LEAN SIX SIGMA AND ITS EFFECT ON QUALITY PERFORMANCE IN MALAYSIAN HOSPITALS

BY

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ABSTRACT

Healthcare is a service industry with unique characteristics. In healthcare, customers are the immediate patients followed by their families and quite possibly their friends, as the outcome of the healthcare service potentially affects all their lives. Any error or mistake can be devastating to individuals and groups alike as lives and quality of life are at risk. In 1999, the Institute of Medicine estimated that up to 98,000 people die annually in the United States alone due to medical errors. To overcome medical patient safety and quality problems, healthcare organisations need to implement the lean six sigma approach to improve quality performance. The lean six sigma approach helps healthcare organisations eliminate waste, variation and work imbalance in the service processes. This approach also eliminates the unnecessary long cycle or waiting time between value-added activities to improve hospitals' performance. The main objective of this study is to investigate the effects of lean six sigma application on the quality performance of Malaysian hospitals. This research also investigates the relationship between top management commitment and quality performance through the mediating effects of the lean six sigma and workforce management of healthcare organisations in Malaysia. This study explores the lean six sigma application and its relationships with top management commitment, workforce management and quality performance based on the theory of constraint (TOC), system thinking theory, and contingency theory. This study applied stratified random sampling to collect data from 15 selected hospitals in Peninsular Malaysia. The self-administered survey questionnaires were distributed to 673 hospital staff (i.e., doctors, nurses, pharmacists and medical laboratory technologists) obtained 335 useful responses with 49.47% valid response rate. The research data were analysed based on exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and structural equation modelling (SEM) by using SPSS version 22 and AMOS version 22 software. The research findings indicate that lean six sigma and workforce management have significant impact on quality performance of Malaysian hospitals, whereas top management commitment was found to have insignificant relationship with quality performance. Although the research findings indicate that top management commitment has no direct significant relationship with quality performance, it has indirect significant relationship with quality performance through the mediating effects of lean six sigma and workforce management. The results also indicate that top management commitment and workforce management have significant impact on lean six sigma application.

