MARKET ANALYSIS AND DEVELOPING A COMPETITIVE MARKETING STRATEGY FOR SELLING MEDICAL SOLID WASTE & WASTEWATER TREATMENT EQUIPMENT TO CUSTOMERS IN VIETNAM

LAHTI UNIVERSITY OF APPLIED SCIENCES
Master Programme in International Business Management
Master's Thesis
Winter 2011
Bui, Thien Toan

Lahti University of Applied Sciences
Master Programme in International Business Management

BUI, THIEN TOAN

Market Analysis and Developing a Competitive Marketing Strategy for Selling Medical Solid Waste and Wastewater Treatment Equipment to Customers in Vietnam

Master's Thesis, 156 pages and 8 appendices

Winter 2011

ABSTRACT

When sustainable development increasingly becomes the global trend, it is also the time that the developing world really demands for cleantech solutions from the western countries to resolve environmental problems it is encountering. In the writer's opinion, this is not just the supply-demand relation following the market principle purely, but for common benefits of human beings in our planet as well. From that perspective and in the hope that Vietnam will be prevented from dangerous infectious diseases, as well as environmental damages caused by hazardous hospital waste, this research has been conducted with respect to two research problems: 1. What is the market demand for hospital waste treatment solutions in Vietnam? 2. How can a western hospital waste treatment product manufacturer sell their products to customers in Vietnam successfully?

In order to get the research objectives done, the inductive approach and mixed methods research design are chosen. Theoretical discussions are associated with marketing management, competitive analysis, risk and stakeholder management, market entry mode and the Canvas business model. The empirical research has been carried out in 3 central cities and 9 provinces in the southern half of Vietnam. The primary data is collected through semi-structure and in-depth interviews with key stakeholders involved in this business in Vietnam.

The research results have shown that there is really urgent and large demand for hazardous medical solid waste and wastewater treatment equipment in Vietnam marketplace. Plus, the Vietnamese Ministry of Health just took a loan of $150 million for a nationwide hospital waste management and treatment performance improvement project from World Bank in 2011. This project is intended to be undertaken between 2011 and 2017 in accordance with the agreement between this ministry and the lender.

As a result, the market entry mode under the form of direct export to two local distributors, the detailed business model and the competitive marketing strategy have been proposed to the western hospital waste treatment products manufacturers.

Key words: healthcare, hospital, medical solid waste, medical wastewater, incinerator, CITENCO, DNURENCO, AIC, competitive, marketing strategy

CONTENTS

ACKNOWLEDGEMENTS

The most special thanks are sent to my parents and fiancée for giving me a chance to enjoy studying in this heaven. Also, I deeply understand that this research cannot be done without assistance of my beloved LUAS and people I have contacted during the field trip. Many thanks to Brett Fifield and Keith O'Hiobhaird – my respected teachers because both of you have taught me extremely useful knowledge and make me really mature. I love Finland from the bottom of my heart because you give unique things I cannot find out in anywhere else. Now I know how to be a globally responsible citizen for you, Finland. Finally, I always remember and thank potential helpers who will give a hand to help my home country treat hospital waste in a sustainable manner.

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

ADB	Asian Development Bank
AIC	Advanced International Joint Stock Company
APEC	Asia – Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
ATM	Automatic Teller Machine
B2B	Business to Business
CITENCO	Ho Chi Minh City Environment Company
DNURENCO	Da Nang Urban Environment Company
DOH	Department of Health
DONRE	Department of Natural Resources & Environment
DOST	Department of Science & Technology
EUROCHAM	European Chamber of Commerce in Vietnam
GDP	Gross Domestic Products
HCMC	Ho Chi Minh City
IMC	Integrated Marketing Communications
MOH	Ministry of Health
MoNRE	Ministry of Natural Resources and Environment
ODA	Official Development Assistance
OECD	Organization for Economic Co-Operation & Development
PEST	Political, Economic, Social, Technological
PR	Public Relations
ROI	Return on Investment
SME	Small and Medium – sized Enterprise
SWOT	Strengths, Weaknesses, Opportunities, Threats
URENCO	Urban Environment Company
UK	United Kingdom
US	United States
VS	Versus
WEF	World Economic Forum
WTO	World Trade Organization

1 INTRODUCTION

This chapter introduces key parts in the research generally. Firstly, *research background* explains where the research problem comes from and why it becomes meaningful and crucial for the target market. The second part expresses *research objectives, research questions and limitations* of the research. Next, the *theoretical discussion* part addresses theoretical concepts and tools utilized in the research. The following section represents *research approach and methodologies* which are applied in the periods of the desk research and of the empirical research. At the end of this chapter, readers can find an overall introduction of the *research structure*.

1.1 Research background

Why is hospital waste treatment business meaningful and crucial in Vietnam?

Located in Southeast Asia with a population of nearly 90 million people, Vietnam is one of the fastest-growth emerging markets in Asia during the last decade. However, the boom in economy and population while related supporting infrastructure systems development rate cannot meet current demand has brought this country many environmental challenges relevant to waste management, particularly the hospital waste treatment issue. Within this research, hospital waste consists of hazardous medical solid waste and wastewater generated by healthcare activities in medical facilities in Vietnam.

In fact, the environmental pollution caused by medical solid waste and wastewater is really serious in Vietnam so far. According to the report of the hospital waste management status up to 2010 by the Ministry of Health (MoH) and Vietnam Environmental Administration, the entire health system generates around 45 tons of hazardous medical solid waste per day. The growth rate of such waste is about 7.6%/year. Only 50% of hospitals sort and collect solid waste in accordance with regulations of the MoH. 35.9% of hospitals are treating hazardous medical solid waste by incinerators, 39.2% contract with local urban environment firms for

treating such waste, and 26.9% treat hazardous medical solid waste by hand-fired furnace or unsafe landfill inside the hospital's space (mostly district level general and special hospitals in the mountain areas). There are 253 two-chamber incinerators and 128 one-chamber ones installed. However, most of these incinerators become environmental pollution causing sources because they fail to meet requirements of air emission control, and have the low using effectiveness and efficiency (Vietnam Environmental Administration, 2010).

Meanwhile, the total amount of wastewater produced by healthcare facilities is approximately 150,000 m3/24 hours, excluded preventive medicine centers and pharmaceutical producers. It is estimated that the quantity of such wastewater will rise to 300,000 m3/24 hours in 2015. There are 809 hospitals (70%) demanding new equipment or upgrading the existing wastewater treatment systems. Among these, there are about 603 hospitals (63%) without wastewater treatment system yet, mainly provincial and district level hospitals. The majority of the existing wastewater treatment systems in hospitals fail to meet requirements of treatment capacity, and national technical regulations on healthcare wastewater (Vietnam Environmental Administration, 2010). For that reason, the wastewater discharged by healthcare establishments has been polluting the environment, particularly the underground water resource, and doing seriously harm to local people's health.

Hazardous medical solid waste usually comprises a broad range of materials from used needles and syringes to soiled dressings, body parts, diagnostic samples, blood, chemicals, pharmaceuticals, medical devices and radioactive materials. Hospital waste is very hazardous because it contains potentially harmful micro-organisms which can infect hospital patients, healthcare workers and the general public. Thus, both medical solid waste and wastewater need to be specially treated to remove threats of infected diseases from the public health.

