Sustainability Model for Rural Telecenter Using Business Intelligence Technique

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Abstract—Telecenter is a place where communities can access computers, the Internet, and other digital technologies to enable them to gather information, create, learn, and communicate with others. However, previous studies found that sustainability issues related to economic, political and institutional, social and technology is one of the major problem faced by the telecenter. Based on that problem this research is planning to design a possible solution on rural telecenters sustainability with the support of business intelligence (BI). The empirical study will be conducted through qualitative and quantitative method including interviews and observations with a range of stakeholders including ministry officers, telecenters managers and operators. Result from the data collection will be analyzed using causal modeling approach of SEM SmartPLS for the validity. The expected finding from this research is the Business Intelligent Requirement Model as a guild for sustainability of the rural telecenters.

Keywords—Rural ICT Telecenter (RICTT), Business Intelligence, Sustainability, Requirement Analysis Modal.

I. INTRODUCTION

TELECENTERS (TC) provide public access to Information and Communication Technologies (ICTs) for educational, personal, social and economic development [1].One of the most important issues in operating telecenter is its sustainability [2]-[4]. The key determinant for sustainability is the ability to maintain competitive advantage. This is associated with telecenter capability to operate independently in terms of financial, administration, technical support, and community acceptance and support [5]-[7]. A finding from a study on telecenter sustainability by [1] indicates that only 22.0% managed to generate sufficient income to continue their operations. Furthermore, good and quality decision is significant for the organizational survival.

The sustainability need to be solved in order to provide continuous ICT facilities to the rural community. Decision-making is usually defined as a process of identifying the problems and the possibilities for solving the problems [8], which includes the efforts before and after the decision is made. In the current competitive environment, one of the

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possible solutions to find the good model for Rural ICT telecenter (RICTT) sustainability guidelines in term of a quality decision making is a Business Intelligent (BI) approach. It is found that [9], BI approach is a set of methodologies and technologies for gathering, storing, analyzing, and providing access to data to help users make better business decisions. Thus, BI can generally be referred to as a process of turning data into information and then into knowledge that can be used for good decision making [10]. Therefore, this paper uses a BI approach in order to seek the potential solution for sustainability of rural telecenters. This done by reviewing the sustainability issues, collecting the variable relate to sustainability, model the BI solution and test the validity of the variable. The finding of this paper will useful for the telecenters decision maker, stakeholder, and the managers to predict and make a right decision to sustaining the rural telecenter in Malaysia.

II. PROBLEM STATEMENT

The real challenge is to make it an integral part of decision-making process and to help an organization in sustaining its competitive advantage. To date, there is no empirical research has been found on the utilization of BI for sustainability of the telecenter. An issue related to sustainability is found that financial support is critical to continuously provide ICT and Internet services to public communities by the stakeholder [3]. Furthermore, telecenters face a problem on how to encourage local people to fully utilize the service offered by the telecenters [11] in term of social sustainability. Access to relevant content with society needs that are updated shows a critical role in stimulating the users in rural community to feel a social continuous connection with telecentres [4]. It is also stated [12] that, when only some social group within the community gains the benefit from the telecenters, it will affect the long term sustainability in term of educating the local communities. There are a number of factors such as quality of service delivered, quality staffing and effective promotion of telecenters which are crucial in achieving social sustainability of telecenters [13]. This problem needs to resolve in order to reduce the digital gap between urban dan rural communities.

Telecenter operations face sustainability problems that need to be resolved in order to sustain. Therefore, this paper attempts to look into several issues which are issues related to sustainability of telecenters, types of information are needed in telecenter strategic business decisions in helping them sustain their competitive advantage and the function of BI in order to help telecenter sustain their competitive advantage. Therefore, this paper proposes a BI decision making model for rural

telecenter sustainability. The study of this paper is conducted at telecenter only in Malaysia from various type of stakeholder and model of TC such as Rural Internet Center (PID) and Community Broadband Center (CBC). While the main focus of this research in more social sustainability issues in general.

III. BACKGROUND STUDY

A. Telecenters

Telecenters are "shared premises where the public can access information and communication technologies" [6]. A telecenter is a place where communities can access computers, the Internet, and other digital technologies to enable them to gather information, create, learn, and communicate with others. Telecenters exist in many countries in the world, although they sometimes have different names. The origin of telecenters can be traced back to Europe's tele-cottage and community technology centers (CTCs) in the United States, both of which emerged in the 1980s as a result of advances in computing. At the time when computers were available, but not yet a common household good to most communities, therefore, public access to computers thru telecenter emerged as the best solution. Today, although home ownership of computers is widespread in most develop and developing countries, there remains a need for free or affordable public access to computing to ensure that everyone has access to technologies that have become essential in our daily life. This place also consider as a technology hub which allows a community to establish many programs and services which provide social, economic and IT support. However, in reality, telecenters are full of varieties and becoming more and more important policy to bridge the digital divide in rural and underserved or unserved areas of developing countries.

