Bridging the Digital Divide – The Role of the Scientific and Technological Information Stations in Rural Areas of Dong Nai Province

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Abtract: The result of this study showed that the scientific and technological stations (stations in short) play a pivotal role in rural development and experiences of these stations could be replicated in many other places. These stations have made the considerable achievements in enhancing socio-economic development and functioned as a common platform for the rural areas. These stations have formed a network of the scientific and technological information in rural areas and helped improve the quality of human life. Great achievements from these stations proved their role as "bridging the digital divide" between urban and rural areas in Dong Nai province and they help guarantee the sustainable development in these rural areas of Dong Nai Province in particular and in the whole country in general

Keywords: Information technology and Communications (ICT), ICT4D, digital divide, scientific and technological information station, science and technology, rural development.

1. Introduction

1.1. Introduction

Since its introduction some decades ago, information and communication technology (ICT) has spread rapidly, enabling swift and worldwide dissemination of information to those who can access. Today, achievements in information and communication technology (ICT) have changed drastically the way we look at the world, especially the way people think. ICT has become a real driving force for socio-economic development as well as sustainable and comprehensive development of each country. There is no denying for the fact that this development, to some extent, has narrowed the digital gap between different regions all over the world. Among 61 provinces in Vietnam, the Dong Nai province, is considered to be one of the most successful provinces in establishing and developing the network of the scientific and technological information stations at all communes, wards and towns in rural and remote areas.

Located in the Southern key economic zone of Vietnam with an area of 5,894.73 km^2 and its population of 2,559,673 (855,703 in the city

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and 1,703,970 in the countryside), Dong Nai, a province 30 km from Ho Chi Minh City in the south, has 11 dependent administrative units, including 171 communes/wards in rural areas, mountainous communes, remote areas. Although there are a lot of industrial zones (29 zones) in Dong Nai, most of the residents (80.67%) here earn their living by doing farming [1]. This also explains the reasons why most of people in these rural areas have poor knowledge of science and technology. All of these above factors led to the establishment of a network of the scientific and technological information stations at communes/wards in the province in order to industrialize and modernize agriculture in rural areas. On December 2003, 12 stations were established via the project *"Models for offering scientific and technological information to serve economic and social development in districts located in Dong Nai province"*, 44 more stations were added in community learning centers in 2008, raising the number to 56. The number of the station went up to 92 in 2011. The thesis will set an example for the effectiveness of the model of scientific and technological information stations in rural areas of Dong Nai province.

1.2. Background

From the start in December 2003 till now, 92 scientific and technological information stations in rural areas of Dong Nai province achieved remarkable results. The annual reports made by the station managers stated that these stations have become digital bridges between rural and urban areas. These bridges have disseminated information about technology, cultivation, animal husbandry, production and education to farmers and rural dwellers via public media. They have also opened up opportunities for residents to access and update the scientific and technological information from all over the world to narrow the digital divide so that they are able to apply modern technology to improve their spiritual and material lives. In less than ten years, these stations have contributed to the promotion of

the socio-economic development in deep-lying, remote and rural areas in Dong Nai province. For instance, the station manager at Xuan Binh ward in Long Khanh town, one of the districts in Dong Nai province, reported that in nearly two years, 5000 people here have applied modern techniques about agriculture, cultivation and breeding for their traditional careers and consequently, their lives have been improved dramatically [2]. In order to highlight the effectiveness of Long An station in Long Thanh district, Le Van Hung, a farmer living in Goc Hamlet in Long An commune stated:

"Not only do I often come to the commune's information website to access the Internet and learn about new techniques in my free time, but I also can borrow science and technology films about agriculture to watch and show them to my neighborhood. I have learnt a lot about new techniques in the process of growing and reaping fruit. Based on these experiences, the productivity has increased as much three times as the one three years ago" [2].

It is the achievement from 92 stations in Dong Nai province that has inspired the researcher to do the research. The aim of this study is to report the level of success of the scientific and technological information stations. This research also estimates the major role of stations and their impacts on the users in rural and remote areas, and identifies the factors determining success and failure of these stations. The research is done with the hope of making some recommendations to make these stations better in the future just in case they have some limitations in their operations and to lay the basic foundation to multiply this model at other localities in the country.

1.3. Aims and objective

The main objective of this research is to clarify the role of the scientific and technological information stations as "digital bridges" among regions in Dong Nai province. As mentioned in the introduction and background, the researcher decided to conduct

this study with the following purposes. First of all, it is very essential for the researcher to evaluate the level of success of the scientific and technological information stations for the last ten years. Secondly, examining the role of the stations and their impacts on the users in rural and remote areas is a must in conducting the research. In addition, the research cannot get any success without the process of identifying main factors promoting or hindering the operation of the scientific and technological information stations. And finally some suggestions should be made to deal with the factors to hinder and to make these stations better in the future. In order to identify the important roles of these stations in people's lives, the researcher has to respond to three following questions.

1.4. Research questions

The thesis seeks to address the three questions including: Firstly, what are the processes through which knowledge and information gets diffused to the community? Secondly, what are factors promoting and hindering the operation of the scientific and technological information stations in Dong Nai province? And, finally, how did the application of new ICT tools affect the welfare of the community?

2. Methodology

2.1. Methodology of study

The research is primarily based on the mixture of qualitative and quantity research methods with primary and secondary data. They are used to estimate the role of the scientific and technological stations in diffusing ICT in all communes, wards and towns in rural areas of Dong Nai province, help narrow digital divide. That is also an attempt to study factors promoting and hindering the operations of these stations in Dong Nai province.