From the point of view of doing responsible business and sustainable development, therefore, medical waste treatment business will resolve this current problem and make a significant contribution to the sustainable development of Vietnamese society in the future.

Why is the hospital waste treatment solution business worth conducting research on?

Recognizing dangerous characteristics and negative impact of hospital waste on the public health and the environment, the MoH imposed Decision No. 43/2007/QĐ-BYT in 2007 and Circular No. 7164/BYT-KCB in 2008 on enhancing the implementation and management of health care waste treatment. According to such legal documentation, hospitals and other health care establishments are requested to apply adequate medical solid waste treatment methods rather than open burning without air pollution control or landfill. Plus, in May 2009, the MoH released Decision No. 1873/QD-BYT on Health Sector Environment Protection Plan – Period 2009-2015 with specific objectives set as follows:

- 100% of national level hospitals and private healthcare establishments must treat hospital waste in accordance with environmental standards.
- 70% of provincial level hospitals and provincial level preventive medicine centers must treat hospital waste in accordance with environmental standards.
- 100% of district level preventive medicine centers and district level medical service centers must preliminarily treat hospital waste before discharging them into the environment.

Besides that, the World Bank has decided to grant the Vietnamese MoH a loan of 150 million US dollars for a nationwide hospital waste management improvement project in May 2011. This project is intended to be implemented between 2011 and 2017 in accordance with the agreement between this ministry and the lender (T.Huong, 2011).

Above information illustrates a substantial potential in Vietnam markets for medical waste treatment solution suppliers. Hence, it is really worth conducting research on ***Market Analysis and Developing a Competitive Marketing Strategy for Selling Medical Solid Waste and Wastewater Treatment Products to Customers in Vietnam Markets.*** The research aims to serve any sustainable medical waste treatment equipment manufacturers in the West who are interested in doing

this business in Vietnam, in particular members of Finnish Cleantech Cluster rather than a particular case company. Western businesses are usually famous for advanced technologies and meeting the triple bottom lines. Thus, it is believed that the success of the research not only proposes an attractive business opportunity to such producers, but also resolves healthcare waste-polluted problems that have been negatively affecting local citizens' heath as well as the environment in Vietnam. Furthermore, an attempt to bridge green business between the West and Vietnam is also embedded in this research.

1.2 Research objectives, questions and limitations

Two primary objectives of the research are:

- To evaluate the business opportunity of the medical waste treatment equipment business in Vietnam, and then
- To develop a competitive marketing strategy for the western medical waste treatment equipment manufacturers who want to enter this market.

In order to achieve those research objectives, the researcher needs to answer two following key research questions:

- What is the market demand for medical waste treatment solutions in Vietnam?
- How can a western medical waste treatment products manufacturer sell its products to customers in Vietnam successfully?

The two key research questions above can be answered by solving problems mentioned in following empirical research questions:

- What is the current hospital waste management context in Vietnam like? How do healthcare facilities deal with medical waste they have produced?
- How does a purchase process take place when a medical establishment needs to equip hospital waste treatment equipment? Who are participants in this process?
- Who are key medical waste treatment product suppliers in this market? What are their products/services? How do they approach and serve their customers?

- Who are key stakeholders involved in this business in Vietnam?
- What is the most reasonable entry mode for a western medical waste treatment equipment manufacturer to enter this market?
- What should a new entrant prepare to be able to be successful in this market?

If the empirical research questions create a 'map' so that the researcher can 'navigate' his activities during the field research period in the target market, following theoretical research questions will provide guidelines to concrete and useful literature that the research should review to make sure that everything is on the right way to gain the research objectives:

- Why is situation analysis crucial in doing business in a foreign market? How is it conducted?
- What are core factors in doing business to business?
- What are the role and the importance of segmenting and targeting a market? How to do that?
- Why should competitive analysis be done? What is included in competitive analysis?
- Why should stakeholder management and risk management be taken into account?
- How to decide a suitable entry mode? And how to design a business model for a foreign corporation to enter a foreign market?
- What are competitive advantage and marketing mix? How to combine them to create an effective competitive marketing strategy?

Limitations:

- At present, Vietnam has 64 different cities and provinces and they spread over more than 3000 km from the north to the south. Plus, travelling is time – consuming and risky in this country. In addition, the author has only two months and a half to undertake empirical research. So, the researcher can only access to key stakeholders, for example city/provincial level hospitals, district level hospital, regional clinics, urban environment firms, city/province departments of health (DoH), of Natural Resource and Environment (DoNRE), and department of Science and Technology (DoST) in the southern half of Vietnam,

including four main regions – the South Central Coast, the Central Highland, the Southeast, and Mekong Delta.

- The research ends at proposing the market entry mode and a competitive marketing strategy for selling the hospital waste treatment products to customers in Vietnam.

1.3 Theoretical discussion

Marketing management expertise and Michael E. Porter's competitive strategies insights are key theoretical discussions used in this research. These will provide a strong base to deal with three widely used central questions while developing a competitive marketing strategy:

1. Where are we now? – Phase 1
2. Where do we want to be? – Phase 2
3. How will we get there? – Phase 3 (Douglas West, 2010 p. 22)

In fact, phase 1 is the starting point of formulating any marketing strategy – *Environmental scanning*. The question no.1 will be answered well by using a scanning tool such as PEST to identify key factors of the macro environment where the business intends to enter.

Next, a company should realize that it is impossible to reach all customers in large, broad, or diverse markets. It needs to identify which market segments it can serve effectively (Kotler, et al., 2009 p. 225). By using theoretical discussions about *analyzing business markets, identifying market segments and targets*, *industry structure analysis, and selecting target market segments*, a company can know well where it wants to be.

After identifying the target market segments, it is crucial for a company to pay close attention to key stakeholders involved in this business. Realizing the role of each key stakeholder helps the new entrant design action plans to approach it ef-

fectively, as well as increase the influence on it and limit barriers or threats from it.

In order to answer the question no. 3 – How will we get there?, it should be based on all analysis earlier to choose the most reasonable *market entry mode* and develop a *competitive marketing strategy*.

These theoretical concepts and arguments come from major resources like books, journals and professional association websites relative to business and marketing management.

1.4 Research approach, methodologies and empirical research

The inductive approach and the mixed methods research design are selected to go about achieving the research objectives. Secondary data is mainly gathered from websites of the MoH, the MoNRE, DoH, DoNRE, Vietnam General Statistic Office, Vietnam Environmental Administration and local newspapers. Meanwhile, primary data results from the in-depth semi-structured interviews and in-depth interviews during the empirical research period.

Interview questions are organized in the form of a questionnaire and used for the in-depth semi-structured interviews with people in charge of healthcare facilities. These interview questions aim to:

- Identify the amount of hazardous healthcare solid waste and wastewater generated by each establishment. The figures found out will serve calculating and designing desired treatment capacity of products.
- Discover the hospital waste treatment equipment buying process to be able to approach key decisive participants in this process most effectively.
- Understand the end-user's degree of satisfaction with the existing hospital waste treatment solution and expectation to make the current situation better. Since then, unmet demand will be recognized to support developing the competitive marketing strategy.

- Support market segmentation.

Most of these interviews are usually ended by an open discussion so that the interviewees have a chance to tell the interviewer more about their expectation in respect to improving the quality of the existing hospital waste treatment solution, as well as other matters. A few interviews have been done via phone because of obstacles associated with traffic and time issues. The categories of the interviewed healthcare establishments are city/provincial level hospitals, district level hospitals and clinics, both general and special hospitals, and both state-owned and private sectors.