In Malaysia, digital divide can be described as disparities between and within societies in the use of digital technologies or a situation whereby part of a community is deprived of the opportunity to gain access to ICT infrastructure facilities [1]. The Malaysian Economic Planning Unit views digital divide is as giving values towards the benefits of development generated through ICT [14]. The telecenters offer a broad range of communication services related to the needs of the community with the idea of a community sharing computer technologies. In Malaysia, more than 2,000 telecenters of various types were initiated either by government departments or private organizations. These centers such as Rural Internet Center, Medan Info Desa, Community Broadband Center and Rural Broadband Library [15] have their own objectives, aims, basic infrastructures, business activities, hierarchy structure and financial supports. A range of important issues is linked to the operation and success of telecenters. These include: sustainability, community relevance, government policy, information and communication technology (ICT), research, community partnerships and participation, telecenter objectives and business planning [6]. Wrong focus often leads to failure, at the same time, it is important to achieve balance between financial and social sustainability. Telecenters receive certain amounts of money from several sources to assist them in sustaining operations and services. The majority of telecenters are currently operating under tight cash budget and financial support is critical in order for the centers to continue giving services to communities [3]. The Malaysian government plans to reduce the funding of the government-operated telecenters soon; therefore, there is a need to formulate new strategies to self-sustain the telecenters operation. Currently the telecenters face the question of how they can generate income yet serve those in the community who cannot afford to pay for "public goods" kinds of services. Reference [6] reported that some centers use income from user fees and other income services to make public goods affordable or free. Reference [7] argues that it is a mistake to write off telecenters that are able to induce locally relevant development but do not generate sufficient revenue to cover their costs.

The purpose of establishing telecenters are: (1) to transform the digital divide into digital opportunity in rural and remote areas of developing country; (2) to provide the most effective solution in rural area for sharing the use of internet or ICT facilities among the communities; (3) to create a knowledge center in rural community; (4) to educate people and to enrich living standard by having access to global information through the internet technology; (5) to promote the sale of local product through the internet or electronic commerce applications; and (6) to provide government information such as natural disaster warning, announcement, e-government services and other e-services to the local communities.

B. Sustainability of Telecenter

Many interpretations made by other researches relate to sustainability of rural telecenters. Sustainability is used to describe the capacity of a project or its result to continue existing or working when funding or the external presence ends. A range of different issues is often linked to the operation and success of telecenters. [6], Sustainability of telecenters means more than just financial sustainability. Issues related to sustainability can be examined in four main categories i.e.; 1. economic sustainability 2. political and institutional sustainability 3. social and cultural sustainability, and 4. technological sustainability.

There is a high level of failures in information systems deployed in developing countries. These can be distinguished by total failures, partial failures and sustainability failures [5], [16]. The primary determinant for sustainability is the ability to maintain competitive advantage. In other point of view [7] for instant describes sustainability as 'the ability of a project or intervention to continue in existence after the implementing agency has departed'. This is associated with telecenter capability to run independently in terms of financial, administration, technical support, and community acceptance and support. Other researchers suggested five pillars, i.e., policy, social, financial, operational and organizational as a key factor for sustainability influence. These pillars, when strengthened, serve as the foundation for long term telecenter sustainability [12], [7], [2], [16], [6].

Telecenters Sustainability cannot be seen on the basis of financial sustainability alone. In order to reach the goals of community development and financial sustainability, telecenters have to integrate social, political, cultural and technical sustainability as vital elements into their planning and operation [3]. Most telecenters receive certain amount of operation capital from several sources to assist them in sustaining operations and services. On top of that majority of telecenters in Malaysia currently are operating under tight cash budget and financial support is critical in order for the centers to continue giving services to communities. According to the authors, Malaysian government plans to reduce the funding of the government-operated telecenters; therefore, there is a need to formulate new strategies to self-sustain the telecenters operation.

