5 S	Housekeeping methodology Safety management
Poka-Yoke	Applications of fail-safe methods
Automation	Standardisation Process technology Information technology Robotics Self-service technology
Visual Management	Control charts Kanban system Gantt Charts Andon board Network diagram

Table 3: Methodology related to lean tools – Source: self.

Lean Six Sigma

At this point in the article the concepts of Six Sigma and Lean have been described. So what is Lean Six Sigma? Stevenson (2012) indicates that some managers believe that these are alternative approaches and some believe they are complementary approaches. However the approaches have different outcomes. The Six Sigma methodology is a well disciplined and structured approach used to enhance process performance and achieve high levels of quality and low levels of variability, whilst the lean methodology has been proven to help organizations achieve on-time delivery of the right quality and quantity to satisfy customers by eliminating waste (Salah, Rahim, Juan and Carretero, 2010). Both approaches have toolboxes with some commonality between them, as illustrated in figure 2.

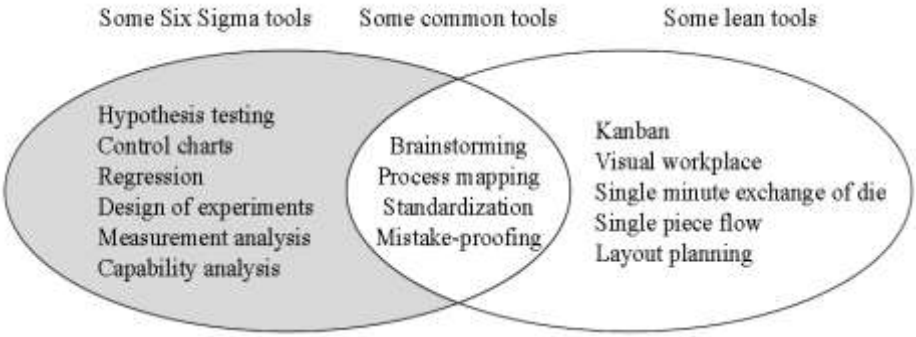


Figure 2: Tools of Lean Six Sigma Source: Salah et al 2010

Table 4 shows the synergies between Lean and Six Sigma

LEAN	SIX SIGMA
Establish methodology for improvement	Policy deployment methodology
Focus on customer value stream	Customer requirements
Use project based implementation	Project management skills
Understand current conditions	Establish and understand a base line
Collect product and production data	Data collection and analyses
Document current layout and flow	Process mapping and flow charting

Time the process	Data collections tools (include time)
Calculate process capability and Takt time	Data collection and calculate process performance
Standardisation of work	Process control
Evaluate options	Cause and effect tools
Plan new layouts	New layouts for new processes
Test to confirm improvement	Statistical and mathematical methods
Reduce recycle times, product defects, change over time, equipment failures	Seven management tools, seven quality control tools, design of experiments and other statistical tools

Table 4: synergies between Lean and Six Sigma adapted from Pyzadek (2000)

However many organisations implement Lean before Six Sigma (called Six Sigma), some implement Six Sigma and then Lean (called Six Sigma Lean) and some obtain maximum value by using both methodologies as an integrated approach (called Lean Six Sigma). Salah et al (2010) propose a framework to achieve an integrated approach as shown in figure 3.

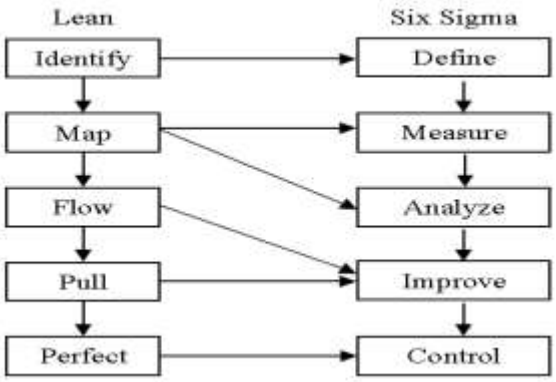


Figure 3: A framework for Lean Sigma Source Salah et al (2010)

In order to assist the hospitality sector in the development of Lean Six Sigma, the author has reconfigured this framework and provided the following framework with four phases: initiation, data management, improvement and freezing.

