UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Faculty of Manufacturing Engineering

PRELIMINARY STUDY OF KEY PERFORMANCE INDICATORS FOR SUSTAINABILITY IN HEALTH CARE INDUSTRY IN MALAYSIA

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PRELIMINARY STUDY OF KEY PERFORMANCE INDICATORS FOR SUSTAINABILITY IN HEALTH CARE INDUSTRY IN MALAYSIA

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**A thesis submitted
in the fulfillment of the requirements for the degree of Master of Science
in Manufacturing Engineering**

Faculty of Manufacturing Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2018

DECLARATION

I declare that this thesis entitled "Key Performance Indicators for Sustainability in Health Care Industry in Malaysia" is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature   :   ………………………………….

Name   :   ………………………………….

Date   :   ………………………………….

APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality as a partial fulfilment of Master of Science in Manufacturing Engineering.

Signature   :   ………………………….

Supervisor Name   :   ………………………….

Date   :   ………………………….

DEDICATION

Dedicated specially for my beloved family, friends, and supervisors.

ABSTRACT

According to the Malaysia Ministry of Health, the health care industry was the fastest-growth industry between 2000 and 2009. This industry is a key driver for the country's economic growth and has contributed more than RM 1 billion to the national GDP in 2016. In today's competitive business environment, companies are concerned about improving sustainability within the organization's infrastructure and performance. Sustainability initiatives are beneficial as they provide an opportunity to a company, not only to reduce cost but also to contribute to the wellbeing of the environment and society. However, there are limited published studies on the evaluation of sustainability performance for the healthcare sector. The aim of this study is to develop a set of key performance indicators (KPIs) and sustainability performance index that can be used to evaluate sustainability performance for the health care industry in Malaysia. This is achieved by 3 objectives: (1) identify key performance indicators for evaluating sustainability performance for primary, secondary, and tertiary industry, (2) propose key performance indicators for evaluating sustainability performance in health care industry, and (3) develop a sustainability performance index for health care industry. First, a literature study of KPIs from various industry namely primary, secondary, and tertiary industries was carried out. Then, a list of KPIs that can be incorporated into health care industry was presented to industrial and academic experts. Next, questionnaires with 70 identified KPIs were distributed to 24 respondents in a private hospital located at Melaka. The results were collected and analyzed using statistic and analytic hierarchy process (AHP). Finally, a sustainability performance index was developed as the evaluation tool for the health care industry. The results were presented to the case company for verification purpose. The outcomes of the study show that the major concern of the private hospital is on the social factor followed by the economic factor and environment factor. The result is not surprising because all private hospitals depend on their patients as main stakeholders; they need to ensure patient satisfaction by providing good quality service which will directly impact the company's economic growth. In addition, private hospitals have to manage clinical waste products effectively according to the rules and regulations of the country to protect the environment. A performance index was developed to monitor the sustainability performance of the health care industry.

ABSTRAK

Berdasarkan daripada Kementerian Kesihatan Malaysia, industri kesihatan dikatakan telah mencapai tahap perkembangan yang pesat bermula dari tahun 2000 hingga 2009. Industri kesihatan merupakan pemacu utama dalam pertumbuhan ekonomi negara dan telah menyumbang lebih daripada RM 1 bilion dalam nasional GDP pada tahun 2016. Dalam persekitaran perniagaan yang kompetitif pada hari ini, kebanyakkan syarikat mula menunjukkan keprihatinan mereka dalam memperbaiki kelestarian dari segi infrastruktur dan prestasi organisasi. Inisiatif-inisiatif kelestarian banyak memberi manfaat seperti mereka menyediakan peluang kepada sebuah syarikat, bukan sahaja untuk mengurangkan kos tetapi juga untuk menyumbang kepada kesejahteraan persekitaran dan masyarakat. Bagaimanapun, terdapat kajian-kajian bercetak yang agak terhad untuk menilai prestasi kelestarian bagi sektor kesihatan. Matlamat daripada kajian ini adalah untuk membangunkan indikator (KPIs) dan indeks prestasi kelestarian yang boleh digunakan bagi menilai prestasi kelestrian untuk industri kesihatan di Malaysia, yang boleh dicapai melalui tiga objektif: (1) mengenalpasti prestasi indikator untuk menilai prestasi kelestarian sektor industri utama, sekunder dan tertier (2) mencadangkan indikator prestasi utama untuk menilai prestasi kelestarian dalam industri kesihatan, (3) membangunkan indeks prestasi kelestarian untuk industri kesihatan. Pada permulaan, kajian leteratur KPIs dari pelbagai industri utama, sekunder dan tertier akan dijalankan. Kemudian, senarai KPIs yang boleh diguna dalam industri kesihatan telah dibentangkan kepada para pakar bidang perisdustrian dan akademik. Berikutnya, soal selidik yang mengandungi 70 KPIs diedarkan kepada 24 responden di hospital swasta. Keputusan soal selidik dikumpul dan dikaji dengan mengunakan statistik dan "analytical hierarchy process" (AHP). Akhirnya, indeks prestasi kelestrarian telah dibangunkan sebagai alat penilaian bagi industri kesihatan. Hasil kajian telah dibentangkan kepada syarikat bagi tujuan pegesahan. Hasil kajian menunjukkan bahawa keprihatinan utama hospital swasta adalah berdasarkan faktor sosial diikuti oleh ekonomi dan persekitaran. Keputusan ini adalah tidak luar biasa kerana semua hospital swasta bergantung kepada pelanggang mereka sebagai pemegang saham utama di mana mereka perlu memastikan kepuasan pelanggan dengan menyediakan perkhidmatan berkualiti yang akan memberi kesan secara langsung kepada pertumbuhan ekonomi syarikat. Sebagai tambahan, hospital swasta perlu mengurus produk sisa buangan dengan berkesan mengikut peraturan dan akta negara bagi melindungi persekitaran. Indeks prestatsi telah dibangunkan untuk memantau prestasi kelestrarian bagi industri kesihatan.