Primary data were collected through questionnaires and interviews. The researcher conducted a survey on the station managers at 92 stations in 11 districts in Dong Nai province by using a questionnaire including thirteen questions. The researcher handed the questionnaires on July 1st 2011 to respondents by using the electronic office (M-Office) (http://www.dost-dongnai.net/m-office) to collect responses. The researcher received 92 completed questionnaires between 1st July and 11th July 2011. All the data were analyzed, interpreted and described in the form of graphs, tables and charts.

Apart from the questionnaire and interviews, the secondary empirical data sources including documents and reports from Dong Nai DoST and the station managers at 92 communes /wards in Dong Nai province and others organizations, along with the Internet sources will also be used to make the research more persuasive.

The subject of this investigation is the station managers coming from 92 communes/wards in rural and remote areas of Dong Nai province and they also have answers to the questionnaire.

Table 1. Gender, age and education of the station managers

Attributes	Item	Frequency	%
Gender	Female	59	64%
	Male	33	36%
	Total	*92*	*100%*
Age	20 – 30 years	76	83%
	30 – 40 years	15	16%
	Over 40 years	1	1%
	Total	*92*	*100%*
Education	Intermediate degree	19	21%
	College degree	39	42%
	University	34	37%
	Total	*92*	*100%*

In addition to the 92 station managers surveyed, this study also uses interview to support for collecting the opinions of leaders of

Dong Nai DoST and the station managers from 11 districts of Dong Nai province. The list of interviewees includes 14 people who are leaders of Dong Nai Department of Science and Technology.

3. Conceptual framework

ICT, ICT4D, digital divide and the scientific and technological information station are the terms for science and technology terms. These terms can be simply defined so as to avoid misunderstanding their meanings and making a long explanation in this research.

3.1. Defines and descriptions in this study

3.1.1. What is ICT, ICT4D?

The Information and Communication Technology (**ICT**) is one of the important driving forces for modern civilization. According to Wikipedia [3], ICT plays as an important role in connecting all means of communications together and integrating telecommunications. Including computer, network hardware and necessary software, ICT is seen as a tool to get information and to keep contact together. ICTs not only include hardware, i.e. PCs, radio and other wireless devices, telecommunications towers, and connection and other physical components. They also comprise software and software system including management information systems (MIS), as well as management methods and practices. Most importantly, they include applications that value and justify the use and investment in ICTs [4].

The acronym **ICT4D** (Information and Communications Technologies for Development) refers to the application of ICTs for development. In the study of Prakash and De [5] in this area concerned with how ICT can contribute to different socio-economic development objectives such as income growth, health education and government service delivery or micro-finance, etc. The focus on

development issues is also evident in the Information for Development Program "InfoDev" initiative for the purpose of exploring innovative uses of information and communication technologies (ICTs) as tools of poverty reduction and sustainable development [6].

ICT is defined in this thesis as technical means including communication and application devices such as radio, television, cellular phones, computer and network hardware and software, satellite systems and book, magazines.

3.1.2. What is the "digital divide"?

The **digital divide** refers to "the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communications technologies (ICTs) and to their use of the Internet for a wide variety of activities. Moreover, the "digital divide" is a term coined to describe the disparity between the "haves" and "have-nots" in respect of information and communication technologies (ICTs) including computer skills, Internet access, etc. [7]. According to Peters [8], digital divide between countries is calculated based on the number of telephones, computers, and Internet users and measured in terms of race, gender, age, disability, location and income between groups of people within countries. The digital divide can be classified such as global, regional and national. Rao [9] pointed out the digital divide at the national level is urban and rural. Clear tendencies of increased concentration of information flows to urban and central areas are showed in developing countries [10], [11].

The "digital divide" has various dimensions and can be variously interpreted. But as used here, the term refers to the gap between rural and urban areas in using a wide variety of activities at the scientific and technological information stations to access information and communications technologies (ICTs).

3.1.3. What is the scientific and technological information station?

The scientific and technological information stations in Dong Nai province are public-access facilities providing electronic information services about science and technology, especially in remote areas where ICTs are not prevalent. These stations are located community learning centers or convenient areas at communes/wards, so local people can easy exchange information and share life and work experiences together. Simultaneously, a scientific - technological information website for the commune/ward was also built with the aim at supplying agriculture information for farmers.

3.2. How has ICT changed society in general?

Information and Communication Technology (ICT) has played a significant role in the development of a society and has changed every facet of our lives. It means that ICT has step by step gone into the way we do business, the way we live and more importantly the way we learn. As analyzing the role of ICT in national development, Sein and Harindranath [12] pointed out that ICT can be broken down into four aspects with regard to development. They described ICT as a commodity, ICT as a supporting development activity, ICT as driver of the economy and ICT directed at specific development projects. Nandi [13] affirmed that the rapid development and proliferation of ICTs have accelerated the economic and social change across all areas of human activities worldwide. Ulrich [14] indicated that ICTs create greatly facilitates the flow of information and knowledge**.** Moreover, Fletcher et al [15] showed that ICTs enable communication unhindered by distance, volume, medium or time and reduce the cost of coordination. Therefore, ICTs have contributed socio-economic development and poverty reduction in global level such as poor people have benefits in increasing income, accessing to job opportunities, improving education and training and better health care [16-19]. ICTs have also engaged with government services, connecting between family and friends, increasing agricultural productivity and enterprise development opportunities [20-21].

