

**PREFERRED COMMUNICATION CHANNELS FOR OFFICE BUILDING
ENERGY CONSERVATION BEHAVIOUR**

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To my beloved dad, mum, sister, brother and friends

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ABSTRACT

In Malaysia, the usage of energy is high especially in commercial sector. The office building energy usage is among the main contributors to the country's energy use. *National Energy Balance* (2012) stated that commercial sector is the second highest which contributed 33.2% of energy usage after industry 45.1% and followed by residential sector of 21.2%. One of the major challenges faced by facilities manager is to reduce the building's energy consumption. Although there are previous energy conservation programs launched, the energy conservation progress in government office building still lacking behind. To improve office building user's energy conservation behaviour effectively, selection of right communication channels then distributes energy conservation messages with the right communication channels remains an important strategy. This study has two objectives. The first objective is to identify the suitable types of communication channel as a medium to deliver information message. Expert's interview was conducted to identify the suitable communication channel in the context of office building. Responses gathered from experts use to formulate survey instrument to achieve second objective. The second objective is to identify preferred communication channels to foster office building energy conservation behaviour. To achieve objective two, the questionnaire was developed based on literature review and expert's interview and distributed to office building staffs in Putrajaya. A total of 525 convenience sample were gathered and analyzed using choice based conjoint analysis (CBC). Five types of communication channels were identified: dialogue oriented approach, mass media, print media, outdoor media and audio visual media. The results showed that the most preferred types of communication channel is mass media while the least preferred is audio visual media. This study then proposed suggestions for the future research.

ABSTRAK

Di Malaysia, penggunaan tenaga adalah tinggi terutamanya dalam sektor komersial. Penggunaan tenaga oleh bangunan pejabat adalah antara penyumbang utama kepada penggunaan tenaga negara. *National Energy Balance (2012)* menyatakan bahawa sektor komersial adalah kedua tertinggi dimana menyumbangkan 33.2% penggunaan tenaga selepas industri 45.1% dan diikuti oleh sektor kediaman 21.2%. Salah satu cabaran besar yang dihadapi oleh pengurus fasiliti adalah untuk mengurangkan penggunaan tenaga dari bangunan. Walaupun terdapat program penjimatan tenaga dilancarkan, perkembangan penjimatan tenaga dalam bangunan kerajaan masih ketinggalan di belakang. Untuk memperbaiki tingkahlaku penjimatan tenaga pekerja bangunan pejabat secara efektif, pemilihan saluran komunikasi yang betul kemudiannya mengedarkan mesej penjimatan tenaga dengan saluran komunikasi yang betul kekal sebagai strategi penting. Kajian ini mempunyai dua objektif. Objektif pertama adalah untuk mengenalpasti kesesuaian jenis saluran komunikasi sebagai perantaraan untuk menyampaikan mesej maklumat. Temuduga pakar telah dijalankan untuk mengenalpasti kesesuaian saluran komunikasi dalam konteks bangunan pejabat. Tindakbalas dikumpul dari pakar digunakan untuk merangka instrumen kajian untuk mencapai objektif kedua. Objektif kedua pula adalah untuk mengenalpasti saluran komunikasi pilihan untuk merangsang tingkahlaku penggunaan tenaga bangunan pejabat. Untuk mencapai objektif kedua, soal selidik telah dibangunkan berdasarkan kajian literatur dan temuduga pakar dan diedarkan kepada staf bangunan pejabat di Putrajaya. Sejumlah 525 sampel lengkap dikumpulkan dan dianalisa menggunakan analisis pilihan secara berkumpulan (CBC). Lima jenis saluran komunikasi telah dikenalpasti: Pendekatan berorientasikan dialog, media massa, media percetakan, media luar dan media audio visual. Hasil telah menunjukkan bahawa jenis saluran komunikasi paling disukai adalah media massa sementara paling kurang dipilih adalah media audio visual. Kajian ini kemudiannya mencadangkan cadangan untuk penyelidikan akan datang.