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LIST OF ABBREVIATIONS

ACA	-	American coating association
AHP	-	Analytic hierarchy process
AIRM	-	Aggregated indices randomization method
AMI	-	Acute myocardial infarction
ANOVA	-	Analysis of variance
ANP	-	Analytic network process
A&D	-	Aerospace and defence
BSI	-	Bloodstream Infections
CEO	-	Chief executive officer
CES	-	Centre for environmental strategy
CI	-	Consistency index
CR	-	Consistency ratio
CSF-s	-	Critical success factors
CSR	-	Corporate social responsibility
DBMS	-	Data base management system
DEA	-	Data envelopment analysis
ELECTRE	-	Elimination and choice expressing reality
EMS	-	Environmental management system
EVI	-	Environmental vulnerability index
FS	-	Flow sort

GALA	-	Greenwich academic literature archive
GDP	-	Gross domestic product
GIST	-	General indicator of science and technology (GIST)
GSCM	-	Green supply chain management
HCDS	-	Health care delivery systems
ICU	-	Intensive care unit
IQR	-	Interquartile range
ISEW	-	Index of sustainable and economic welfare
KPI	-	Key performance indicator
KPIs	-	Key performance indicators
LCA	-	Life cycle assessment
MACBETH	-	Measuring attractiveness by categorical based evaluation technique
MAGIQ	-	Multi attribute global inference of quality
MAUT	-	Multi attribute utility theory
MCDA	-	Multi criteria decision analysis
MCDM	-	Multi criteria decision making
MHTC	-	Malaysia Healthcare Travel Council
MIDA	-	Malaysia Investment Development Authority
n	-	Number of data
N	-	Population proportion
NEF	-	New Economics Foundation
NHL	-	National health insurance
NISTEP	-	National Institute of Science and Technology Policy
OSHA	-	Occupational safety and health
PAPRIKA	-	Potentially all pairwise ranking of all possible alternatives

PIC	-	People in charge
PROMETHEE-		Preference ranking organization method for enrichment evaluation
PV	-	Column vector
Q1	-	Quartile 1
Q2	-	Quartile 2
Q3	-	Quartile 3
RI	-	Random index
R & D	-	Research and development
S	-	Sample size
SBSC	-	Sustainability balanced scorecard
SD	-	Sustainable development
SD-SRM	-	Sustainable development and stakeholder relations management
SII	-	Summary innovation index
SPI	-	Sustainability performance index
SPSS	-	Statistical package for the social sciences
SRM	-	Stakeholder relations management
SSN	-	Sustainability solution navigator
TEI	-	Total experience index
TOPSIS	-	Technique for order performance by similarity to ideal solution
USDOC	-	United States Department of Commerce
USI	-	Urban sustainability index
UTA	-	User acceptance testing
UTADIS	-	Utilities additives discriminates
UTI	-	Urinary tract infection
X	-	Z value (e.g. 1.96 for 95% confidence level)
3R	-	Reduce, reuse, recycle

LIST OF PUBLICATIONS

<u>Journal</u>

Wong, K.L., Chong, K.E., Chew, B.C., Tay, C.C. and Mohamed, S.B., 2018. Key Performance Indicators for Measuring Sustainability in Health Care Industry in Malaysia. *Journal of Fundamental and Applied Sciences*, *10*(1S), pp. 646-657.

CHAPTER 1

INTRODUCTION

1.1   Introduction

Sustainability means improving human well-being, ecological integrity, and social justice for current and future generations. The concept of sustainability includes three dimensions which are economic, environment and social factor; it is very crucial need to all industries around the world. Sustainability meets our current needs without compromising the needs of the future generation. Human beings can cultivate economic growth system into a sustainable methodology that does not threaten environment or earth's life supporting system. Industry basically can be divided into three main types namely primary, secondary and tertiary. Industry views sustainability as an important practice to stay competitive and successful.

Increasing consumer demand for environmental friendly products, shrinking non-renewable resources, and stricter regulations related to environment and occupational health and safety are the factors that make achieving sustainability important to all industries. Sustainable practice has been seen to be certainly related with competitive outcomes. Hence, developing sustainable strategies is critical for any industry to have competitive advantage over their competitors. There are issues and challenges when implementing sustainability strategies such as loss of biodiversity, climate change, social and economic changeability. These issues are faced by all types of industries regardless whether they are from the primary, secondary and tertiary industry/service industry.