The diffusion of ICTs into low-income countries and communities has been recent and rapid. Heeks and Molla [22] summarized the guidance on good practice for ICT4D project implementation (see figure 1 below).
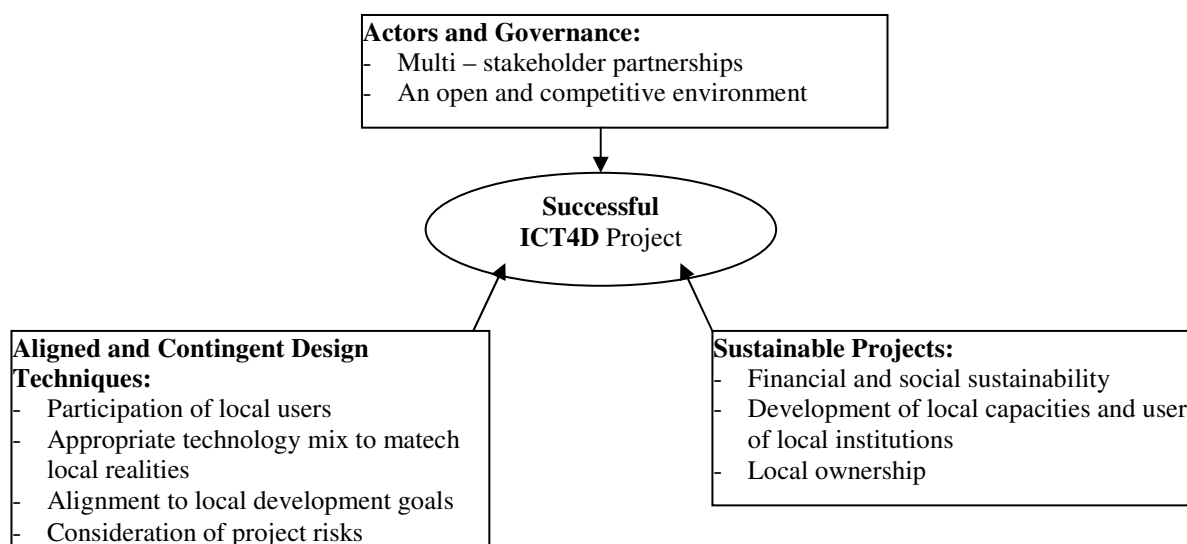

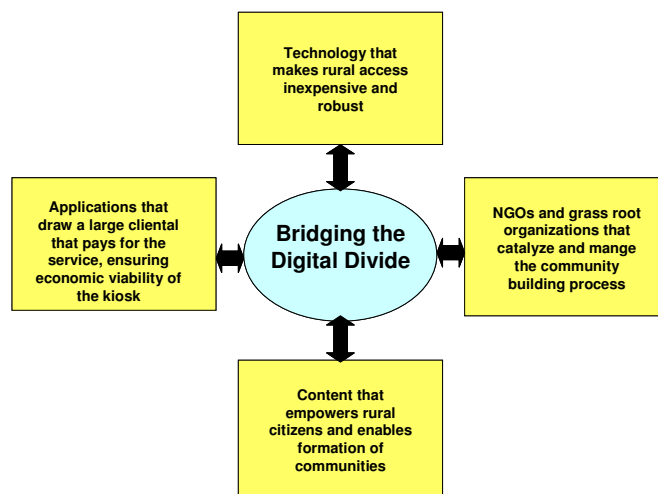Figure 1. Good practice for ICT4D project implementation.

Source: [2]

Figure 2.Closing the digital divide through innovative reforms and partnership

Source: 11th International Anti-Corruption Conference

Moreover, Bhatnagar [23] in 11th International Anti-Corruption Conference with entitle *"BHOOMI: Closing the digital divide through innovative reforms and partnership"*, drawn from the successes and failures among the pilot rural tele-center projects in India (see figure 2 below).

3.3. Impact of ICT deployment for rural and agriculture development

3.3.1. The supportive evidence from the relevant researches

ICT plays an important role in information society. People have benefited greatly from ITC application; in other words every aspect of human's lives has been affected and improved since the first day of ITC utilization. However, digital divide still exists in both developed and developing countries. Not everyone has the same opportunity/equal chance to have reliable access to Internet or to learn how to use computers. Various attempts have been made to bridge the digital gap and ITC can been considered the key to reducing this digital gap.

Lessons from more developed countries

In an effort to close the digital divide between urban and rural areas in Korea, Kang [24] reports the effectiveness of village

information network ('invil') for disadvantaged groups with low income (established by policy makers and strategy leaders).

Implementation of ITC in developing countries

The notion of information stations is not new in developing countries including Vietnam. Internet adoption has been exploited in different names and programs such as Internet/cyber café, Rural Library Networking, Communication Information Centers, Community Telecenters, etc. Below is a review of the use of ITC in developing countries.

Internet café

A survey, part of research project in progress, conducted among internet café users within Tanzania, Africa, by Bjorn and Stein [25] shows discrepancy in the possibility of access to Internet, the number of Internet users in rural and urban regions. Internet users are younger and most of them are students. However, the use of internet yields almost similar results which communication and information searching activities are ranked higher.

Relating to Internet café, Rangaswamy [26] investigated shared public cyber spaces in India. The findings reveal that other forms of

telecommunication such as mobile telephony, cable/satellite TV, and FM radio co-exist within café bases. Daily commerce cannot survive without technology. ITC is mostly used by entrepreneurial activities, multiple players

Community Information Centers (CIC)

A pilot project, entitled "Rural transformation by the establishment of community centers in the rural areas of Nepal", which was done by Sudip [27] highlights the role of CIC in improving life quality for people living in remote places.