Similarly, another questionnaire is also prepared for the local urban environment companies (URENCOs) because some of them are now responsible for collecting, transporting and treating hazardous medical solid waste produced by healthcare facilities located in urban areas.

Regardless of the healthcare establishments and the urban environment firms above, the remaining stakeholders, for instance DoH, DoNRE and hospital waste treatment product suppliers, are interviewed under the form of the in-depth interview. The interviews with people in charge of DoH and DoNRE have revealed vital information relevant to the hospital waste treatment equipment buying process, the role and the influence of these departments on this business. Luckily, some DoH and DoNRE warmly provide the interviewer with latest reports on the current hospital waste management and treatment state in the city or province, detailed statistics of the quantity of hazardous medical solid waste and wastewater produced by all healthcare facilities under their direct management and monitoring. They even reveal actual action plans they have been preparing to submit to the MoH to ask for medical waste treatment system investment budget in the city or province.

Due to the limitation of the time fund and budget for the empirical research, as well as other objective causes, only one medical waste treatment product supplier – VINASECO is interviewed via phone. That is because this company is placed in

the north while the interviewer is living in the south of Vietnam. Intelligence about other competitors serving the purpose of competition analysis is collected from their websites, evaluations of related stakeholders and local newspapers.

Most interviews are tape-recorded. A few ones are taken notes because the interviewees disagree to be recorded. Contents of the interview are often transcribed and translated into English at the end of the interviewing day or weekend. Microsoft Excel software is utilized to build charts relevant to the amount of hospital waste generated by healthcare facilities, desired treating capacity of equipment, and monthly payment for operating existing incinerators on the basis of actual figures provided by the interviewees.

1.5 Research structure

The research consists of six chapters and appendices. Chapter 1 introduces the research background firstly, next the research objectives, questions and limitations, and then theoretical discussions. At the end of this chapter, the research approach and methodologies as well as the empirical research are also mentioned.

Chapter 2 is about theoretical concepts and discussions applied in the research. This chapter begins with the macro environmental scan. After that, knowledge of the institutional market is provided to discover core factors which need to be understood well when doing business in this market. Once the kind of the market that the company wants to enter is realized, insights of market segmentation help categorize potential market segments that the firm can take into consideration to serve. Next, findings from analyzing competition and the industry structure prepare the ground for evaluating the segments and then selecting the target segment to serve. After the target segment selected, it would be vital to deepen the nature of competition inside that segment with respect to lessons learnt from the strongest competitor’s success.

Next, Chapter 3 discusses the research approach and methodologies applied in this research. It shows the reason why the inductive approach is selected to conduct

the research rather than others. Also, it argues the necessity and unique benefits of utilizing the mixed methods research strategy, which combines quantitative and qualitative research to accomplish the research.

Chapter 4 deals with analyzing data gathered during the empirical research in respect to the sequence of theoretical discussions expressed in Chapter 2. According to that, scanning core macro environment factors of Vietnam comes first, then understanding the Vietnam health system, next the current medical waste management status in Vietnam, and uncovering the medical waste treatment equipment buying process. The following sections are Vietnam medical waste treatment markets segmentation, analyzing the industry structure according to Porter's Five Forces model, and evaluating and selecting the target segments to serve respectively. After that, the research deals with a deep competitor analysis in this segment to find out the best rival and its strengths and weaknesses. Finally, stakeholder and risk management is represented.

Chapter 5 is about recommendations based on the findings from Chapter 4. This chapter presents the market entry mode, the business model Canvas and the competitive marketing strategy recommended by the researcher.

Chapter 6 generalizes striking points of the research with respect to answering all the research questions and solving the research problems sequentially. In addition, it shows other markets where the research can be applied. Eventually, the future research is introduced.

At the end of this document, appendices are represented so that the reader can look for more specific information relevant to interviews conducted during the empirical research. In addition, some Vietnamese legal documents associated with this research are also provided to support the reader more.

2 THEORETICAL DISCUSSION

In practice, marketing follows a logical process. The marketing planning process consists of analyzing marketing opportunities, selecting target markets, designing marketing strategies, developing marketing programs and managing the marketing effort (Kotler, et al., 2009 p. 12).

When a business is established, it will definitely be affected by the marketing environment in which it operates and competes. Generally, the marketing environment consists of the macro environment and the micro environment.

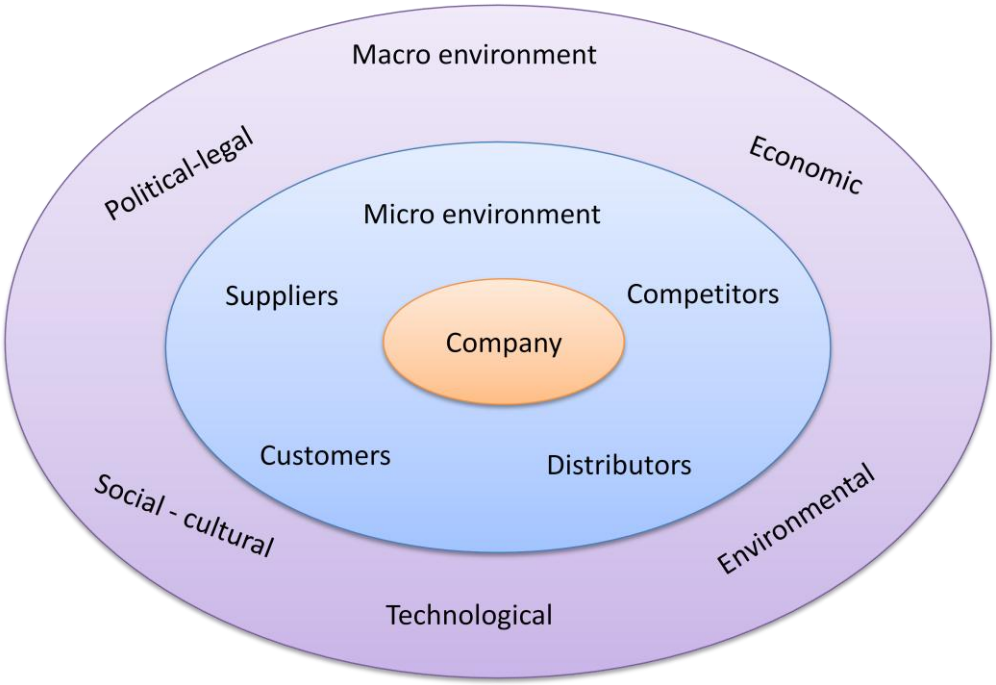

FIGURE 1. Marketing environment
Source (West, et al., 2010 p. 72)

To be successful, the firm must ensure a strategic fit between what the environment wants and what it has to offer, as well as between what it needs and what the environment can provide (West, et al., 2010 p. 72). Therefore, the first task in formulating a marketing strategy for a business is to have a strong understanding of the marketing environment in which it is operating.

2.1 Macro environment scan

The macro environment, also called the broad environment or the external marketing environment, includes five fundamental components: political – legal factors, economic factors, social – cultural factors, technological factors and natural environment. These groups of factors contain forces that can have a heavy impact on players' strategic decisions in different ways. Then the forces can produce trends and market needs which reveal the shape of the future as well as provide new opportunities. Also, these forces are uncontrollable and pose threats. Thus, the company must pay close attention to them so that it can make timely adjustments to their marketing strategies to become fit to new scenarios. If performing that carefully and successfully, the company will have more chances to be the winner in the game. That is because successful companies are the companies that recognize and respond profitably to unmet market needs and trends (Kotler, et al., 2009 pp. 15, 78, 79).