خلاصة البحث

تؤدي الرعاية الصحية دوراً في صناعة الخدمات ذات الخصائص الفريدة من نوعها. وتقدم للمرضى المصابين فعلاً، ومن بعدهم أفراد أسرهم، ومن المحتمل جداً أن يلي هؤلاء أصدقاء المرضى، حيث إنه من المحتمل أن تؤثر نتائج خدمات الرعاية الصحية على المرضى طوال حياتهم. فالخطأ في هذا المجال يمكن أن يكون مدمراً للأفراد والجماعات على حد سواء، حيث تكون الأرواح ونوعية الحياة عرضة للخطر. في عام 1999م، نشر معهد طبي تقريراً عن خطأ بشري: "بناء نظام صحي أكثر أمناً" قُدِّر أن ما يقرب من 98،000 شخص يموتون سنوياً في الولايات المتحدة وحدها بسبب الأخطاء الطبية. للتغلب على مشاكل سلامة المريض الطبية، وتحقيق الجودة فإن مؤسسات الرعاية الصحية تحتاج إلى تنفيذ منهج سيغما ذا الخطوات الست (مقياس للجودة يسعى للاقتراب من الكمال) لتحسين جودة الأداء. خطوات منهج سيغما الست (sigma) حيث تساعد مؤسسات الرعاية الصحية في التخلص من النفايات، والتخلص من التباين، وعدم التوازن في العمل في الأمور المتعلقة بعمليات الخدمة. كما يلغي هذا المنهج الدورة الطويلة غير الضرورية أو المدة الزمنية للانتظار بين الأنشطة ذات القيمة المضافة لتحسين جودة الأداء في المستشفيات. الهدف الرئيسي من هذه الدراسة هو دراسة آثار تطبيق خطوات منهج سيغما الست على جودة الأداء في المستشفيات الماليزية. كما يدرس هذا البحث العلاقة بين التزام الإدارة العليا، وجودة الأداء من خلال الآثار الوسيطة لخطوات سيغما الست، وإدارة القوى العاملة ومؤسسات الرعاية الصحية بماليزيا. تبحث هذه الدراسة تطبيق خطوات سيجما الست، وعلاقاتها مع التزام الإدارة العليا، وإدارة القوى العاملة، وجودة الأداء على أساس نظرية الجبرية (TOC)، ونظرية نظام التفكير، ونظرية الطوارئ. تم تطبيق هذه الدراسة على عينة عشوائية طبقية لجمع البيانات، وتكونت العينة من خمس عشرة مستشفى مختارة من شبه جزيرة ماليزيا. تمت عملية توزيع الاستبيان ذاتيا على 673 من موظفي المستشفيات المختارة، وهم☹الأطباء، والممرضين، والصيادلة، وتقنيي المختبرات الطبية) بلغ عدد الاستجابات الصالحة 335 استجابة، وهي تشكل ما نسبته 49.47٪ من مجموع النسخ التي تم توزيعها. وقد تم تحليل البيانات والبحوث على أساس تحليل العامل الاستكشافي (EFA)، وتحليل العامل التأكيدي (CFA)، ونمذجة المعادلة الهيكلية (SEM) باستخدام برنامج الحزمة الإحصائية للعلوم الاجتماعية SPSS الإصدار 22، ونسخة البرمجيات AMOS الإصدار 22. أشارت نتائج البحوث إلى أن خطوات منهج سيغما الست، وإدارة القوى العاملة لها تأثير ذات دلالة كبيرة على جودة الأداء في المستشفيات الماليزية، في حين وُجِد أن التزام الإدارة العليا ليس له علاقة دالة على جودة الأداء. على الرغم من أن نتائج البحوث تشير إلى أن التزام الإدارة العليا ليس له علاقة كبيرة مباشرة على جودة الأداء، ولكن له علاقة كبيرة دالة غير مباشرة على جودة الأداء من خلال الآثار الوسيطة لخطوات سيغما الست المعتمد عليها وإدارة القوى العاملة، وأشارت نتائج الدراسة أيضا إلى أن التزام الإدارة العليا وإدارة القوى العاملة لها تأثير كبير على تطبيق خطوات سيغما الست. هذا البحث يقدم إسهامات نظرية، ومنهجية، وعملية لمبادئ منهج سيغما الستة المعتمد عليها، ومن المتوقع أن توفر نتائج البحث مبادئ توجيهية لتعزيز مستوى جودة الأداء في مؤسسات الرعاية الصحية في ماليزيا وكذلك في البلدان الأخرى.

APPROVAL PAGE

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DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at IIUM or other institutions.

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DEDICATION

This research is dedicated to my loving parents whose compassion for me flows like a waterfall that continually nourishes my soul

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LIST OF ABBREVIATIONS

AMOS	Analysis of Moment Structures
ASV	Average Shared Squared Variance
AVE	Average Variance Extracted
BVA	Business value-added
CEO	Chief Executive Officer
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CHC	Commonwealth Health Corporation
CI	Continuous Improvement
CMV	Common methods variance
CR	Composite reliability
CSM	Customer Satisfaction Measurement
CTQ	Critical to Quality
CVA	Customer value-added
DFSS	Design for Six Sigma
DMAIC	Define Measure Analyse Improve Control
EFA	Exploratory Factor Analysis
ER	Emergency Room
ETP	Economic Transformation Programme
FMEA	Failure Mode and Effects Analysis
GDP	Gross Domestic Product
GE	General Electric
GIF	Goodness-of-fit
GM	General Motors
GNI	Gross National Income
HR	Human resource
IHM	Institute for Health Management
IIUM	International Islamic University Malaysia
IPR	Institut Perubatan Respiratori
JCI	Joint Commission International
JIT	Just-in-time
KMO	Kaiser-Meyer-Olkin
LSS	Lean Six Sigma
MLT	Medical Laboratory Technologist
MOH	Ministry of Health
MPC	Malaysia Productivity Corporation
MREC	Medical Research & Ethical Committee
MSQH	Malaysian Society for Quality of Health
MSV	Maximum Shared Variance
NFI	Normed Fit Index
NIH	National Institute of Health
NKEA	National Key Economic Area
NVA	Non-value-added
OPD	Outpatient department