In addition, Islam and Hoq [28] conducted a study on "Community Internet Access in Rural Areas: A study on Information Centers in Bangladesh". The study emphasizes the importance of CIC and its affect on user community. The two researchers assert that CIC is of paramount importance for the development of Bangladeshi society.

Devi, Meetie and Singh [29] also pointed out in the study "Community Information Centres and libraries in digital environment: a study of Manipur". They showed the major role of Community Information Centres and libraries and its impact on the user community in the state of Manipur, India.

On the study on "Community Information Centers: A Step to Bring Connectivity of the Rural Communities in Bangladesh", Islam and Islam [30] identified that community information centers will make easier community peoples life to enter information arena with an easy environment and help them to increase their skills, expertization in their respective fields.

Rural Library networking

Meitei and Devi [31] emphasize the vital role of ITC in information era and states that there is an urgent need of building "Rural Library Information Network System". A closer co-operation between government agencies, institutions, libraries and information centers would be essential for bridging digital divide in rural areas of Manipur (India)

Likewise, village information centers were implemented in Pondicherry, India. The study done by Jeremy [32] shows how the living conditions have changed/ improved thanks to ITC utilization.

Community Tele-centers

Another form of ITC which has been employed in Malaysia is community tele-centers. Ibrahim, Sulaiman and Faziharudean [33] examine the impact of the tele-centers on the underserved community. The result from questionnaire proves the effectiveness of these tele-centers and confirms that without ITC application, digital divide between the rural poor and the city dwellers.

Soriano's [34] study about "Exploring the ICT and Rural Poverty Reduction Link: Community Tele-centers and Rural Livelihoods in Wu'an, China" applied the 'Rural Livelihood' framework of analysis to explore the link between ICT and rural poverty reduction by analyzing the roles of community Tele-centers in enhancing the livelihood strategies of rural poor households in Wu'an, China.

3.3.2. Evidence from newspapers, journals, reports, television and radio in Vietnam

Since less than ten years, the scientific and technological information stations at communes/wards have got some remarkable success and contributed to the socio-economic development in rural areas in Dong Nai province.

Firstly, the newspapers, journals and television proved the role of these stations in socio-economic development in rural areas and helped reduce the gap in information and knowledge between rural and urban areas in Dong Nai province. The article entitled "*IT and advanced science and technology have been applied to rural areas in Dong Nai to serve economic and social development*" by Vietnamese Science Activities Review [35], showed that Dong Nai DoST has focused on building IT resources for serving agriculture and rural development under the motto

"Bringing science to your house, not to farmers to go away" and "Narrowing the digital gap between rural and urban" via the scientific and technological information stations in rural areas.

Secondly, the websites also asserted that these stations have brought science and technology for farmers to develop agriculture in rural areas and improved their lives**.** These websites also showed the role important of the state agencies and the station managers in managing and operation of these stations. On December 22nd, 2010, the news *posted* on the website of Vietnamese Farmers' Union entitled *"Bringing science to farmers"* by Xuan Dinh [36] cited that with the slogan "Door- to- door science and technology", Dong Nai provincial DoST promoted the information dissemination to farmers through setting up information station in the whole province.

Finally, the annual reports of station managers proved that the operation of these stations has brought great effects in rural development and improved local people's in rural areas via concrete examples of how people's lives have been changed. An annual report from Bao Binh commune in Cam My district gave an example farmer. Mr. Pham Thanh Dong saw films about the database of scientific and technological films, and then he applied new techniques of chicken breeding to my daily work in 2009. At the end of this year, his income was increased twice and his life has been improved since then. He would like to say thank to DoST who founded the station and the station managers who spread knowledge and information about science and technology [2].

3.3.3. Personal experience in evaluating the effectiveness of the station.

As a general manager of these stations, we highly appreciate the cooperation of the station managers in running the operation of the stations. Without their enthusiasm and creativeness, farmers as well as local people can not approach modern technology. Through annual workshops and seminars, the station

managers do their best to handle new skills in managing the station with the hope of attracting as many residents to the station as possible. Moreover, Dong Nai DoST as an executive organization makes much contribution to the success of the stations. They support the stations finance and provide latest news about science and technology to the station managers timely. Personally speaking, state agency plays a vital role in enhancing the development of the station, meanwhile the station managers are decision – makers the success or failure of the station.

4. Data analysis and findings

The following findings were taken out from the questionnaires from 1st July 2011 to 11th July 2011 by 92 scientific and technological information station managers at communes/wards in rural areas and interviews conducted on July 12th 2011 by 14 leaders working in Dong Nai province.

4.1. The critical factors in the efficiency of the operation of these stations

4.1.1. The popularity of the scientific and technological stations in rural areas

The first three questions in the questionnaire were focused on the number of people who have the demand of accessing or searching information from these stations. The responses of these questions showed that every month only 6% of the population came and to these stations and asked for information, meanwhile 15% of the whole population used the Internet at home to access. In relation to the average population of each commune/ward in Dong Nai province (about 14,000 inhabitants), the rate of local people visiting these stations is not very high. There are two reasons to explain for it. Firstly, some stations were not located in the community learning centers and far away from the residents' houses, counting for 35% responses of the station managers. Secondly, the local people are lack

of the information about the activities from these stations so the residents are doubtful of the benefits they will get from the stations, counting for 33% of the station managers.

