APPROVAL

‘I/We hereby declare that have read this thesis and in our research is sufficient in terms of scope and quality. This project is submitted to Universiti Teknikal Malaysia Melaka as a requirement for completion and reward Bachelor Degree of Technology Management (Technology Innovation)’

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SUSTAINABLE WATER MANAGEMENT FOR WATER SUPPLY EFFICIENCY: A CASE STUDY AT SYARIKAT AIR MELAKA BERHAD

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DECLARATION

I declare that this project entitled "Sustainable Water Management for Water Supply Efficiency: A Case Study at Syarikat Air Melaka Berhad" is the result of my own research except as cited in the references. The project paper has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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DEDICATION

This dissertation is dedicated to those who have been helping in the making of this dissertation.

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ABSTRACT

Water use has been growing at more than twice than rate of population growth in last century. This level of population growth will result in increased demand for potential water from agriculture, industrial and domestic sectors of the economy. Rapidly rising demand and falling supplies of fresh water are leaving ever more nations to face chronic water shortages. The objective of this research is examined current water management systems in Syarikat Air Melaka Berhad (SAMB), assessing how far the current systems manage to keep the water sustainably. This research aimed to identify the effectiveness of programs implemented by the SAMB to sustain the water supply. Furthermore, this research aimed to formulate and propose improvements and enhancements for better water management systems. This research is beneficial for the government, university and the public. The research is been conducted at Syarikat Air Melaka Berhad (SAMB) through interviews of thirty respondents. From there, researcher gained crucial information and point of view from the managerial perspective and also technical and technology insight regarding sustainable water management at SAMB.

ABSTRAK

Penggunaan air telah berkembang pada lebih daripada dua kali ganda daripada kadar pertumbuhan penduduk pada abad lepas. Tahap pertumbuhan penduduk akan mengakibatkan peningkatan permintaan untuk air yang berpotensi daripada sektor pertanian, industri dan sektor dalam ekonomi. Peningkatan permintaan bekalan air yang mendadak dan Kemerosotan sumber bekalan air mengakibatkan negara menghadapi masalah kekurangan air yang kronik. Objektif kajian ini adalah mengkaji sistem pengurusan air semasa di Syarikat Air Melaka Berhad (samb), menilai sejauh mana sistem semasa peguruskan penyimpan air yang lestari. Kajian ini bertujuan untuk mengenal pasti keberkesanan program yang dilaksanakan oleh SAMB untuk mengekalkan kelestarian bekalan air. Tambahan pula, kajian ini bertujuan untuk merangka dan mencadangkan penambahbaikan dan peningkatan sistem pengurusan air yang lebih baik. Kajian ini memberi manfaat kepada kerajaan, universiti dan orang ramai. Kajian ini dijalankan di Syarikat Air Melaka Berhad (SAMB) melalui temu bual dengan lima belas responden. Melalui temu-bual tersebut, penyelidik mendapat maklumat penting dan memperoleh pandangan dari sudut pengurusan dan juga pandangan dari sudut teknikal dan teknologi mengenai pengurusan air yang lestari di SAMB.

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LIST OF ABBREVIATION

ALC	=	Active Leakage Control
DAF	=	Dissolve Air Floatation
DMZ	=	District Metering Zone
GIS	=	Geographical Information System
IOC	=	Inorganic Compound
KETTHA	=	Kementerian Tenaga, Teknologi Hijau dan Air
NRW	=	Non-Revenue Water
O&M	=	Operation and Maintenance
PAAB	=	Pengurusan Aset Air Berhad
PAM	=	Perbadanan Air Melaka
PBAPP	=	Perbadanan Bekalan Air Pulau Pinang
PRV	=	Presure Reducing Valve
RMK-10	=	Rancangan Malaysia ke – 10
SAMB	=	Syarikat Air Melaka Berhad
SAJ	=	Syarikat Air Johor
SIRIM	=	Standards and Industrial Research Institute of Malaysia
SOC	=	Synthetic Organic Compound
SPAN	=	Suruhanjaya Perkhidmatan Air Negara
UFW	=	Unaccounted for Water
UFM	=	Ultra Filtration Membrane
VOC	=	Volatile Organic Compound

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

According to Fogden (2009), defines "safe drinking water" as water from an improved water source, which includes household connections, public standpipes, boreholes, protected dug wells, protected dug wells, protected springs and rainwater collections. Fogden (2009) also states that water use has been growing at more than twice than rate of population growth in last century. This level of population growth will result in increased demand for potential water from agriculture, industrial and domestic sectors of the economy. Rapidly rising demand and falling supplies of fresh water are leaving ever more nations to face chronic water shortages. By 2025, 1.8 billion people are expected to be living in countries or regions with absolute water scarcity, and two-thirds of the world population could be under stress conditions.