In the book named 'Emerging Markets – Lessons for Business Success and the Outlook for Different Markets", Nenad Pacek and Daniel Thorniley (2007) suggest an unique approach for collecting most crucial macro environment intelligence in emerging markets to prepare for a market entry as summarized in Table 1 below.

TABLE 1. Understanding the macro environment with respect to emerging markets

1. Understanding the political and economic environment	
Political outlook	What is the level of political risk and how will or might if affect the business?
Government policies and their impact on business	What is the quality of public administration and government bureaucracy? Is it an effective and efficient government to deal with? How quick is policy formulation and execution? How open is the government to foreign involvement in the economy? Does it encourage and even provide incentives for

	foreign investment? Does the government encourage free trade? Does it allow and even encourage non-tariff barriers? Does the government protect intellectual property? Who are the key government players at the federal, regional and city levels that can make or break plans for a business? (Pacek, et al., 2007 p. 34)
Economic outlook	How sustainable is economic growth? What is driving the economic growth? What are the exchange rate, interest and inflation rate like? (Pacek, et al., 2007 p. 33)
2. Understanding the business environment	
Financial market	How efficient is the banking system? Is it possible to finance operations locally or will it be necessary to rely on in-company finance or sources from abroad? Is it easy or difficult to transfer money within the country? How difficult is it to move funds or profits in and out of the country? What other potential sources of funding (development banks, government agencies, etc.) can be tapped into the project? (Pacek, et al., 2007 p. 35)
Labour market	How educated is the labour force? What are the main weaknesses of the labour force? Which areas will require most training? Is there any attempt to improve the current situation? What are the wage/salary rates for the employees who will be needed? (Pacek, et al., 2007 p. 35)
Taxation	What is the outlook for tax incentives for environmental technology equipment? What kind of organizational structure is the most advantageous in terms of taxation and local cost structure? (Pacek, et al., 2007 p. 35)
Legal framework	What is the legal environment outlook? Is there any hope that the local legal system will improve? If yes, how long will the process last? Can foreign companies rely on local commercial courts? What is the discrepancy between laws on paper and actual implementation? Is the discrepancy between interpretations of the same laws from province to province or from city

	to city? (Pacek, et al., 2007 p. 36)
Bureaucratic obstacles to business	What are the most common bureaucratic obstacles for the business? How easy or difficult is it to move goods through customs? How easy or difficult is it to set up business in the country? How long does it take and what is required? Is the any hope to improve the current situation? What is the level of corruption? How does it affect business? Is it getting better or worse? Who is corrupt? Which individuals and which government institutions? What is the transparency level?
Infrastructure	What is the quality of local transport infrastructure and telecommunications infrastructure?
Foreign trade environment	Is the country a member of WTO? If it is, how closely does it follow WTO rules? Does it belong to any trade blocs or regional free trade-areas?
Local culture	What specific aspects of local culture that should be taken into consideration to do local business successfully?

Source: Adapted from Chapter 3- Market Entry Preparation, Emerging Markets – Lessons for business success and the outlook for different markets, Nenad Pacek and Daniel Thorniley, 2007.

2.2 B2B market environment

Introduction to the Business Market (B2B market)

Kotler and Amstrong (2001) define the business market that includes organizations buying goods and services to produce other products or services that are sold, rented or supplied to others. It also comprises retailing and wholesaling firms that acquire goods to resell or rent to others. However, this definition has become too narrow in the scenario of the global economic development recently. According to Jim Blythe and Alan Zimmerman (2005), customers who are institutions like hospitals, schools, charities and government organizations also joint to make up the business market. The business market consists of not just physical

products but services as well. In fact, businesses, governments, organizations and institutions buy virtually every product and service.

Kotler, et al., (2009) addressed several characteristics of B2B markets that contrast sharply with those of customer markets as follows:

- *Fewer and larger buyers* – This feature results from the fact that the amount of business buyers is far fewer, but the size of each purchase order is usually much larger than those in customer markets.
- *Close supplier-customer relationship* – Because of the smaller customer base and the importance as well as power of the larger customers, suppliers are frequently expected to customize their offerings to individual business customer needs. Business buyers often select suppliers who also buy from them.
- *Professional purchasing* – Businesses usually establish their own purchasing policies, constraints, and requirements which suppliers must follow them, for example, requests for quotations, proposals, and purchase contracts.
- *Multiple buying influences* – Business buying decisions are typically influenced by many people. Business buying committees including technical experts and even senior managers are common in the purchase of major goods. In this case, only well-trained sales forces can deal with the well-trained buyers.
- *Multiple sales calls* – Because more people are involved in the organizational buying process, sales teams need to make multiple sales calls to be able to win business orders. Some sales cycles can take years, so suppliers must be patient and make a lot of attempts to pursue targeted objectives.
- *Inelastic demand* – The total demand for plenty of business goods and services is not much affected by price changes.
- *Fluctuating demand* – The demand for business goods and services tends to be more volatile. A percentage increase in customer demand can lead to a far larger percentage rise in business demand.
- *Geographically concentrated buyers* – Business buyers tend to be concentrated in certain regions. This characteristic helps to reduce selling costs. Si-

multaneously, business marketers need to monitor regional shifts of certain industries.

- *Direct purchasing* – Organizational buyers often buy directly from manufacturers rather than through intermediaries, in particular goods that are technically complex or expensive (Kotler, et al., 2009 pp. 196-198).

Based on many years' experience, Jim Blythe and Alan Zimmerman (2005) come with another striking feature of B2B markets that buyers sometimes also purchase to avoid penalties from government regulators or negative publicity from activist groups. Thus, B2B marketers should pay very close attention to meeting local government's regulations so that they can design the most effective B2B marketing programs when doing international business (Blythe, et al., 2005 p. 4).

Understanding B2B customers

Hooley et al.,(2008) suggest six core question to understand B2B customers as illustrated in Figure 2 below.