4.1.2. The vital role of these stations as "a digital bridge between rural and urban areas"

With a fairly low number of people visiting these stations, question number four was made with the purpose of estimating what benefits that the users get from the scientific and technological information resources. Most of the station managers were of the opinion that the stations run efficiently and that they are effective in meeting the demands of the users. 13% of the station managers asserted that the users got a lot of benefits from these information resources. And 71% of station managers confirmed that the information from these stations supported for the local people's jobs as farmers. However, only 16% of the station managers did not rely on these information resources (see chart 1).
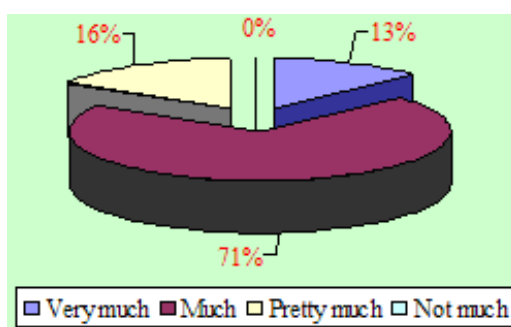

Chart 1. Do the scientific and technological information resoures supplies by the station meet users' demand?

In order to make sure of the types of the scientific and technological information resources that help change the local people's lives in these regions, question number five was made in the questionnaire. Based on the results of the findings, over 50% of the station managers agreed that all of the resources supplied by these stations met the users' demands. These stations are considered as rural technological electronic libraries where offer freely valuable scientific-technological sources serving research scientific and technological information, films about agricultural production, rural life and scientific, technical and technological documents and database of scientific, technical, consulting cultivation, breeding, education and health for local people. Digitalized information sources at these stations keep increasing to integrate. The information sources are listed in table 2 below**.**

Table 2. List of scientific and technological information sources at the station

Number	Name of S&T database
1	Database of 100 thousand scientific – technological questions and answers
2	Database of 21 fruit tree varieties with competitive and export advantages
3	Database of 200 questions and answers of diseases and pesticide use in crop plants
4	Database of 10 thousand scientific – technological films
5	Database of 700 rural technology films
6	Database of 2000 scientific films
7	Database of 150 specialist consultants in S&T Information
8	Database of 21 the fruit tree varieties with export and competitive advantages
9	Database of 20,000 indexes of master's and doctoral theses inside and outside the nation

Table 3. Types of media is most commonly used in station

Types of media	Percent
Books, newspapers and magazines	63%
Internet access station	63%
Websites of commune/ward	63%
Radio broadcasting	63%
Showing flims in public	63%

Source: by author

Mr. Nguyen Thanh Chin, Director of Dong Nai Center for Informatics and Scientific-Technological Information and a supplier, gave his opinion about the frequent database in an interview. Apart from the database systems, these stations have also used a lot of types of media such as Internet access station, radio broadcasting, website of communes, films show in public, and books, newspapers and magazines resources about scientific and technological fields in order to diffuse scientific and technological information to local people. Therefore, the objective of the question number six is aimed to sort out the types of media which are commonly used. 63% of the station managers said that their local people used the website of commune/ward to get information about price market, weather, and experiences in production. The same percentage of station managers asserted that radio broadcasting from loud speakers early in the morning helped farmers understand more about agriculture directly and timely (see table 3).

4.1.3. The achievements from these stations

Question number seven is aimed to evaluate the effectiveness of the operations of these stations in rural areas. The result of this survey showed that most of the station managers agreed on the effectiveness of these stations. 22% of the station managers affirmed that these stations have worked *very efficiently* and 70% of them stated that the operations of these stations were *fairly efficient*. The number of interviewees had the same opinion with the station managers. To make it clear, the station manager in Vinh Cuu district cited an example. He said that the productivity of rice in his region increased 20% compared to that last year. Therefore, the standard of living of Vinh Cuu people was improved and better than before. However, 8% of the station managers did not highly appreciate the effects of these stations. According to them, the local people only use these stations to entertain themselves or play games. No matter what different purposes the users have, the local people know how to use these stations in their own ways (see chart 2 below).
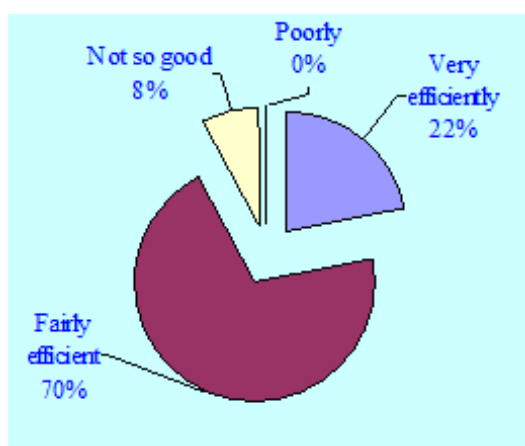

Chart 2. The effect of the station.

Source: by author

Because 92% of the station managers totally agreed on the operation of these stations, the question number eight was mentioned to know how much people's lives has been changed with the help of these stations. The result of this question seems to be optimistic. 87% of the station managers affirmed that their local people are able to apply modern techniques to agriculture, cultivation, production and raising cattle and poultry, and 61% of the station managers agreed that their local people know how to access the Internet to search for useful information. 60% of these station managers confirmed that residents know how to exchange information and share life and work experiences to enrich their lives and 71% of the station managers asserted that local people's material and mental lives have been improved (see table 4 below).

Table 4. How have People's lives changed by station?