Fogden (2009) also stated that water prices are usually higher in regions where water is scarce. As demand for potential safe drinking water increase and the total volume of available freshwater resources falls, the price of drinking water is likely to increase. Water supply costs are also determined by the infrastructure costs involved in sourcing, cleaning and transporting drinking water. As the decline in freshwater resources means that water companies have to employ ever more extreme measures to extract water. In addition, as demand increase, the water infrastructure has to be extended to serve more consumers, and the aging infrastructure needs to be maintained and replaced.

1.2 Research Questions

Under The Kementerian Tenaga, Teknologi Hijau dan Air (KETTHA), government has been implementing various programs and formulating strategies to maximizing every energy resources including water resources. Every program aims to enhance optimization of water management system and fully utilize water resources to the optimum. Through Rancangan Malaysia Ke -10 (RMK-10), various implementation of projects and economic incentives by the government has been arising question whether these project really give positive impact towards waters resources, did these programs and incentives really achieve their target and expectation.

Thus, research questions are constructed as stated below;

I. What are the impacts of sustainable water management towards water supply efficiency?

II. How does Syarikat Air Melaka Berhad manage the water supply sustainably?

III. What are the innovative suggestions to improve sustainable water management system towards water supply efficiency?

1.3 Research Objectives

The objectives of this research are to examine current water management systems in Syarikat Air Melaka Berhad (SAMB), assessing how far the current systems manage to keep the water sustainably. This research also aims to identify the effectiveness of programs implemented by the SAMB to sustain the water supply. Furthermore, this research aims to formulate and propose improvements and enhancements for better water management systems. This research will be beneficial for the government, university and the public.

Thus, the objectives of the research are stated as below;

I. To assess the impact of sustainable water management towards water supply efficiency.

II. To assess the strategies of Syarikat Air Melaka Berhad (SAMB) in managing water supply sustainably.

III. To propose innovative suggestions on sustainable water management system towards water supply efficiency.

1.4 Scope and Limitation

This research will only cover the aspects of water distribution and water treatment system in supplying a safe and clean water supply. This research will not focusing on the sources of the water supply. The research is only been conducted at Syarikat Air Melaka Berhad, there are several other water agencies in other states that are excluded in this research. Second, this research focuses on the company managerial aspects on how the water agency manages water sustainably. Third, the respondents for the research consist of middle managers, engineers and technician who have been involving with sustainable water management at SAMB. Lastly, the research will assume that all respondents will provide an honest and correct answer when the respondent is being interview by the researcher.

1.5 Importance of Study

The study allows the researcher to gain deeper understanding on how to achieve sustainable water management. The research also allow the researcher to take part in finding ways, generating and producing ideas and alternative in helping to sustain the water resources. The research will allow the university and the government to share same mutual interests in improving the sustainable water management system in Malaysia. The success of this research will help the authority to measure the impacts of the current water management system. Where, the research focuses on the sustainable water system, and enhance efficient water supply which are critical to the interests of all humans, nations and governments.

1.6 Summary

Sustainable Water management is crucial for any country to advance ahead, water resources plays an important roles in the development of every sectors in Malaysia. Plenty water resources allow a country to have rapid development on sectors such as agriculture and industrial sectors. Country with advance development of its sectors will have a strong economy. It is the government role to create an effective and appropriate institutions and management which enhance sustainability on the water resources handling. Implementing a proper system, that keeps the balance of human needs with the needs of the natural environment. To do so, sustainable water management system need to be applied, which not only it will optimize the usage of water resources but also ensure the environmental sustainability.

CHAPTER 2

LITERATURE REVIEW

2.1 Definition

Sustainable water management use in the context of planning involves ensuring there are adequate supplies of fresh water for present and future generations and for the environment. It addresses all catchment waters from storm water, carried as surface water in rivers, creeks and held in reservoirs and dams (Cullen, 2004).

2.2 Impacts of Sustainable Water Management

Ross (2012) highlights the importance sustainable water management, where it is vital in providing the public with clean and safe water and helping to ensure the environmental, economic, and social health of the nation's communities.

With our finite water resources, there are increasing demands for our drinking supply, and also for other societal needs including energy, agriculture, industry, and water needed to support healthy nature ecosystems. Having adequate water of sufficient quality underpins the national's health, economy, security and ecology, ensuring that water resources are safe for use and can be sustained for future generations.

2.2.1 Cost-Effective Investment

According to Farley (2008), detection and control of leakage varies from company to company, and the choice of methodology is largely dependent on local conditions, which may include financial constraints on equipment and other resources. Staffing resources are relevant, as a labour intensive methodology may be suitable if manpower is plentiful and cheap. The main factor governing choice of technology, however, it is whether a particular methodology is economic for the cost savings achieved. A low activity method, such as repair of visible leaks only, may be cost-effective in supply areas where water is plentifu1 and cheap to produce. On the other hand, countries which have a high cost of production and supply can justify a much higher level of activity, like leakage monitoring, or even telemetry systems, to warn of a burst or leakage occurring.