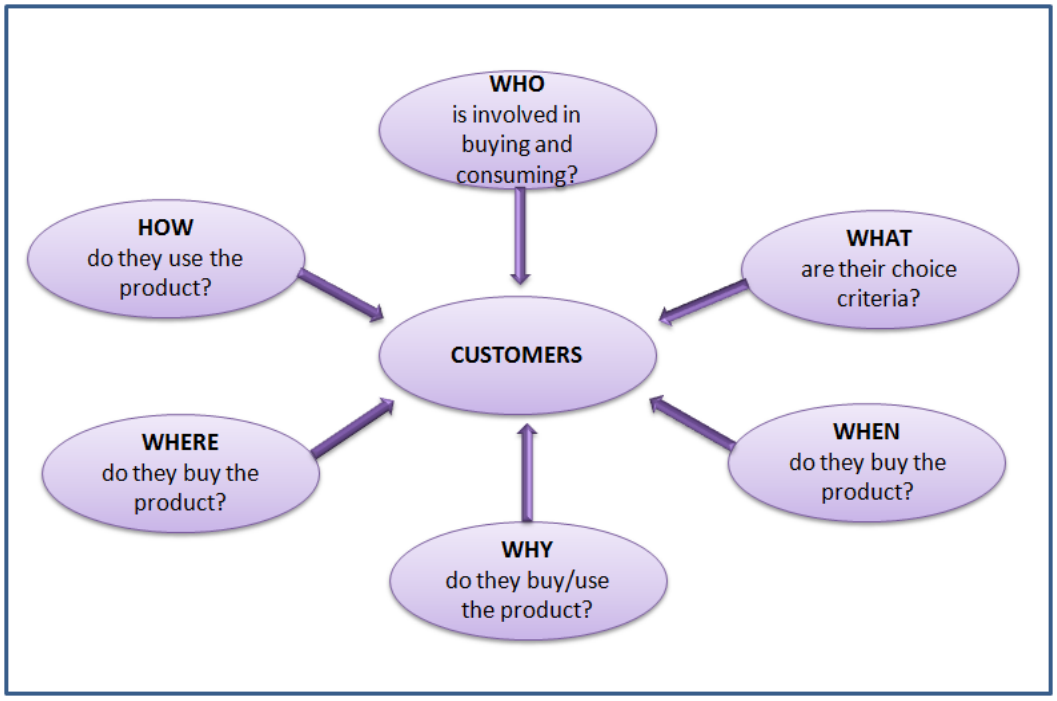

FIGURE 2. Understanding customers - Key questions

Source: (Hooley et al., 2008 p. 96)

Finding the clear answers for these questions will provide the marketer with a bright picture to be able to approach the customer effectively.

What is Organizational Buying?

Webster and Wind define *organizational buying* as the decision making process by which formal organizations establish the need for purchased products and services and identify, evaluate, and choose among alternative brands and suppliers (Kotler, et al., 2009 p. 196).
The number of decisions in making a purchase the organizational buyer faces depends on the *buying situation*. Robinson and others distinguish three types of buying situations: the straight rebuy, modified rebuy, and new task (Kotler, et al., 2009 p. 198). B2B marketers should take into consideration the buying situations to prepare appropriate reactions.

- The *straight rebuy* is the situation where the purchaser re-orders the same products from the same suppliers. In this circumstance, the buyer makes the fewest buying decisions, needs no new information from in-suppliers, as well as does not need to engage in much negotiation. For 'out-suppliers', they need to offer something new or to exploit dissatisfaction with a current supplier. They should try to get a small order first to build a relationship with the buyer and then enlarge their purchase share over time (Kotler, et al., 2009 p. 198; Blythe, et al., 2005 p. 24).
- In the *modified rebuy* case, the buyer re-evaluates its habitual buying patterns in a hope of improvement. Product specifications, prices, delivery requirements, other terms, or even the supplier may be changed. These changes may result from the fact that the buyer becomes aware of better alternatives than ones currently employed through environmental scanning or marketing activities by out-suppliers. Hence, this may be an opportunity for out-suppliers to gain some business by proposing a better offer (Kotler, et al., 2009 p. 198; Blythe, et al., 2005 p. 24).
- *New task* – This type of buying situation takes place when the purchaser buys a product or service for the first time. New-task buying may pass through sev-

eral stages: awareness, interest, evaluation, trial, and adoption. This forces the buyer to face a complex decision making process. As a result, the new-task buying requires the greatest amount of effort and the greatest involvement of individuals at all levels of the organization (Kotler, et al., 2009 pp. 198-199; Blythe, et al., 2005 pp. 24-25).

From the viewpoint of the B2B marketers, this buying situation brings them main chances of winning new customers. In order to win the game, the marketers have to firstly utilize communication tools like the mass media, salespeople, technical sources, etc. at each stage of this buying behavior effectively; secondly try to reach as many key participants in the decision making process as possible; and provide such participants with helpful information and assistance (Kotler, et al., 2009 pp. 198-199).

Organizational buying behavior

For marketers, it is vital to understand the organizational buying behavior. Because B2B customers operate in the environment, their buying behavior is influenced by some or all of environmental factors. Loudon and Della Bitta (1993) point out environmental influences on the buying behavior as follows:

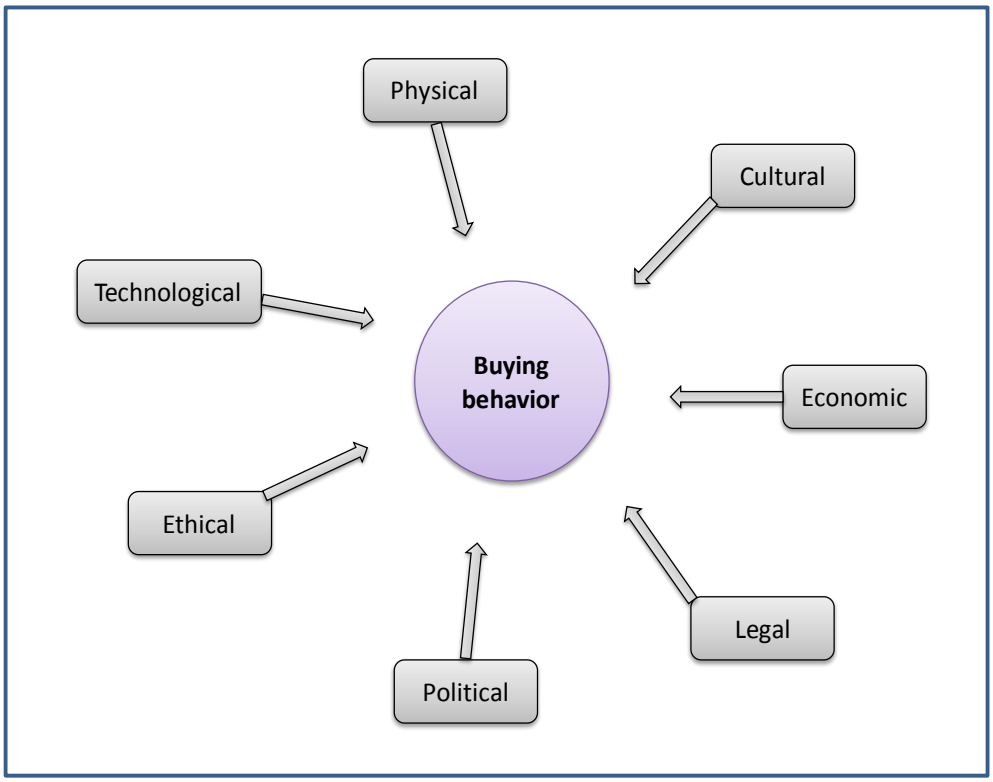

FIGURE 3. Environmental influences on organizational buying behavior
Source: Jim Blythe and Alan Smith 2005

- *Physical influences* – Many organizational buyers prefer to work with local suppliers because they may want to support local partners, or may prefer to deal with people from the same cultural background and inside their national boundaries to limit certain disadvantages (Blythe, et al., 2005 p. 18). Therefore, foreign newcomers need to take these into account to plan solutions.
- *Technological impact* – The level of technological development available among local suppliers will affect what buyers can obtain. Thus, the technology of sellers and buyers must be compatible.
- *Ethical influences* – Normally, organizational buyers are expected to act at all times for the benefit of organization rather than personal gain. In most cultures, giving a bribe is unethical or illegal, especially after the OECD Anti-Bribery Convention has been widely adopted. However, in some Asian emerging markets like China, India and Vietnam where corruption among political officials and businesspeople is rife, bribery is the normal way of doing business. Refusing to give a bribery is likely to loose the business

(Kotler, et al., 2009 p. 96; Blythe, et al., 2005 p. 19). Marketers should pay close attention to these issues.