P4P	Pay-for-performance
PCA	Principal Component Analysis
PDCA	Plan-do-check-act
PDSA	Plan do study and act
PFI	Private Funding Initiatives
PNFI	Parsimony Normed Fit Index
PP	Process Performance
QA	Quality Assurance
QC	Quality Circle
QFD	Quality Deployment Function
QM	Quality Management
QP	Quality Performance
RACI	Responsible, Accountable, Consulted, and Informed
RCA	Root Cause Analysis
RMSEA	Root Mean Square Error of Approximation
ROIC	Return on Investment Capital
RQ	Research Question
S.E.	Standard Errors
SEM	Structural equation modelling
SIPOC	Suppliers, inputs, process, outputs, and customers
SOP	Standard operating procedures
SPC	Statistical Process Control
SPSS	Statistical Package for Social Science
TMC	Top Management Commitment
TOC	Theory of Constraints
TPM	Total Productive Maintenance
VIF	Variance Inflation Factor
VOC	Voice of customer
VPC	Visual process control
VSM	Value Stream Map
WFM	Workforce Management

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

In the early 1950s, Taiichi Ohno introduced the "Lean Production System" concept to reduce waste from production processing. The concept was first implemented by the Toyota Company to reduce unnecessary production wastes and to improve production quality (Dahlgaard and Dahlgaard-Park, 2006). By implementing the Lean Production System, Toyota was able to increase value added parts to the cars produced by the company and reduced all other non-value added tasks. In 2004, Toyota beat Ford and became the world's second largest automobile producer after General Motors (GM). In 2006, Toyota's profits increased to $USD 12 billion, which was nearly double GM's highest annual earnings of $USD 6.9 billion in 1995. In contrast, GM lost $USD 3.4 billion in the quarter ending June 2006 and Ford lost $USD 12.7 billion (Chalice, 2007). In 2008, Toyota beat General Motors (GM) and became the world's largest and most powerful automobile producer. The 'Lean' approach improves performance by reducing operation costs. Toyota's success is partly due to its successful implementation of the Lean Production System. In the late 1990, Xerox Corporation adopted Lean approach to increase quality production by reducing waste and cost. After Lean approach was successfully implemented by Xerox Corporation, many service organisations (i.e., education, banking and tourism) including healthcare organisations started to adopt lean approach to reduce waste and costs to improve their quality performance towards customer satisfaction.

In addition to the Lean approach, healthcare organisations also adopted the Six Sigma methodology to continuously improve performance and service quality (Rohini and Mallikarjun, 2011; Plonien, 2013). Healthcare service providers embraced the Six Sigma concept after it was fully developed, tested, and adopted in the manufacturing sector by companies such as Motorola, Allied Signal, and General Electric (Ganti and Ganti, 2004). The integration of Lean and Six Sigma methods can enhance patient care and satisfaction through quality performance and services (Heuvel et al., 2006a; Hina-Syeda et al., 2013). The Lean Six Sigma (LSS) approach ensures the success of healthcare organisations by reducing the number of shortcomings such as patient waiting time and delivery of medical test reports, along with unnecessary medical costs (Gijo and Antony, 2013). The LSS approach also helps healthcare organisations establish a culture of continuous improvement in healthcare service to ensure accurate results in a timely fashion (Heuvel et al., 2006a; Neufeld et al., 2013).