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CBC - Choice Based Conjoint

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CHAPTER 1

INTRODUCTION

1.1 Introduction

In this modern era, it is easy to obtain and access information from various sources globally. Information in the form of messages is conveyed through the medium called communication channels. There are many types of channels to access for information including the newspaper, blog, video, poster, radio and many others. This study aims to identify the preferred communication channels to facilitate office building energy conservation behaviour. Various energy challenges poses treats to the world to achieve a sustainable energy future. These challenges includes but not limited to depleted energy resources, the increase of world temperature, rising of sea levels, and environmental degradation caused by burning of fossil fuels to generate energy. One of the immediate solutions is to reduce the energy demand. Therefore, the world needs to consume energy efficiently for more sustainable energy future.

The issue of global warming issues nowadays that caused by excessive energy usage is one of the proofs that world is negatively affectedly by human activities. The Earth Hour Day which was held on the 29th March 2014 from 8.30 pm to 9.30 pm proved that energy conservation behaviour is still needed to reduce the impact of global warming (The Sun, 2014). In some cases, the application of electrical devices exceeding the standard always occurs. In some cases, people lack concerns such that they did not switch off electrical appliances, using air conditioner

exceeding the desired temperature, or using lamp in the morning to create elegant images for building.

“Programs that intend to foster sustainable behaviour should include a communication component” (Unnisa and Rav, 2012). Appropriate communication channel is among the keys to ensure effective information delivery. This simply means that the right selection of channels will bring effective solution to facilitate desired behaviour change. Thus, the selection of right combination of channels can potentially lead to effective energy conservation behaviour change.

1.2 Problem Statement

According to Bruntland Report 1987 by World Commission, sustainable development is “*development that meets the need of the present without compromising the ability of future generations to meet their own needs.*” Based on this definition, environmental sustainable development concept is an important matter to be adopted in all cities to prevent any environmental pollution that can bring to the exhaustion of the natural resources. Sustainability encompasses the environmental, economic and social requirements aspect (Godwin, 2011). This is known as a triple bottom line of sustainability. According to Ahmad and Tahar (2014), energy is one of the crucial elements for a sustainable development. This means that in order to achieve a sustainable development, we have to sustain our energy sources which is depleting from day to day. For example, in developed countries, the energy consumption is higher than in the undeveloped countries. Many buildings are set up for business related competition, not realizing the tremendous energy wasted. Surprisingly, many developed countries such as the United Kingdom, China and so on are having problems regarding the excessive usage of energy. According to Ke *et al.* (2012), China’s industrial energy consumption increased by 134% from 1996 to 2010 although the economic energy intensity decreased by 46%. For the case in the United Kingdom, the country’s total energy consumption in 2013 has increased 0.7% in compared to the previous year (United Kingdom Government Report, 2013).

Similar scenario are also happening in Malaysia. According to Ahmad and Tahar (2014), Malaysian are one of the largest electricity consumers among the people of the Southeast Asian Nations member countries. The demands of energy are expected to increase due to social development and economic growth. Many commercial building such as shopping complexes, hotels, high-rise office buildings, and office building buildings are built. These developments then will bring to the requirement of energy. Therefore, the ongoing development is parallel with the increases in the demand for energy.

Currently, one of the major challenges faced by facility manager is to reduce the building's energy consumption. Role of a facility manager is not only limited to one area. Their roles are wide and may include energy management, space management, maintenance operation, financial planning, health and safety, project management and so on (El-Haram and Agapiou, 2002). According to Ucci *et. al.* (2012), facility managers are now becoming increasingly aware of the need of occupant behaviour in energy conservation building. Facility managers clearly have different functions in office building energy use whereby his role on any energy saving measures can bring to large impact on total office building energy use (Lo *et. al.*, 2012).

Energy conservation has become a subject of worldwide discussions. It is known that excessive use of energy is harmful to our world and it brings negative impact to the environment. Excessive electricity consumption is a factor that causes environmental problems such as global warming and the loss of natural resources. According to The Canada Press (2013), a scientist whose name is Camilo Mora and his team has conducted a research on global warming and the results have been published in Journal Nature in October 2013. The results revealed that the world will be experiencing hot temperature starting with Jakarta in 2020, Singapore in 2028, Mexico in 2013, Cairo in 2036 and so with the other countries, while it was reported that Malaysia will experience hot temperature two decades from now. Such findings are worrying and countries which has hot and humid weather will be more affected by this phenomenon.