The centers face with the question of how they can generate income, yet at the same time serve those in their communities who cannot afford to pay for "public goods" kind of services. [6] Argued that there are centers that use the income from user fees and other income services to make public goods affordable. In this regard, financial sustainability is assumed to have big influence in operating and managing telecenters. Therefore making the right business decision is most crucial in order to maintain the services to the communities. In this respect, utilization of current technologies such as business intelligence would greatly enhance business decisions made in relation to telecenters sustainability issues.

C. Business Intelligence

The term of business intelligent (BI) is first introduce by Howard Dresner in 1989. He was the analyst of the Gartner group, an information technology researcher firm that implemented BI in the ICT industry. He then first coined BI term in 1996 an introduced the term to describe a set of concepts and methods to improve business decision making, by extracting and analyzing data from database for strategy formulation. BI is the art of wading through tons of data overload, sieving through data and presenting information both internally as well as externally [17]. Internal information normally resides in the organizational databases while external information is from market intelligence on which management can act or build strategies. BI systems consist of a complete process of creating reports and analysis for decision making from start to end.

Generally BI application combines data gathering, data storage, and knowledge management tools to present complex internal and useful information for decision makers [18]. BI applications include the activities of *decision support systems*, *query and reporting, online analytical processing (OLAP), statistical analysis, forecasting, and data mining*. BI has different definitions from different field of expert and is view from several approaches [19].

There is no standard definition agreed by the researchers. These depend on the area of expert from different filed. To some customer relationship management (CRM) expert, BI is all about the integration of front-office application with operation of back-off applications. To some warehouse expert,

BI is just a new term for data warehousing; that providing decision support applications on a new technology platform. To some data mining statisticians, BI represents the advanced data mining algorithm, such as neutral induction technique.

Almost all definitions share the same focus, even though definitions have been defined from two broad perspectives of managerial and technical [20], [21]. The managerial approach sees BI as a process that gathers data from inside and outside of organizations and integrates them in order to generate information relevant to decision-making process. Among the vendor/author that implemented the managerial approach as in [22]-[24]. While the technical approach presents BI as a set of tools that support the process. Among the vendor/author that implemented the technical approach as in [23], [17].

D. Business Intelligent and Sustainability

Business Intelligence (BI) software is designed to help people make more informed decisions by aggregating many different sources of data into a meaningful format. BI is already in use in many organizations today, by finance departments to analyze financial performance, sales and marketing to identify customer trends, and operations to enhance the efficiency of supply chains. BI technologies provide historical, current and predictive views of business operations. The main objective of business intelligence deployments is to support better business decision-making. Though the term business intelligence is sometimes a synonym for competitive intelligence (because they both support decision making), BI uses technology technologies gathers, analyses and disseminates information with a tropical focus on company competitors.

BI method is claimed to involve methodologies focusing on identification of strategic information which needs to be integrated into data warehouses and BI applications. The BI literature displays a lack of clear frameworks that could serve as guides to such an important phase: the definition of user requirements and information needs. The literature on BI is short on methodological approaches to information planning. In the data warehousing literature, one finds a huge number of studies based on two authors, [25] and [26], who are directly concerned with defining the structure and content of a data warehouse. However, both Inmon and Kimball provide few guidelines regarding definition of corporate performance Indicators, which is the heart of a BI system from a corporate level perspective.

Therefore, utilizing BI as the forward in achieving sustainability of telecenter is an innovative approach as these centers have collected massive amount of data that are currently analyzed using simple descriptive statistics. Advanced analytics using BI would allow the data to be analyzed in depth, thus new patterns could be discovered and the findings from analysis can then be utilized for decision making.

IV. RESEARCH METHODOLOGY

The purpose of this paper is to investigate how stakeholders in Malaysian rural telecenters perceive sustainability of their

organizations with the support of business intelligent. The preliminary research model, which is developed based on extensive literature review and interviews, is illustrated in Fig. 1.
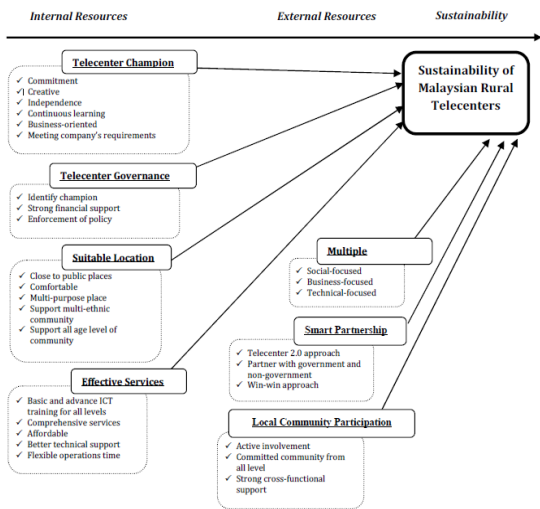