- *Political influences* – In international trade, trade sanctions, trade barriers, specially non-tariff barriers, preferred-nation status and so forth all affect the way in which buyers are permitted or encouraged to puchase. In some cases, domestic businesses receive certain assistance from governments (Blythe, et al., 2005 p. 19). Foreign suppliers need to know these well to deal with local competitors.
- *Legal influences* – Regulations of specific technical standards heavily affect buyers' decisions, in particular in purchasing technical equipment. Vendors can obtain a competitive advantage by anticipating changes in laws (Blythe, et al., 2005 p. 19).
- *Economic influences* – The level of demand in the economy and the current taxation regime within buyers' countries influence buyers's abilities and needs (Blythe, et al., 2005 p. 19).
- *Cultural influences* – When doing international business, cultural influences come to the forefront. Corporate culture also expresses its ethical stance and attitudes towards suppliers among other things. In addition, participants involved in the organizational buying process tend to act in accordance with their own culture (Blythe, et al., 2005 p. 19). Potential suppliers should pay special attention to these matters to design an appropriate approach.

  Besides that, organizational factors like organizational policies, procedures, structure, systems of towards, authority, status and communication systems will affect B2B buyers relate to salespeople (Blythe, et al., 2005 p. 19).

How does the organizational purchasing process take place?

After gaining concrete information about the organizational buying behavior, B2B marketers need to understand how an organizational purchasing department works. The purchasing process will vary depending on the types of products involved. Robinson and Associates introduced a model called the *Buygrid Framework* which describes eight stages in the industrial buying process. These stages are called buy-phases.

TABLE 2. Buygrid framework

		Buying situations (Buy-classes)		
		New-task	Modified-rebuy	Straight-rebuy
Major stages (Buy-phases)	1. Problem recognition	Yes	Maybe	No
	2. General need description	Yes	Maybe	No
	3. Product specification	Yes	Yes	Yes
	4. Supplier research	Yes	Maybe	No
	5. Proposal solicitation	Yes	Maybe	No
	6. Supplier selection	Yes	Maybe	No
	7. Order-routine specification	Yes	Maybe	No
	8. Performance review	Yes	Yes	Yes

Source: Adapted from (Kotler, et al., 2009 p. 204; Blythe, et al., 2005 pp. 24, 25))

The buying process begins when someone in the organization recognizes a problem or need that can be met by acquiring a good or service. At this stage, business marketers can stimulate problem recognition by direct email, telemarketing, and calling on prospects. Next, the buyer determines the needed item's general characteristics and required quantity. At this moment, business markets can help by describing how their products meet or even exceed the buyer's needs. Now an organization's engineering team is assigned to develop the item's specifications. If there is no technical department in the organization, the buyer can utilize outside reliably qualified consultancy services. Writing specifications precisely is crucial because it allows the buyer to refuse components that fail to meet specified standards. Then the organization tries to identify the most appropriate suppliers. Now is time for B2B marketing activities by suppliers. Several effective communication tools at this time are the mass media, trade shows, trade advertisements, the internet, word-of-mouth throughout business network, etc. The buyer next invites qualified suppliers to submit proposals. After evaluating proposals, only a few qualified suppliers are invited to make formal presentation. B2B marketers must be trained skills in researching, writing and presenting proposals. After that, selecting a supplier is based on certain attributes such as delivery terms, price, supplier reputation, product reliability, service reliability, supplier flexibility and oth-

er matters which depend on the type of buying situation. In addition, the buyer may also attempt to negotiate with preferred suppliers for better prices and terms before making the final selection. To overcome price pressures, B2B marketers may provide evidence that the 'total cost of ownership' of using their products is lower than that of rivals' products. After selecting suppliers, the buyer negotiates the final order, listing the technical specifications, the quantity needed, delivery time and terms, return policies, warranties, etc. Finally, the purchaser periodically reviews the performance of the chosen supplier(s) (Kotler, et al., 2009 pp. 204-212; Blythe, et al., 2005 pp. 24-25).

Who are participants in the organizational buying process?

As illustrated earlier, the organizational buying decision making process usually relates to some or many individuals. To target their efforts properly, B2B marketers have to figure out: who are the major decision participants? What decisions do they influence? What is their level of influence? What evaluation criteria do they use? (Kotler, et al., 2009 p. 201)

Webster and Wind (1972) called the decision making unit of a buying organization the *buying center*. The buying center consists of 'all individuals and groups who takes part in the purchasing decision making process, who share some common goals and the risk arising from the decisions'. The buying center includes:

- *Initiators* – Users, or someone who recognizes the problem, or others in organization who requests something be purchased.
- *Users* – Those who use the product or service, and also help define the product specifications. Business marketers should develop the relationships with the users to collect information for anticipating problems or needs, as well as let them know about related suppliers' products.
- *Influencers* – People who influence the buying decision. Technical personnel are particularly important influencers. They often assist to define product specifications and provide information for evaluating alternatives. Potential suppliers need to build a strong relationship with the influencers and actively provide them technical documents about suppliers' products. This will bring the

suppliers certain advantages when the organizational buyer prepares product specifications.

- *Deciders* – People who decide on product requirements or on suppliers. Out-suppliers need try their best to approach these people. It is very vital to build strong relationships with the deciders and show them evidence that the supplier is more qualified than other competitors in terms of supplier evaluation criteria set by the organizational buyer.
- *Approvers* – People who authorize the proposed actions of deciders or buyers. Because the approvers are often top managers and rather hard to reach, business marketers may influence them by distance-communication tools like the mass media, reputation, brand names, or word-of-mouth throughout business network.
- *Buyers* – Those who have formal authority to select the supplier and negotiate purchase terms. In more complex purchases, the buyers might include high-level managers in the organization. It is crucial for business marketers to have a close relationship with these buyers. The major role of these buyers is bargaining purchase terms. Therefore, suppliers need to prove that their offerings are flexible enough and even exceed benefits the buyer expects. In this situation, suppliers had better allocate their most skillful salespeople to deal with partners.
- *Gatekeepers* – People who have power to prevent sellers from reaching members of the buying center. They may be procurement/purchasing agents, receptionists, and telephone operators. This may be considered 'the first gate' that business marketers need to pass so that they can reach 'next key gates' in the organizational buying decision making process. Thus, salespersons should normally set relationships with them (Kotler, et al., 2009 pp. 200-201; Blythe, et al., 2005 p. 17).

The buying center may include people outside the target customer organization, such as government officials, consultants, technical advisors, and other members of marketing channel (Kotler, et al., 2009 p. 201).

Eventually, even though some organizational buying process is established, buying decisions are still made by human beings within that organization. Thus, it seems unrealistic to suppose that decision makers do not have some emotional or irrational input in their decision making (Blythe, et al., 2005 p. 16). This approach may make potential suppliers more confident when they enter a new market in which even a close business buyer – supplier relationship has been existing. As long as out-suppliers are qualified and match their efforts to right members of the decision making process, they can completely win the job.