According to Baumert *et. al.*, (2005), the larger contributor of greenhouse gases is by the use of energy for electricity and heat with 24.6 percent of emission compared to other sectors and according to PBL Netherlands Agency (2013), the sector of power generation in 2010 was the highest contributor with 38 percent of CO₂ emission as compared to other sectors. These facts show that the electricity sector is the biggest contributor to the emission causing global warming and the rate of emission to increases over the years. This also means that using coal for energy consumption for electricity generation purposes are more than the other sectors. This worrying situation requires immediate and serious action considering the adverse effects it brings which includes the rising of temperature and the depleting of world's natural resources. Global warming does not only cause the temperature to rise, but also gives another impacts such as the extinction of plants and animals, thinning of glacier, rising of sea level and the lack of protection from UV ray from the sun (Stuart, 2012).

Even worse, it is a norm for countries with hot and humid climates to depend heavily on air conditioners to cool the air. According to Masjuki *et. al.* (2001), the number of air conditioner increases drastically in Malaysia from year to year and it will be even higher in the near future. This means that countries with hot climates are more likely to use air conditioners thus this increase is proportionate with increase in energy consumption. This will contribute to the higher level of emission which causes global warming and the exhaustion of energy resources.

Therefore, one of the ways in achieving energy sustainability is by reducing the energy demand. Reduction of energy demand can be achieved by two approaches namely the technology approach and behavioural approach. Technology approach refers to application of technology instrument while behavioural approach is more on monitoring people behaviour. According to The Environics Institute (2013), not all energy users are actively practicing energy conservation behaviour despite being alert that energy conservation practice will not only benefit them, but also to the government and most importantly to the world. According to The Environics Institute (2013), people do know about global warming but society is not ready to move ahead where they still use electricity like never been reminded. We need to

encourage people to practice energy conservation behaviour. They need to be reminded that energy conservation is not only about reducing the cost of electricity but also on saving the depleting world's natural resources.

Basically, they are two approaches that are used in energy conservation. These approaches are known as technology approach and behavioural approach (Mohon *et. al.*, 1983). The technology approach refers to using technology instruments such as installing energy devices, automation system, installation of a new process and other technological instruments to achieve energy reduction. The implementation comes with a cost and sometimes it is high. People may fail to adopt the technologies because of many factors such as knowledge, expertise, money and others. The behaviour approach is focusing on improving consumer's energy use behaviour (Choong, 2009).

Behavioural approach has been acknowledged as an approach which requires lesser costs in compared to technology approach. Particularly, for organizations that have a limited budget, behavioural approach is always a priority because it requires little capital. Behaviour approach is easier and inexpensive compared to the others approaches that uses energy efficient appliances and better maintenance of appliances (Sweeney *et. al.*, 2013). According to Loozen and Moosdijk (2001), 5-10% of energy cost can be saved by adopting energy use behaviour. According to Yamtraipat *et. al.*, (2006) 24% energy consumption can be reduced by using standard of air conditioner from 22 to 26 degree Celsius. This proves that by improving user's energy use behaviour, significant amount of energy can be conserved.

To reduce energy consumption, there are many efforts made by the Malaysian government. For example, a total of 5% of renewable energy usage introduced by the government in the 9th Malaysian Plan is to reduce the pollution of the atmosphere. This clearly shows that Malaysian government is taking initiative towards a more sustainable energy future. Besides that, there are many NGO's that are collaborating in creating awareness among the energy users (Saidur, 2009). There have also been many policies introduced for energy efficiency. According to the National Seminar on Low Energy Office (LEO) Building (2009), there are many

buildings that are built with low energy office after the government new policy had been implemented. Besides that, the Malaysian Government is urging the nation to save energy. The application of The Japanese Cool Biz concept for office workers is one of the example. In the concept, one of the features is workers must maintain air conditioning temperature at 24 degree Celsius (Aliagha and Cin, 2013). This approach imposes that the Malaysian Government is giving high commitment in reducing energy consumption.