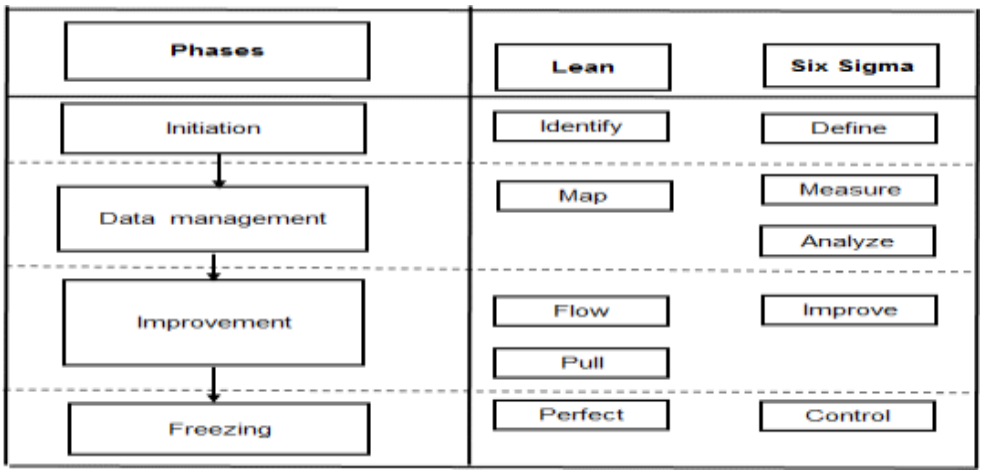


Figure 4: Reconfigured Integrated Framework for Lean Six Sigma

It is also important to note that the guiding process mathematical relationship needs to cater for the lean side as;

$Y = f(x_1) + f(x_2) + \ldots\ldots\ldots\ldots\ldots f(x_n) + W$, where W = Waste.

Recommended approach for Lean Sigma in the Hospitality Sector

The recommendations are discussed with reference to the integrated framework.

Initiation Phase

At this stage training is provided on Lean and Six Sigma. The opportunities for process improvement are identified with base line data from the voice of the customer. Critical to quality metrics and the desired tolerance for their performance are identified with a SIPOC diagram. A financial analyses is conducted and the financial projection of improvements are approved. Waste should also be financially quantified. Team members are identified and a project charter formulated.

In the hospitality industry projects can, for example, be defined from customer satisfaction surveys, customer complaints, loss of market share and internal audits.

Data Management Phase

This phase involves process mapping, setting up and validating a measurement system and collecting credible data to identify the process input variables that impact significantly on the output. Essentially the data collected here should showcase the current process performance and capability with value stream mapping. All non-value activities should also be identified here. In addition, the data needs to be analysed to show major problems and methods employed to find the root causes. Analyses may include graphical tools, Pareto analyses, hypothesis tests, correlation and regression tests and ANOVA analyses.

In the hospitality sector, for example, there is a huge cost on labour. The process should be looked at from recruitment to work performance. Inputs could be union activity, skills, performance, absenteeism, disputes, grievances, disciplinary measures, work policies, working hours, leave cycle etc. The measurement systems should be able to capture appropriate data, for example, time sheets, attendance registers, overtime pay slips, training records etc. After analyses it may be found that a few of the inputs have a huge impact on the cost of labour. For example, this could be overtime, long working hours, absenteeism and training. After root cause analyses the causes may be manager inability to schedule, due to many variables in the system, a lack of medical facilities for employees and unfair productivity requirements.

Improvement phase

Work in this phase is to eliminate defects and waste with mathematical modelling and the manipulation of the critical inputs to get the optimum solution. This may require the development and implementation of a proper scheduling system, review of the employment policies to cater for medical requirements, and may even require replacing staff with automation and process technology to reduce costs. An improvement implementation also needs to be developed.

Freezing phase

In this phase controls are implemented to sustain the improvements. Updated control charts, mistake proofing mechanisms, internal audits, financial analyses, award systems, and a good dashboard monitoring system may be used.

Conclusions

Six-Sigma is an effective systematic quality approach, which ultimately leads to increases in the triple bottom line. This is predominantly why Six-Sigma replaced TQM and developed into the pivotal aspect of quality management. The way to recognize and meet the specific needs, wants and expectations of hotel guests and the objective of delivering high-quality service to customers in the Hospitality industry are essential when seeking to accomplish and sustain a competitive edge. Applying Lean Six Sigma to hospitality operations makes processes efficient and far more effective. This invariably bodes well for demanding guests.

Six Sigma and Hospitality go hand in hand according to the extant literature since in will lead to increases customer loyalty and a drop in employee turnover and thus operating costs. Revenues tend to improve which bodes well for any business. There is for example, less chance of losses due to billing mistakes by front desk employees or restaurant staff dealing with busting work spaces. In addition there could for example also be shorter housekeeping room turnaround times and the implementation of inter alia, uniform cleaning procedures. (Gomes et al., 2007).

Lean and Six Sigma are two important process quality methods geared to achieving superior process efficiency and great effectiveness. These are important aspects which provide a hotel with a competitive advantage, based on exceptional customer service experiences relating to desired guest product and service quality. Even though they are individual approaches, various organisations fail to understand them and engage with them blindly, resulting in what turn out to be disappointing results. The more recent approach is to integrate Lean Six Sigma, and in the absence of an integrated framework, to still operate in parallel. The author has proposed an integrated framework for Lean Six Sigma to operate in a holistic manner by offering four phases: initiation, data management, improvement and freezing for the service industry. This framework is derived from literature and future research should concentrate on operationalising and improving this framework.

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