2.3 Segmenting and targeting B2B markets

A company cannot reach and serve all its customers well in wide markets. Thus, market segmentation should be performed. The market segmentation is vital for a company's success. Dividing the market up into reasonable segments is just a starting point. The firm must then plan for effectively targeting those identified segments (West, et al., 2010 p. 152). A market segmentation and targeting process is depicted as Figure 4 below.

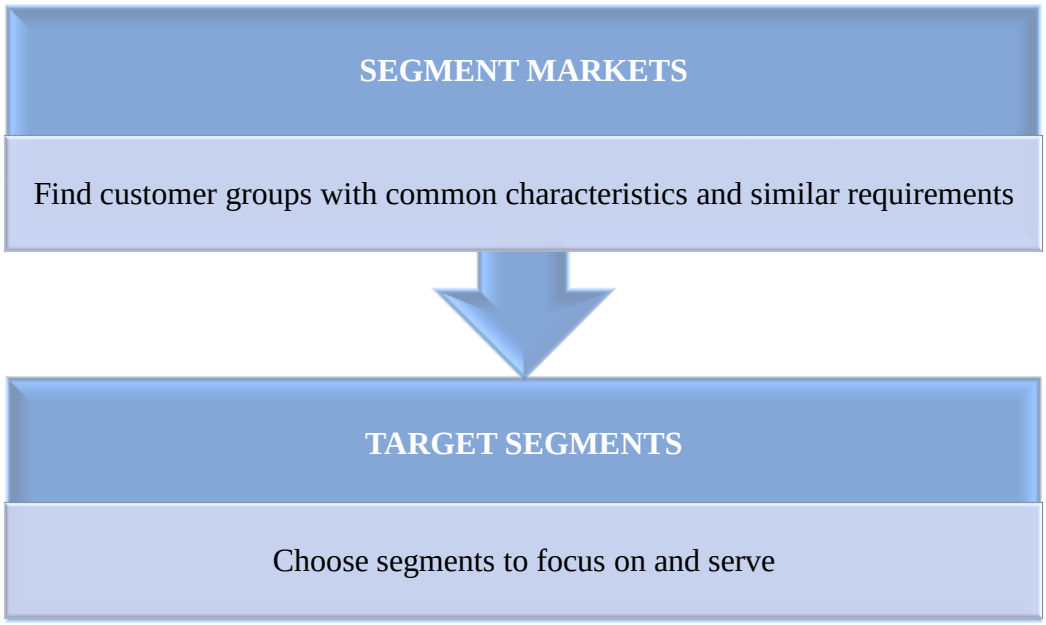

FIGURE 4. Market segmentation and targeting process

Source: Adapted from Kotler (2003), according to Jim Blythe and Zimmerman (2005)

This process will be explained specifically in the next sections.

B2B market segmentation

What are the importance and benefits of segmenting markets?

Since Wendell Smith described the idea of market segmentation in 1956, firms have begun to choose the most profitable groups of customers to target. Market segmentation is about dividing markets into segments with similar buying characteristics and requirements, then finding out and serving the most rewarding customers. If a company is able to offer a unique set of benefits to a particular market segment, it will have gained a significant competitive advantage (Blythe, et al., 2005 p. 85).

Effective and successful market segmentation produces a number of important advantages for a firm. First, by determining the most rewarding segments, the firm can develop specific marketing strategies for one or a number of identified segments. It means that product/service offering, the pricing, the promotion and the distribution will be tailored to satisfy each segment. Since then, the company can gain a stronger competitive position and properly allocate its budgets in related activities. Second, it allows target markets to be matched to the company's competencies, and that a smaller company can also create a defensible niche in the market. Third, it helps the firm identify gaps in the market and figure out unmet or underserved segments which can serve as targets for new product development or extension of the existing product or service range. Fourth, good market segmentation may illustrate specific segments that are still in growth in mature or declining markets. Finally, once the segments are clearly identified and the marketing process begins, the firm can monitor and evaluate the success of these efforts, as well as re-allocate or re-segment as necessary (Blythe, et al., 2005 p. 85; Kotler, et al., 2009; Hooley, et al., 2008 p. 232).

What are variables for segmenting B2B market?

Bonoma and Shapiro proposed major segmentation variables for the B2B market as depicted in Table 3 below. The variables are placed in accordance with decreasing degree of importance in segmenting. The table also illustrates key relative questions that B2B marketers need to ask in determining which segments and customers to serve (Kotler, et al., 2009 p. 248).

TABLE 3. Major segmentation variables for the B2B market

Demographic characteristics	
1.	*Industry*: Which industries should we serve?
2.	*Organization size*: What size organization should we serve?
3.	*Location*: What geographical areas should we serve?
Operating variables	
4.	*Technology*: What is the customer's stage of technology development? Which technologies should we serve?
5.	*User or non-user status*: Should we serve heavy users, medium users, light users, or no-users?
6.	*Customer capabilities*: Each B2B customer may significantly differ from another in terms of their capabilities. Hence, each one demands for different types of supplement or collaboration services at a different level. So should we serve customers needing many or few services?
Purchasing approaches	
7.	*Purchasing organization*: Centralized purchasing may require suppliers to have ability to operate national account management, while decentralize may require more extensive field sales operation. Hence, should we serve centralized or decentralized purchasing organizations?
8.	*Power structure*: Should we serve organizations that the engineering power dominated, or financially dominated, and so on?
9.	*Nature of existing relationships*: Should we serve organizations with which we have strong relationships, or simply go after the most desirable companies, or so on?
10.	*General purchasing policies*: Should we serve organizations that prefer leasing? Service contract? Systems purchases? Sealed bidding?

11.	*Purchasing criteria*: Should we serve organizations that are seeking quality? Service? Price?
Situational factors	
12.	*Urgency*: Should we serve organizations that need quick and sudden delivery or service?
13.	*Size of order*: Should we focus on large or small order?
Personal characteristics	
15.	*Attitudes toward risk*: Should we serve risk-taking or risk-avoiding customers?
16.	*Loyalty*: Should we serve B2B customers that show high loyalty to their suppliers?

Source: Adapted from Thomas V. Bonoma and Benson P. Shapiro according to Kotler, et al., 2009; Hooley, et al., 2008; Blythe, et al., 2005.

Targeting market segments

Once a company has recognized possible market segments, it has to evaluate the segments, decide how many target segments should be chosen, and then how to target them. That is because not all segmentation schemes are useful and suitable to its capability.

According to Hooley et al., (2008), factors affecting the market segment attractiveness are summarized in Figure 5 below.