People's lives have changed by station	Percent
Residents are able to apply modern techniques to their jobs	87%
Improving people's material and mental lives	71%
People know how to access the Internet	61%
Residents know how to exchange information and share their experiences	60%

In order to strengthen the dramatic effects of these stations, 100% interviewees agreed that theses stations play a vital role in rural development. Another interviewee, the station manager in Trang Bom district gave an example of a farmer. Mr. Nguyen Van Hung, a farmer at Xuan Bac commune, Xuan Loc district, said:

"I saw films about the database of scientific and technological films, and then I applied new techniques of chicken breeding to my daily work in 2009. At the end of this year, my income was increased twice and my life has been improved since then. I would like to say thank you to DoST who founded the station".

Two – third of station managers in Cam My district said that most of their local people agreed on the helpfulness of the station. They claimed that they now know how to apply news techniques to production, and animal husbandry.

The purpose of question number thirteen is aimed at illustrating these achievements. The findings showed that all of the station managers were eager of talking about the achievements they got from their stations. They gave concrete examples of how people's lives have been changed since the establishment of these stations. Mr Tran Quang Viet, a farmer of Xuan Hoa Commune in Long Khanh district, shared his experience in doing farming successfully. He said:

"After upgrading technical knowledge about pig breeding from the station, I decided to invest more in sheds, food, and health care to raise pigs. At present, my pig farm has been developed to 300 pigs, and my income is about one billion VND per year."

The model of Tan Trieu Pomelo Village in Vinh Cuu district is set as a good example for everyone to follow. At the end of 2004, Dong Nai DoST launched a station at Tan Binh commune, in which pomelo plantation accounts for the largest area in Vinh Cuu district in order to provide information of science and technology favourably, timely and effectively for farmers. To popularize Tan Trieu pomelo products in domestic and overseas markets, a website http://www.vacr-vinhcuu.com.vn was built in 2007. As a consequence, at the beginning of the year 2007, over 50,000 pomelos and 15,000 liters of wine of pomelo have been sold. It is expected that consumption volume of these products will reach over 100,000 pomelos and 25,000 liters of wine in the year.

Mr. Nguyen Duc Hien, a disabled person at Suoi Cat commune in Xuan Loc district, is an outstanding example. He has overcome difficulties and enriched for himself and

society. He accessed and searched useful information from the scientific and technological information station via Internet. He has learnt and approached new techniques in mechanical production fields. He established the Duc Hien Association for Disabled and created jobs for 286 employees who are disabled. Although the association's products are made by disabled persons, these products were sold in the market and got high awards in technology invention competitions in Dong Nai province such as "DH/K102 - Slow Generator", "A machine used to trap rats". He also got a golden cup at The Technology and Equipment Trade Fair (Techmart Vietnam in 2005).

These examples cited that the stations to some extent have got great achievements and made much contribution to changing the local people's lives. The point is that what factors made these stations successful?

4.2. Factors promoting the operation of these stations

To investigate the factors supporting the operation of these stations, question number nine was conducted. This survey determined that the vast majority 77% of the station managers concurred that the support of State organizations in terms of policies and mechanisms play an important role (see table 5 below). Director of Dong Nai DoST stated that every year, a big sum of money is invested in the station to upgrade the equipment. For example, Dong Nai DoST have built stations supplying high speed transmission line VSAT-IP from 2005 to 2010 for the scientific and technological information stations without ADSL service.

72% of the station managers affirmed that their enthusiasm, creativeness and responsibility in supplying useful and quick scientific and technological information to meet the local people's demands, is a vital factor to get success. The manager must be in constant touch with the needs and problems of the community they serve. They must have formal

as well as informal mechanisms for understanding how the community can make best use of the information that becomes available from their station. In this study, we have found that the ability and creativity of the station managers were crucial to the success of the stations. This finding is supported by other studies such as Mancini and Marek (2004) findings who stated that leadership and staffing competency are likely the primary "linchpins" in program success and sustainability.

51% of the station managers agreed on the use of the electronic office (M-Office) to operate, exchange experiences as well as information between grass root and local management. It is obvious that the station can not be a digital bridge without their cooperation (see table 5 below).

65% of the station managers from some stations agreed on their feasible areas where the users have the feeling of relax and friendliness. These above factors have brought remarkable effects for the users. Although these stations have got a lot of achievements they still have some limitations that hinder the operation as we will discuss in the next section (see table 5 below).

Table 5. Factors promoting to the operation of the station

Factors promoting to the operation of the station	Percent
The support of State Agencies	77%
The responisibility of the station manager	72%
The userful scientific and technological information resources	67%
Feasible location	65%
Using the electronic office (M-Office)	51%

Source: by author

4.3. Factors hindering the operation of these stations

Beside the positive factors promoting the operation of these stations, there are some factors that hinder the development of these stations at communes/wards, including support of local authority, location of the stations and

shortcomings of information. Question number ten focused on figuring out the reasons for these obstacles.

Firstly, local authorities do not give full support of money, qualified and relevant labor forces for these stations to work more effectively, which resulted in the problems of lowering effectiveness of these stations. 23% of the station managers agreed on the lack of support and interest of local authorities and 33% of these station managers found that lack of close collaboration between local organizations such as farmer association, woman association and youth union resulted in obstacles for development of these stations (see table 6 below). 28% of the station managers pointed at the low competence of the station managers at a few stations.

Secondly, the obstruction of operation of these stations is their location. 35% of the station managers showed that a few stations are located in inconvenient areas that are far away from local people's houses or not located in the community learning centers. Therefore, it is not easy to attract local people's attendance.

Thirdly, the obstacle lies in outdated and inappropriate information. 34% of these station managers showed that a few databases installed in these stations are not appropriate for the local's situation and meeting local people's demands in rural areas (see table 6 below). A leader of Dong Nai scientific management office said that a few database are not adequate for the local's farming conditions.