In Malaysia, healthcare quality is a primary concern for the policy makers as well as health industry. Both private and public Malaysian healthcare systems are regulated by the Ministry of Health (MOH). Between these two healthcare sectors, the public health sector plays a more important role than the private healthcare sector in terms of family planning, medical information campaign, skilled delivery care, preventions of transmitted diseases and immunisations. In addition, the public healthcare provides equitable access to the poor, which is a basic fundamental right for the citizens whereas, private healthcare services are meant for those who can afford (Munisamy and Osman-Rani, 2010). However, over the last few decades, the private healthcare sector has been rapidly growing and playing an increasingly important role in the provision of healthcare services such as the development of specialist hospitals, care centres for surgical treatment, medical tourism, continuous

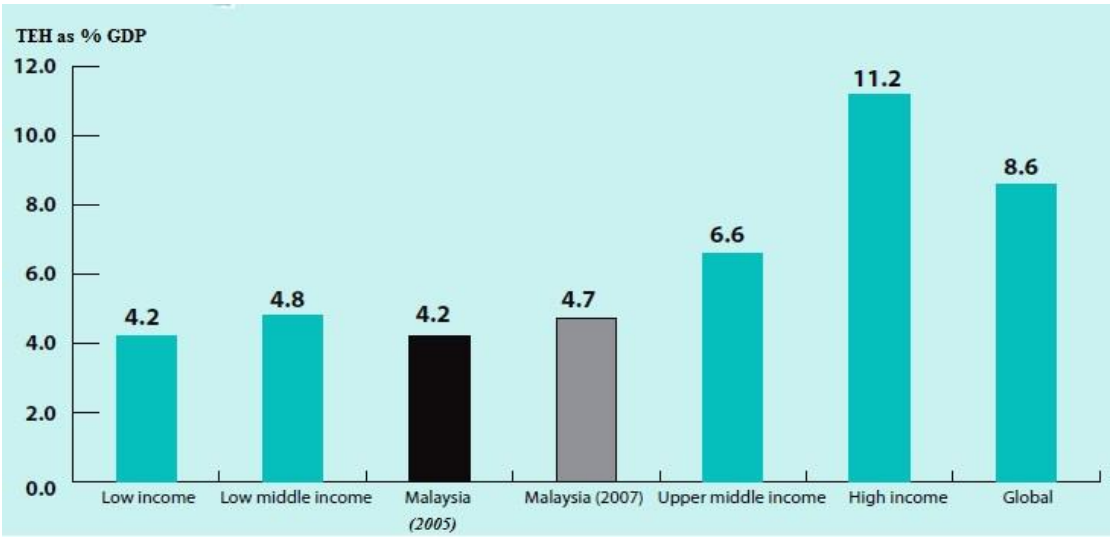
improvement in healthcare, information technology, and private medical insurance for local patients (Teo, 2013; MOH, 2012). Currently, both public and private hospitals are focusing on how to minimise medical errors, how to increase patient safety, how to reduce waiting time, and how to reduce waste and cost by implementing quality applications in healthcare service such as PDCA (Plan-do-check-act), 5S, 5whys, Root Cause Analysis (RCA), Lean and Six Sigma. According to the Annual Report MOH (2007), Shazali et al., (2013) and myMetro (2014), Malaysian healthcare industry has been started to adopt Lean and Six Sigma approach to reduce medical errors in the service, increase patient safety, reduce waiting time, reduce waste and cost towards quality performance of the hospital.

With the above background, this study examines the implementation of Lean Six Sigma and its effect on quality performance of the Malaysian healthcare organisations. The next section presents an overview of Malaysian healthcare industry, the statement of the problem and its significance, followed by the research questions and objectives to be pursued in this study. Prior to this, a brief outline of the Malaysian healthcare sector vis-à-vis public and private health expenditure is provided below.

1.2 OVERVIEW OF MALAYSIAN HEALTHCARE INDUSTRY

In Malaysia, healthcare services are principally provided by the Ministry of Health Malaysia (MOH). Besides the Ministry of Health (MOH), other ministries also provide healthcare services such as the Ministry of Education (through its university hospitals) and the Ministry of Defence (through its army hospitals). Nevertheless, these ministries offer only limited healthcare services to its patients. According to a report by the Economic Transformation Programme (ETP), the Malaysian government

spends approximately 5 percent of GDP (Gross Domestic Product) to provide healthcare services to the people, which is more than regional peers (e.g. Indonesia and Thailand) and other developing countries (e.g. Bangladesh, Pakistan and Sri Lanka). However, in 2005, total expenditure on health (TEH) in Malaysia was only 4.2 percent of GDP and increased only 0.5 percent of GDP in 2007 (Malaysia National Health Accounts, 2007; Annual Report MOH, 2012), which is less than lower and upper middle income countries (see Figure 1.1).