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Several studies on sustainability have been conducted for the three main types of industries. The primary industry puts the highest priority on health, safety and wellbeing of workers, companies with environmental stewardship, economic prosperity and social wellbeing can achieve a greater level of corporate sustainability (Batterham, 2014).

The secondary industry which is also the manufacturing industry is crucial for the country's economy. However, the manufacturing industry accounts for enormous resource consumption and waste excretion. Therefore, it is important that the manufacturing industry develops sustainable products through sustainable manufacturing with the needs of quantitative and quantitative metrics for evaluating and improving the sustainability performance of manufacturing processes and systems (Averam et al., 2011; Jawahir et al., 2006).

Based on sustainability studies for the tertiary industry, the banking sector has reacted quite slowly compared to other sectors to face sustainability challenges. The banking sector normally considers themselves as an environmentally friendly industry; however they are very slow to examine the environmental performance of clients when exposed to risk. The contribution of banks in sustainability development is huge because of their economy role; banks transform money in term of scale, risk, spatial location and duration which have a significant impact on the economic development of nations (Jeucken, 2004).

Many studies on sustainability have been conducted on either the primary or secondary industry; however, there is lack of study on the service industry particularly in the health care industry.

The health care industry in Malaysia has top-notch medical services and continuously attempts to provide effective, trustworthy, and harmless treatments in comfortable surroundings with ease of access and at reasonable prices in a sustainable

manner (MHTC, 2015). Numerous issues threaten the performance and sustainability of Malaysia's health system against a background of rising health expenditure. Underlying the challenges facing Malaysia are some unique features of the health system itself which offers world-wide coverage through a payers and network of providers with a growing public-private contrast. Meanwhile, public demand for high quality health care keeps growing and public scrutiny is increasing. The health care system has some control over the supply for health services but not much on the demand for healthcare services. This has led to consequences such as unfairness in access to health services, inappropriate treatments, varying quality and standards of care and costs that cannot always be excellently controlled (Ministry of Health Malaysia, 2015).

Studies have shown that most health care institutions recognizes the importance of sustainable development but there is no one single obvious model that can be implemented by the national health care service. Although such a method is not available, but they believe that sustainability practice is highly possible and requires extensive organizational commitment (Celia, 2012).

In addition, research has also shown that not many KPIs have been developed to measure sustainability performance in the tertiary health care sector. Most of the sustainability performance measures were conducted in the manufacturing environment.

Therefore, this study suggests a set of KPIs and sustainability performance index based on the triple bottom line of sustainability for measuring sustainability performance in the health care industry.

1.2   Problem Statement

The global demand for healthcare services is expected to continuously expand in the future due to projected demographic shifts, among which are the increase in the aging

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population, life expectancy and lifestyle diseases. Healthcare in Malaysia not only provides health service to residents but also international patients as it aids in economic growth. Recently, Malaysia was crowned as 'Medical Travel Destination of the Year' for the second consecutive year at the international Medical Travel Journal's Medical Travel Awards 2016 (MIDA, 2017). Due to the continuous expansion of the healthcare industries, challenges especially in organising and maintaining principle for sustainable development, which includes economic, environment and social factor are expected to occur.

In order to meet the challenges when implementing sustainability strategies, a set of KPIs is essential to measure sustainability performance index. The KPIs for measuring sustainability in the manufacturing sector has been well documented. However, currently there is lack of information about KPIs used by the health care industry to measure the sustainability performance. The lack of KPIs information renders the sustainability practice to achieve well in the health care industries. Besides, the absence of KPIs could not evaluate the sustainability performance of health care industry. Hence, a sustainability performance index is required to be developed and used in the health care industries to understand their current level of sustainability performance.

1.3 Objectives

The aim of this study is to develop a set of key performance indicators and performance index that can be used to evaluate sustainability performance for the health care industry in Malaysia.

The objectives for this study are:

1. To identify key performance indicators for evaluating sustainability performance for the primary, secondary and tertiary industries.

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2. To propose key performance indicators for evaluating sustainability performance in the health care industry.

3. To develop a sustainability performance index for the health care industry.

1.4 Scope of Study

The scope of this project is within a service industry (private hospital in Malaysia). Data is collected through the distribution of a questionnaire to a case company located at Melaka. Then, statistical analysis and analytic hierarchy process (AHP) are used as the methodology for calculating and analysing the KPIs based on three factors of sustainability which are environment, economic and social. A sustainability performance index is developed to identify own sustainability performance level.

1.5 Organization of Report

This report is constructed as follows:

I. Chapter 1- Introduction

It introduces the overall report with the background of the study, problem statement, objective, scope and organization of the report.

II. Chapter 2- Literature review

This chapter presents the literature review on sustainability and key performance indicators used in various industries based on journals, books, articles, corporate sustainability reports and other resources. It discusses the usage of questionnaires and AHP in evaluating the sustainability performance.

III. Chapter 3- Methodology

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