Therefore, the station managers must face a lot of difficulties in their management and operation. 29% of them agreed that poor equipment also hinders the development of these stations (see table 6 below). They said that they can not upload information on the commune/ward websites or have difficulty in collecting information.

4.4. The solutions to the issues

There are still some difficult problems in maintaining and multiplying the effects of these stations in rural areas, so there should be the solutions to these issues. It is also the purpose of the question number eleven and twelve. The survey showed that 100% of station managers supported the flowing opinions:

Firstly, the state organizations should do more support in terms of policies and mechanisms to promote the activities of these stations. They provide money and new, modern equipment for the stations every year.

Table 6. Factors hindering the operation of the station

Factors hindering the operation of the station	Percent
Inconvenient station' location	35%
Information resources do not suit for residents' demands	34%
The lack of close collaboration among local organization and information about the station' actives	33%
Poor equipments of station	29%
The low competence of the station manager	28%
The lack of support and internet of local authorities	23%

Source: by author

Secondly, local authorities should pay more attention to the operation of the stations. Increasing salaries and welfares for those who work at these places is one way to encourage and motivate them to work full time and in a long term.

Finally, the stations managers should be flexible in dealing with current and appropriate issues in managing the stations. Also, the station managers should frequently disseminate activities of these stations to local people to boost their benefits in rural development and attract more local people's attention.

All the interviewees at DoST agreed with the above solutions. Director of Dong Nai DoST stated:

"The project "the scientific and technological information stations at communes/wards in rural areas" should be

maintained and developed. The fund for these stations should rise up to 50% a year. The recruitment for a head manager in each district should be done so that he/she can help the station manger with development of science and technology. Besides, DoST has also strengthened the information resources which connect closely to satisfy users' demand in rural areas. They often organize a lot of workshops and contests for local people in these districts. Local governments should pay more attention to the operations at the station to guarantee good condition for the variety of activities at the station"

In conclusion, as an executive organization, Dong Nai DoST have the responsibilities for supervising and supporting these stations in terms of finance and investment. Being considered as the bridges between DoST and local people, local authorities should manage and create good conditions for these stations offering scientific and technological information to satisfy the need of users.

5. Conclusion and recommendation

This chapter presents the conclusions and recommendations, which are based on the major findings of the study in line with the research objectives. The conclusion involves a summary of the most significant issues and their perceived implications as found out in the study. The recommendations on the other hand are proposed purposely for enhancing the role of the scientific and technological information station in rural areas of Dong Nai province in the future.

5.1. Conclusion

With the advancement in community rural development, ICTs used as an instrument for dissemination of information for socioeconomic development is getting more and more popular. ICTs enable information to be disseminated and provide the opportunity for people to acquire information anytime, anywhere and about anything, which they can use to develop themselves socially, culturally and economically.

The result of this study showed that these stations play a pivotal role in rural development and experiences of these stations could be multiplied in many other places. These stations have got some dramatic achievements in enhancing socio-economic development and functioning as a common platform and network for rural community. According to many station managers, they can not get success in managing their stations without the support of State organizations in terms of policies and mechanisms. Their annual visiting and training workshops encourage and motivate station managers a lot. Their investment in equipment and machinery supports the station managers to do their jobs well. Moreover, the station managers themselves play a vital role in developing the stations. Their boundless enthusiasm, creativeness together with their responsibilities help the local people understand more about the activities of the stations and diffusion scientific and technological information to users quickly, timely and exactly. The finding also supports previous research by Norizan [37] analyzed and identified 6 factors namely community involvement, the local champions, the leadership of the telecentres' operators, management of telecentres, adequate infrastructure and local content which are equally important as access.

In general, these stations have formed a network of the scientific and technological information in rural areas and help the upgrading quality of human life. Great achievements from these stations proved their role as "bridging the digital divide" between urban and rural areas in Dong Nai province and they help guarantee the sustainable development in these areas and in the whole country.

The finding of Samuel et al. [38] has also been contributed towards understanding the extent to which ICT could be deployed in Nigerian disadvantaged communities to bridge the digital divide, focusing on internal factors and external factors. Firstly, internal factors in disadvantaged communities conclude ICT infrastructure provision, ICT centre management and Risks of ICT provision in rural communities. Secondly, external factors in disadvantaged communities include Influencing factors in ICT provision, Government policy on ICT provision, and Understanding causes of digital divide (see figure 3 below). According to this Figure, causes of the digital divide in disadvantaged communities may be coupled to the risks involved in providing ICT in the area. There is a clear indication that a committed management structure and appropriate ICT Government policies with suitable infrastructure would produce the desired benefits that would make ICT centres be disadvantaged communities sustainable.

The relevance and applicability of the finding of this study for other parts of Vietnam and the world is very high and practical for rural development via the application of ICTs for development in order to diffuse directly science and technology to local people and improve their lives.
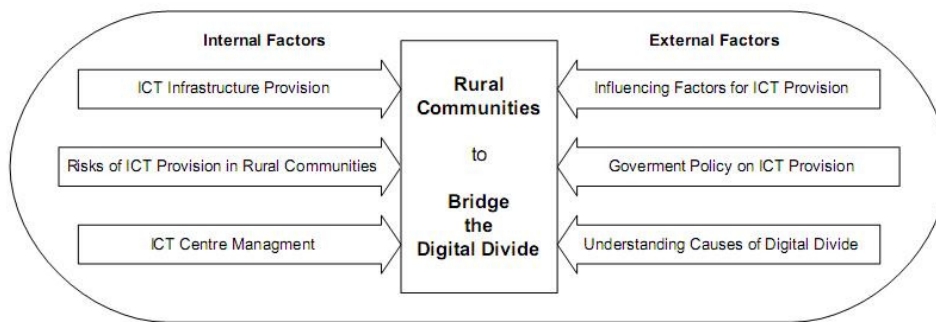

Figure 3. Influencing Factors towards a sustainable ICT model.