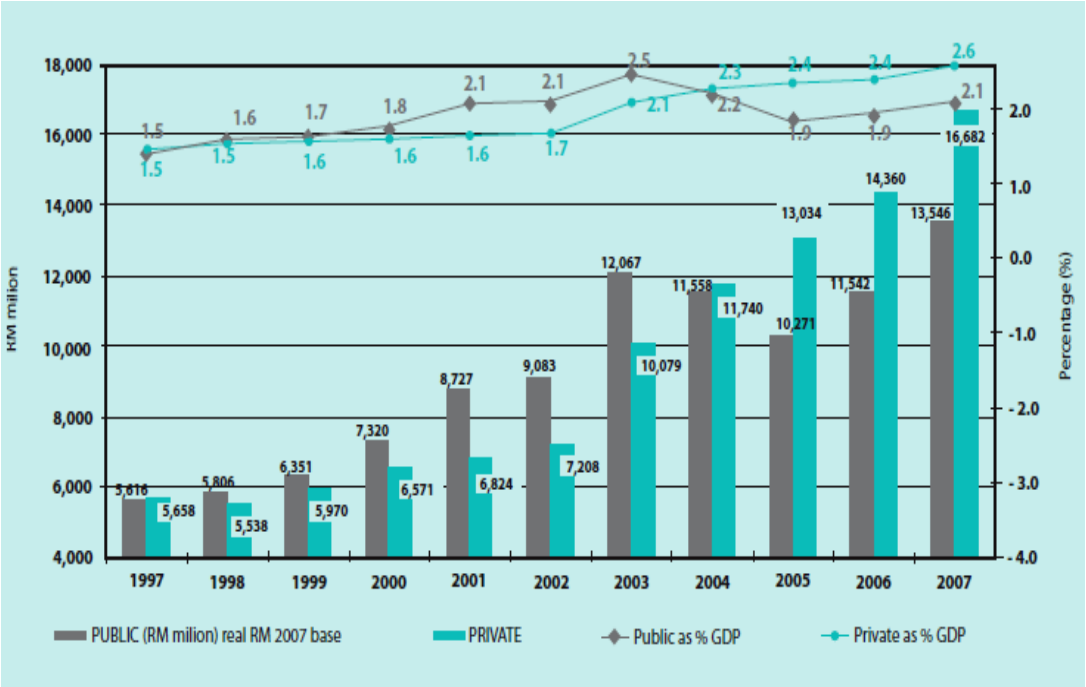


Source: MOH (2012*)*

Figure 1.1: Total Expenditure on Healthcare as percentage of GDP in Malaysia

Currently, the Malaysian healthcare sector contributes RM 15 billion to the Gross National Income (GNI), and 4.7 percent of the Malaysian GDP is dedicated towards the healthcare sector (MOH, 2012). Out of the 4.7 percent of GDP, 2.1 percent is allocated for public healthcare and the remaining 2.6 percent for private healthcare sector (MOH, 2012). The main objectives of this spending are to increase health awareness, improve healthy lifestyle activities, establish a comprehensive healthcare system for the citizens, and empower the community to plan individual

wellness programmes through efficiency and effectiveness of the healthcare delivery system (MOH, 2012). From 2000 to 2003, public healthcare sector spending was higher than the private healthcare sector, but in 2004, it reversed the spending ratio and currently private healthcare spending is higher than the public healthcare sector (see Figure 1.2). In 2004, the private healthcare sector started to focus on medical tourism where the hospitals increase their expenditure to attract more patients out of the country.



Source: MOH (2012)

Figure 1.2: Expenditure on Malaysian healthcare in public and private sector, 1997-2007 (RM value)

Even though Malaysian tourism has been improved a reasonable level of quality performance over the years, but it remains behind its two neighbouring countries of Thailand and Singapore in terms of international patient services.