Fig. 1 Preliminary BI Model for Sustainability of Rural Telecenters

The model shows two groups of variables, 'External Resources' and 'Internal Resources', impact on the dependant variable 'Sustainability of the Malaysian Rural Telecenter'. The first determinant group has 4 independent variables of (1) Telecenter's Champion, (2) Telecenter's Governance, (3) Effective Services, and (4) Suitable Location, while the second group has 1 variable – (1) Local Community Participation. These variables will be the determinant factors in sustainability of the Malaysian rural telecenters through proper BI planning phase [10]. This research explores how BI can support the sustainability of contemporary Malaysian rural telecenters. BI methods and tools are viewed to have important roles to play in helping telecenter organizations implement and monitor sustainable practices. The establishment of telecenter as multi-purpose community centre is among the initiatives taken by the Malaysian government to reduce digital gap in the country. Among the important issues in telecenters operations is the sustainability, where the key determinant is the ability to maintain the center's competitive advantage.

This is associated with telecenter capability to run independently in terms of financial, administration, technical as well as community acceptance and support. Thus, the research attempts to explore how telecenters resources, internally and externally, be utilized for these purpose. Mix method approach consists of qualitative and quantitative process is employed as a research methodology in this study. The use of both methods in the same study is commonly referred a few researcher such as [27]. The research process will conducted into two sequential phases that involved eleven steps as shown in Fig. 2.
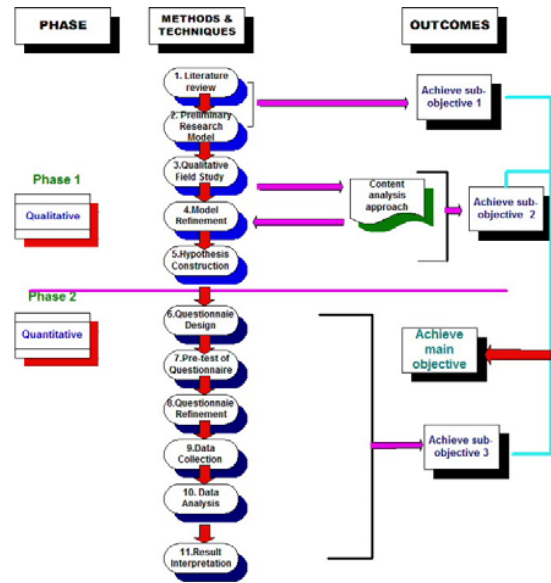

Fig. 2 Research Phases and Outcomes (Adapted from [10])

A. Qualitative Field Study Method

This study endeavored to explore the phenomenon of sustainability of rural telecenters in Malaysia, to validate and enhance the factors and variables identified as part of comprehensive literature review. Since this phase was concerned with understanding telecenters sustainability, the qualitative method is considered the most appropriate. The researchers argue that the goal of understanding a phenomenon from the point of view of the participants and its particular social and institutional context was difficult to achieve when textual data were quantified [28]. Therefore, it was believed that a 'pseudo case study' that involved a qualitative study of a small number of participants would meet the objectives of this phase of the study. As such, a field study approach [29] and [30] has been adopted as the research method for the qualitative phase.

Qualitative methods permit the evaluator to study selected issues in depth and detail. Approaching fieldwork without being constrained by predetermined knowledge, contributes to the depth, openness, and detail of qualitative inquiry [29]. The field study acquires the researcher to be involved in investigating the factors influencing the success of BI deployment and its relationships with the use of BI-based knowledge in sustaining competitive advantage of the participating organizations. A qualitative research approach is adopted and the research process is sub-divided into 5 sequential steps as shown in Fig. 1 also shows the step 6 until 11 for the second phase of the research process using quantitative method.

B. Quantitative Field of Study

The second phase of the research aims at finding the important factors and variables affecting the sustainability of the telecenters, which was reflected in the BI model developed prior to this phase. A number of hypotheses were derived from the model, which were subjected to an empirical testing that

focused on verifying or falsifying these hypotheses as in [28]. Since the methods used in this phase were designed to be detached and independent of the specific situation under study, a quantitative method is considered most appropriate. Therefore, the survey method was considered most appropriate for this study and a questionnaire-based survey was adopted.