Indeed, the office building energy usage is among the main contributors to the major usage of energy. According to Saidur (2009) commercial sector in Malaysia is the second largest user with 32 percentage of the total energy use in Malaysia after industrial sector followed by residential sector. Saidur (2009) added that air-conditioning usage contribute a major energy after lighting, lift and pumps in a commercial building. We can conclude that commercial buildings comprises the most energy use after lighting, lift and pumps in a commercial building. According to National Energy Balance (2012) by Suruhanjaya Tenaga, energy usage in 2012 by commercial sector is the second highest resulting to 33.2% after industrial 45.1% and residential sector 21.2%. We can conclude that commercial buildings contribute a larger percentage of energy consumption than residential buildings. In China, the average energy usage of an office building is about 10-20 times higher than the residential buildings (Yang *et. al.*, 2008). Yang *et. al.* (2008) asserted that factors such as to enhanced comfort level and increase pressure for building services will lead to the demand of electricity in the future.

Although there are previous relevant programs launched, the energy conservation progress in government office building is still lacking behind. Furthermore, we must consider the old buildings built without advanced technology or without energy efficiency planning. In order to make sure that office building meet the needs and use energy efficiently, they need to train their staff with energy conservation behaviour. According to Ucci *et. al.* (2012), many facility managers, designers and policy makers are now becoming aware of the need of improving occupant's energy conservation behaviour and carbon reduction in buildings. Proper end user energy management can save 20 percent of the office building electricity

consumption (Junnila, 2007). This mean by targeting the end user of the building to apply their energy conservation behaviour, the energy conservation is reachable.

Unfortunately, users must have voluntary behaviour order to ensure their energy conservation behavior at all times. According to Ampt (2003), voluntary behaviour change is when individual make choices without regulation or feeling of external compulsion. According to Ampt (2003), people need tools for the voluntary behavioural changes, in which some of the tools includes the scope of communication channels such as word of mouth, using prompts, using groups, using media for reminders and many other tools.

Thus, in order to improve users' energy conservation behaviour, the selection of right communication channels remains as an important strategy. A manager will face many alternative channels to use and due to this, appropriate and relevant choices must be made so that this contributes to the effectiveness of solution (Melcher and Beller, 1968). Nowadays, there are many communication channels used to deliver information on energy conservation. Communication channels are referred as the medium of message to be delivered to users. They are many types of communication channels such as dialogue oriented approach, mass media, small media such as print media, audio visual media, utility media and outdoor media. Knowing the right medium will ensure that the messages can be delivered effectively. Selecting inappropriate communication channels might contribute to program failure.

There are many studies carried out which uses a variety of communication channels to effectively raise awareness and change people's behaviour. One of the examples of the communication channels is video which can be exploited meaningfully to raise awareness and provide information on climate change and global warming. According to Kritmanorote (2011), there is one environmental video with the title "*The Most Terrifying Video You'll Ever See* and *An Inconvenient Truth* that reached million viewers which is proven successful in raising energy awareness among people. Other studies are by (Fjeldsoe *et.al.*, 2009) whereby the research about using Short Message Service (SMS) managed to achieve its goal to be as a

reminder to change the unhealthy behaviour among people. Positive behaviour changes by using SMS were recorded from 13 of 14 SMS interventions. Based on another study, it was reported that using variety of communication channels in marketing has improved the hygiene behaviour of 497 women in Ghana (Scott *et. al.*, 2008). The study showed that television and radio channels bring greater impacts than other channels on changing the behaviour with 30 percent increase in hand washing behaviour.

There are also many studies which used various communication channels to foster energy conservation behaviour. Studies by Bertrand *et. al.* (2011), showed that in order to educate energy efficient habit among kids, website '*www.LoseYourExcuse*' was established in first campaign where kids can download energy action plan from the website. Then, for the second campaign, cartoon such as TinkerBell, Malcolm and April were used as advertisement in television and radio programme. Later, another website called '*www.energy.gov/tink*' was established to drive kids in energy conservation behaviour. TinkerBell Cartoon was the most viewed by kids followed by others advertisement. According to Hargreaves (2011), communication channels such as group meeting to do 'List of Conservation Actions' are established for energy conservation behaviour among staff. The list contain on reminder about desk layout to get natural light, using of low energy light bulbs, remove lighting tubes and all non essential equipment must be switch off on lunch hour once a week. Furthermore, electronic mail also has been used to spread the energy conservation message in the office building.