Source: International Journal of Education and Development using Information and Communication Technology (IJEDICT), 2005

Experiences and lessons learned from building the network of these stations

Many valuable experiences and lessons were learned from the foundation of these stations in several districts in Dong Nai province. First of all, the process of establishing these stations will be able to work better and more effectively if it is combined with relevant programs and projects that have been being carried out in the local areas for several years. If this combination is put into practice, local people's lives might be improved. Secondly, when being well-equipped with modern machines, these stations will attract resident's interests and closely cooperate with socio- economic organizations at grass root and provincial level in order to establish strong links with other organizations and mutual support in bringing science and technology to rural development. Finally, information resources had better be mobilized in many fields such as healthcare, education, trade, etc so that the users have many good chances of improving database recourses in these stations in rural areas.

5.2. Recommendations

The needs of scientific and technological information in rural areas in Dong Nai are very

huge, urgent and specified. Therefore, Dong Nai DoST had better promote scientific and technological information resources to serve these areas by consolidating and strengthening the position of agriculture as the foundation of the economy. Based on the results of the findings, we propose some recommendations to promote and multiply the effects of these stations in the future.

5.2.1. What should local authorities do?

Local authorities themselves have the responsibility for recruiting qualified and enthusiastic employees with high salaries and welfare to motivate and encourage them to do their jobs well. Their creativeness and enthusiasm will make much contribution to developing and maintaining the operation of the station. The station managers play important role of being a member of the network of scientific and technological information between DoST and the station, so the training courses should be done regularly to upgrade informatics and management skills. Sharing experiences in supplying information and managing the station among station managers is also necessary. Every quarter, there should be a seminar to exchange information among station managers.

5.2.2. What should Dong Nai DoST do?

Dong Nai should steadfastly make agriculture, rural areas, and farmers the top priority of the government's work, carry out agricultural modernization while deepening industrialization and urbanization, and consolidate and build upon the favorable situation in agriculture and rural areas. To do this, DoST should invest more money and modern equipment in the station so that local authorities can support the station as well as the station manager. They can make a budget for diffusing scientific and technological information in rural areas and maintaining the machinery.

To build the close relationship between leaders of districts and communes and the station managers in order to bring high effect in

the management of these stations is an urgent task to do. To do this well, DoST have to supply suitable information for each area to meet local people's demands and build a lot of useful and realistic scientific and technological database to enrich information resources.

DoST should also socialize in supplying S&T information in rural areas of scientific and technological organizations to create the equality for local people in exploring and using information of these stations. Therefore, socialization in supplying information for local people is a corn solution to maintain, develop and multiply the effects of the stations in the future.

DoST together with other departments/organizations in Dong Nai province concerned with agricultural development had better realize the potential of ICT for the speedy dissemination of information to local people, and promote the cooperation between the technical experts and agricultural experts because normally an agricultural expert usually doesn't know much information about new techniques, while a professional in technology has not enough knowledge about agriculture to give advice on various problems.

5.3. The academic implications of this thesis

This thesis shows the implementation of the program "Offering scientific and technological information to serve economic and social development in districts located in Dong Nai province" has contributed a great deal to enhancing socio-economic development and has improved the rural dwellers' lives. Therefore, we suggest that State agencies should make policies and strategies for science and technology development that will be suitable for rural and agriculture sustainable development. This study also concludes that the use of ICT in creating opportunities and developing potentials to increase revenue for the people and communities will positively drive the developing economies, and the

applications of ICT for development are believed to greatly contribute to solving the primary problems of countries: poverty reduction, sustainable development and the move towards a knowledge-based economy.

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Cầu nối thu hẹp khoảng cách số - vai trò của các Điểm Thông tin Khoa học và Công nghệ tại khu vực nông thôn của tỉnh Đồng Nai

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Tóm tắt: Kết quả của nghiên cứu này cho thấy rằng những Điểm thông tin khoa học và công nghệ (viết tắt là Điểm) đóng vai trò then chốt đối với phát triển nông thôn và dựa vào những kinh nghiệm này sẽ có thể nhân rộng các Điểm này ở nhiều nơi khác. Những Điểm này đóng góp nhiều thành tựu đáng kể trong việc thúc đẩy phát triển kinh tế - xã hội hội và tạo ra nền tảng, mạng lưới liên kết chung cho cộng đồng nông thôn. Những Điểm này đã hình thành mạng lưới thông tin khoa học và công nghệ trong khu vực nông thôn và giúp nâng cao chất lượng cuộc sống con người. Những thành tựu nổi bật đạt được từ những Điểm này đã chứng minh vai trò của chúng như làm "cầu nối thu hẹp khoảng cách số" giữa thành thị và nông thôn trên địa bàn tinh Đồng Nai và chúng giúp đảm bảo sự phát triển bền vững cho khu vực nông thôn của tỉnh Đồng Nai nói riêng và cả nước nói chung.

Từ khóa: Công nghệ thông tin và truyền thông, công nghệ thông tin và truyền thông dành cho phát triển (ICT4D) , thu hẹp khoảng cách, Điểm thông tin khoa học và công nghệ, khoa học và công nghệ, phát triển nông thôn.