V. SAMPLE SELECTION

This study will implement convenience sampling procedure as it is the most commonly used in business research [30]. Furthermore, this category of sample relied on available subjects who were close at hand or easily accessible [31]. Stakeholders from different relevant agencies including telecenters and ministries in Malaysia who were willing to participate were selected. Main selection criterion was that the selected participants have to be directly involved telecenters activities and initiatives and they have to have some level of decision-making in their organizations regarding telecenters. The participants will be contact personally to participate in the interviews on voluntarily basis. Data collection and analysis method in qualitative studies are different from quantitative techniques [32]. Interview, has been accepted as one of the major techniques of data collection for qualitative study [33]. Many researches in various fields such as psychology [34] and education [35] have employed interviews as a method of qualitative data collection. Researchers have identified three categories of interview that can be used [36] i.e.;

- Standardized (formal or structured)
- Unstandardized (informal or nondirective)
- Semi-standardized (guided-semi-structured/focused)

For this study, semi-structured interview will be chosen as a method of collecting relevant qualitative data to explore and refine the model of BI for telecenter success in Malaysian. Here, the list of themes, issues to be addressed and questions to be asked were identified and pre-defined by the researcher. The use of semi-structured interviews ensured that information was captured from the respondents' perspectives rather than being imposed by the researcher. The guiding semi-structured questions were developed from comprehensive literature review. Example of semi-structured interview questions have focused on the following areas of information needed in the field study;

- Please give some overview of Malaysian rural telecenters
- What is the motivation for establishing the telecenters?
- In your opinion, what are the issues and challenges faced by telecenters currently?
- In your opinion, do we still need telecenters now as people now own computers at home?
- What do you think are some of the main factors that contribute to telecenters' sustainability?
- What is the source of income of your telecenters?
- What are the main problems that you face in managing the telecenters?

- What do you think in terms of knowledge or information needed for decision making in regard to telecenters sustainability?
- Do you think that your telecenter can be sustainable?

The participants were contacted personally by the researcher before the actual interviews took place. The participants were also aware of the interviews being recorded by a micro-audio recorder, of course with their permissions

VI. DATA ANALYSIS

This research used content analysis approach in interpreting the interviews scripts. The main reason of choosing this method was the field study was more exploratory in nature at this stage, rather than confirmatory [31]. The other reason is that content analysis is useful in analyzing interview data and is cost effective. This analysis will be performing after qualitative field study and model refinement in phase 1 of the study. The data will be broken down to the very fine details in order to generate the variables and factors from the interview scripts. The content analyses were carried out in two stages which involved several sequential step-by-step processes [37] and [31]. Table I below describe the stages involved with the subsequent processes:

TABLE I
CONTENT ANALYSIS STAGE

Stage 1	o Review all transcripts o Produce categories of key words o Identify relationships among factors o Match factors with variables from the literature o Develop raw tables of factors, variables and links of each interview	dealt with single scripts and the procedures
Stage 2	o Recheck all the transcripts o Identify similarities and differences o Unify all variables and links using the "union" concept o Develop final tables of factors, variables and links o Develop the combined model of BI for Sustainable Competitive Advantage	dealt with cross scripts and the aim is to integrate all the factors, variables and links and the procedures

The final output from this phase was a comprehensive BI model based on interview scripts from the qualitative survey. The combined model was used as a basis for the construction of hypotheses. The information gather from extensive literature reviews plus findings from interviews made up the hypotheses. The refined BI model and hypotheses defined were used in the next phase of the main quantitative research. Finally the model will be test in next phase of the study using quantity analysis method. A causal modeling approach of (SEM) using SmartPLS will be undertaken to validate the final BI model for sustainability of the Malaysian rural telecenter [38]. This part of the research will use a quantitative approach, which will test a number of hypotheses and the model itself.

VII. SIGNIFICANCE OF RESEARCH

This research is significant with covers the following issues;

1. The use of content analysis to discover and explicate key issues faced by rural telecenters as they aim to fill their national mission;
2. The support of the telecenters managers in enhancing participation by local communities;
3. The identification of essential capabilities for effective and socially sustainable rural telecenters; and
4. The identification of sustainability model developed which can provide a basis for future telecenter research.

VIII. CONCLUSION

This paper explain brief concept of the research step to follow using both qualitative and quantitative using BI technique to model the sustainable model for rural telecenter. This research contributes to both theory and practice by a series of data collection will give the idea to construct the BI model that will test using SEM method.

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