Liemberger (2010) emphasizes that sustainability of water management able to provide a number of financial benefits. Sustainable water management able to maximize the value of each investment on the water infrastructure, including:

a) Minimizing costs by optimizing investment choices, operating water and wastewater systems more efficiently, and pursuing cost-effective investment and management strategies, such as collaboration and partnering with neighboring systems to leverage resources and improve efficiency.

b) Maximizing results and investments to ensure a continuing source of water, treatment, and discharge capacity, as well as financing capability.

c) Improving the ability to analyze a range of alternatives, including (as appropriate) both traditional and non-traditional infrastructure alternatives, such as green infrastructure and/or decentralized systems, and selecting the option or mix of options that best meet the needs of the utility and the community it serves.

d) Engendering greater support for the utility by recognizing community values and sustainability priorities.

e) Ensuring that financial and revenue strategies are adequate to finance, operate, maintain and replace essential infrastructure throughout its operational life, while appropriately considering the needs of disadvantages household.

2.2.2 Adequate Water Supply

According to Liemberger on 2010, One of the major issues affecting water utilities in the developing world is the considerable difference between the amount of water put into the distribution system and the amount of water billed to consumers (also called "non-revenue water" [NRW]). High levels of NRW reflect huge volumes of water being lost through leaks, not being invoiced to customers, or both. It seriously affects the financial viability of water utilities through lost revenues and increased operational costs.

According to Farley (2008), globally, water demand is rising and resources are diminishing. Water loss from the pipe network, always the *bête noire* of the operations engineer, has long been a feature of operations management, even in countries with a well-developed infrastructure and good operating practices. A diagnostic approach, followed by the practical implementation of solutions which are practicable and achievable, is recommended for developing a water loss management strategy. However, practitioners working in developing countries will invariably face a slower pace, greater financial constraints, less developed infrastructure, lower levels of skills and technology, and political, cultural and social influences.

2.2.3Safe and Clean Water Supply

According to Liemberger on 2010, eighty percent of the diseases were caused by drinking unclean water, lack of sanitation, and poor hygiene. According to Hopkins (2002), unlike genetic disease, which individuals are predisposed to, acquiring water, sanitation, and hygiene related diseases are controllable and preventable. The spread of these diseases depends on environmental conditions and behavior in the household and community. Diarrhea, acute respiratory infection, measles, malaria and malnutrition are the most common diseases related to water. Illnesses related to water, sanitation and hygiene include the following:

a) Water-borne diseases occur when a disease-causing agent the body through drinking.

b) Water-washed diseases occur because of inadequate hygiene conditions and practices.

c) Water-based diseases include those illnesses that are spread through a disease vector that lives in water.

Hopkins (2010) also added that diarrheal disease is one of major risk factor in emergency settings because it can cause sickness and death among children. Most diarrheal diseases including viral gastroenteritis, cholera, Shigellosis, typhoid, polio and some forms of hepatitis being spread by fecal-oral means are often called fecal-oral diseases. Fecal-oral disease transmission occurs when feces, which contain disease causing pathogens, from one person enters the mouth and is ingested by another person. Fecal-oral diseases can easily spread in overcrowded unsanitary conditions, which are typical of camps and settlements in emergencies. Factors related to fecal-oral disease spread include drinking water contaminated with fecal material which can occur at the source, during transport or in the household, poor hygiene due to a lack of water or hygienic practices and poor food hygiene.

2.3 Sustainable Water Management Strategy

Wiedeman (2012) stated that disinfection of drinking water is none of the major public health advances of the 20th century. Water suppliers use a variety of treatment processes to remove contaminants from drinking water. These individual processes may be arranged in a series of processes applied in sequence. The most commonly used processes include filtration, flocculation and sedimentation. Some treatment system includes ion exchange and absorption. Water utilizes select a combination of treatment processes most appropriate to treat the contaminants found in the raw water used by the system.

2.3.1 Water Treatment Systems

According to Wiedeman (2012), water treatment systems come in all shapes and sizes, and no two are exactly the same. They may be publicly or privately owned and maintained. While their design may vary, they all share the same goal: providing safe, reliable d-*rinking water to communities they serve. The amount and type of treatment applied by a public water system varies with the source type and quality. Large-scale water supply systems tend to rely on surface water resources, while smaller systems tend to rely on ground water. However, surface water systems are exposed to direct wet weather runoff and to the atmosphere and are therefore more easily contaminated.

Types of treatment according to Wiedeman (2012):

a) Flocculation/Sedimentation/Coagulation

Flocculation refers to water treatment processes that combine or coagulate small particles into larger particles, which settle out of the water as sediment. Alum and iron salts or synthetic organic polymers are generally used to promote