Based on the previous literatures as discussed above, it shows that various types of communication channels were used to facilitate desired behaviour change. This shows that communication channels can bring a positive reaction when the right ones are used. However, the suitability of communication channels being used may vary across local context. For example, performance art of theater is usable in changing environmental behaviour (Alison, 2007). These channels are not suitable in the office building context. Another example is using agents like health care provider to provide some information (Mitchell *et. al.*, 2012). These communication channels are also not suitable in the office building context.

Thus, the research question raised is what are the preferred communication channels to foster energy conservation behaviour among office building users. This research is conducted to identify what are the communication channels that are preferred by most people in the context of office building energy conservation behaviour. To the best of author's knowledge, only one similar study has been conducted. The study conducted by Lee *et. al.* (2013) was focused on preferred communication channels, types of messages and preferred ways of delivering information for the purpose to foster energy conservation among public office users using frequency analysis. Considering most of the interventions used more than one channel to foster desired behaviour change, this study uses conjoint analysis to identify the combination of communication channels that are preferred by the office building users in fostering energy conservation behaviour. This study is expected to identify additional relevant communication channels in complementing the seven communication channels which has been identified in the study by Lee *et. al.* (2013).

1.3 Objectives

- 1) To identify suitable types of communication channels as a medium to deliver information message.
- 2) To identify the preferred communication channels to foster office building energy conservation behaviour.

1.4 Scope of study

The scope of study is focused on the office building located in Putrajaya. The respondents are the office building users of Putrajaya government office building.

1.5 Significance of Study

This study was conducted for the purpose of giving benefit to social body, government, and public. This study provides guidance to allocate limited sources effectively by targeting the right communication channel. From this study, the preferred communication channel identified in this study may serve as a reference guide for other organizations in designing relevant energy conservation program. Other benefits that can be obtained is the findings will complement the existing literatures which addressing the preferred communication channels to foster office building energy conservation behaviour.

1.6 Research Methodology

This research consists of Five Stage. The research methodologies are as follows:

I. Stage One: Literature Review

In the beginning stage, the authors have done the title research on the selection of topics. Then, selection of and scope of the study were determined. The discussion was done with the supervisor to specify the rationale of the study. Then, literature review was done by reviewing published literatures from books, journals, websites and newspaper relating to energy conservation behaviour and communication channels. The section covers definition of energy, office building energy conservation behaviour, understanding communication, types of channels and previous study on the communication channels.

II. Stage Two: Design Survey Instrument

This stage is to design survey instrument. It is includes design questionnaire, sampling strategy used, and pre-testing the developed questionnaire before

being distribute to the respondents. The survey instrument used to generate questionnaire is Sawtooth Software.

III. Stage 3: Data Collection

The questionnaire is developed based on the literature review. After that, the questionnaire was distributed to all staffs of government building in Putrajaya. The data collection stage is to gather empirical data on the preferred communication channels to foster office building energy conservation behaviour.

IV. Stage 4: Analyze Data

This stage is to analyze the raw data gathered from field. The data collected is compiled and analyzed in order to answers to the research objectives. Choice based conjoint analysis assisted by Sawtooth Software is used to analyze the raw data gathered.

V. Stage 5: Conclusion and Recommendation

This stage is the final stage of the study in which the authors make conclusions based on the findings after reviewing briefly the literature and results. Then, some recommendations for future research are presented.

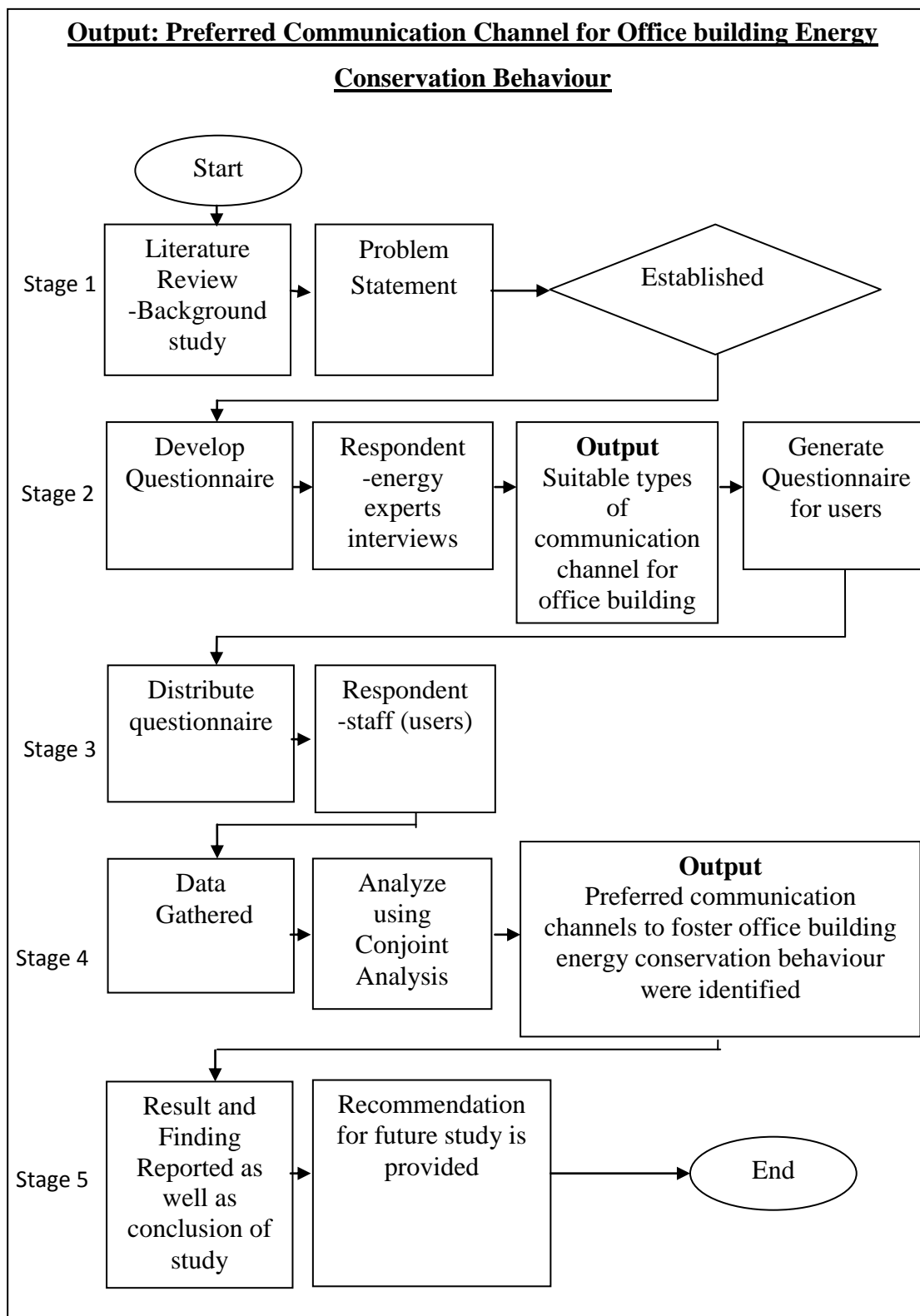


Figure 1.1: Overview of research methodology

1.7 Layout of Chapter

The research consisted of five chapters. Overall it focuses on the communication channels in order to improve office building energy conservation behaviour. Chapter One is about the introduction of energy challenges and importance of energy conservation behaviour. In this chapter, research objectives were obtained from the problem statement. Others aspect covered are aim of study, scope of study, significance of study, methodology of study, and the chapters outlined.

For Chapter two, it includes the literature review where theoretical part was carried out. Literature on the energy conservation behaviour and the types of communication channels are reviewed. This part will explain on the types of communication channels that can be used to change or retain people's behaviour. In this chapter based on the types of communication channels, attributes questionnaires was developed.

Next, some of the explanation about this case study will be covered in Chapter Three where in this study, the case study focuses on office building in Putrajaya.

In chapter four, the method used to analyze the data collected from the questionnaire is explained. The data were analyzed briefly using choice based conjoint analysis. Some discussion from the analysis is also performed. Finally, the conclusion and recommendations are presented in Chapter Five for further research. The study flow chart is shown in Figure 1.1.

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