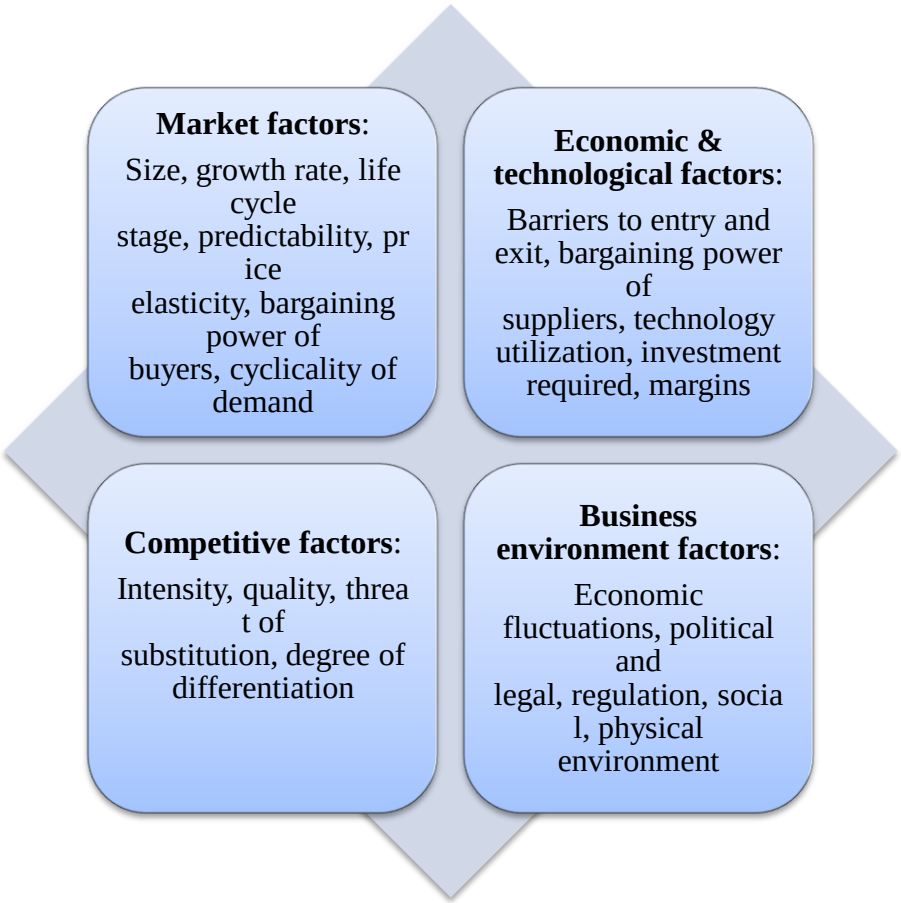

FIGURE 5. Factors affecting the market segment attractiveness

Source: Adapted from Hooley et al., 2008 & Kotler et al., 2009

It is easy to realize that the majority of factors suggested in Figure 5 can be found in Porter's Five Forces model for analyzing the competitive environment. Therefore, the application of Porter's model here is absolutely reasonable.

Industry competition analysis – Porter's Five Forces Model

According to Porter's point of view, competition in an industry depends on five basic competitive forces including customers (buyers), suppliers, potential entrants, substitute products and competitors. The extended rivalry that results from all fives forces defines an industry's structure and shapes the nature of competitive interaction within an industry.

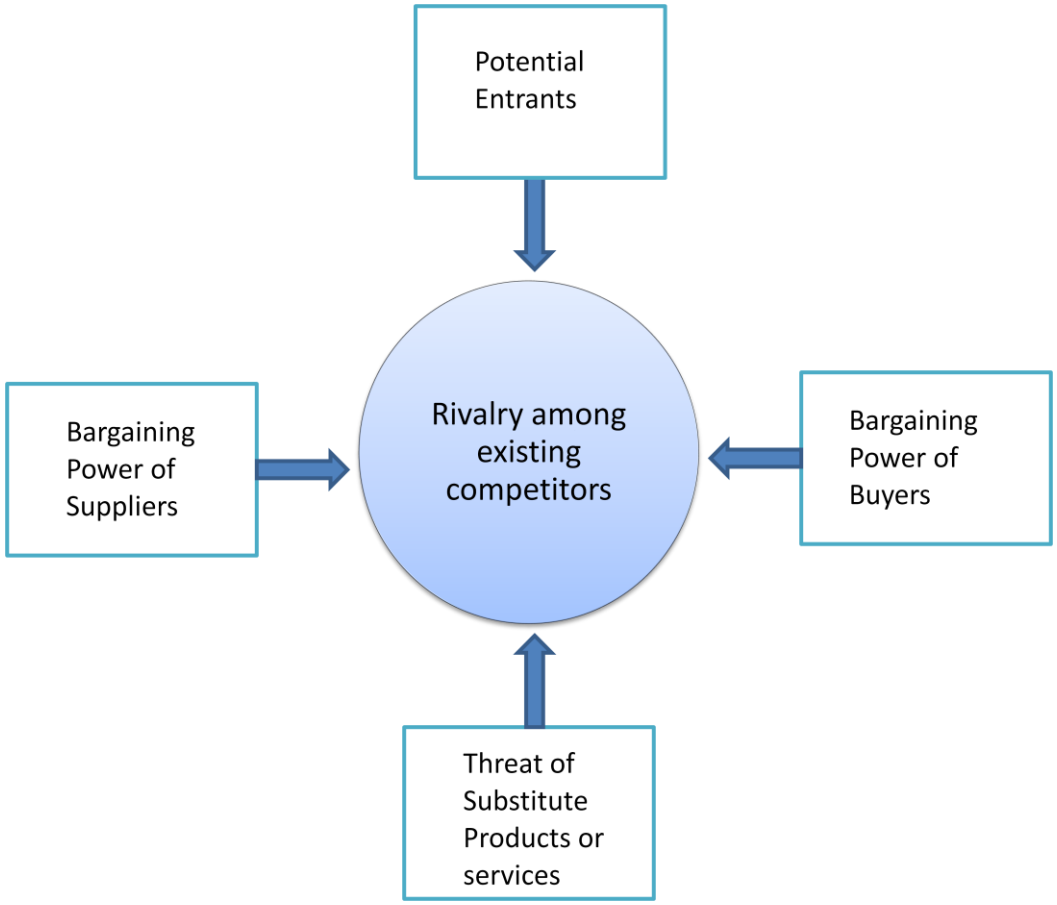

FIGURE 6. The five forces that shape industry competition

Source: Adapted from Michael E. Porter (2008)

1. *THREAT of ENTRY*

   The threat of entry in an industry depends on the height of entry barriers. Entry barriers are advantages that incumbents have in relation to new entrants. Such advantages can be found in seven major sources, including supply-side economies of scale, product differentiation, capital requirements, access to distribution channels and government policy (Porter, 2008 pp. 8-12)

2. THE POWER of SUPPLIERS

   According to Porter's opinion, a supplier group becomes powerful if:

   - It is more concentrated than the industry it sells to.
   - It does not depend heavily on the industry for its revenues. However, if a particular industry accounts for a large portion of a supplier group's

volume or profit, suppliers will want to protect the industry through reasonable pricing and assist in research and development activities.

- Industry participants face switching costs in changing suppliers. When switching cost are high, industry participants find it hard to change to another supplier.
- Suppliers offer products or services that are differentiated.
- There is no substitute for what the supplier group provides.
- The supplier group can credibly threaten to integrate forward into the industry (Porter, 2008 pp. 13-14).

3. THE POWER of BUYERS

The power of buyers results from the fact that they have negotiating leverage relative to industry participants. A customer group has negotiating leverage if:

- There are few buyers, or each one purchases large volume in relation to the size of a single vendor.
- The industry's products are standardized or undifferentiated. So, buyers can always find an equivalent product.
- Buyers face few switching costs in changing vendors.
- Buyers can credibly threaten to integrate backward and produce industry's product themselves if vendors are too profitable.

A buyer group is price sensitive if:

- The product it purchases from the industry represents a significant proportion of its cost structure or procurement budget.
- The buyer group earns low profits, is strapped for cash, or is otherwise under pressure to trim its purchasing costs.
- The quality of buyers' products or services is little affected by the industry's product.
- Buyers focus on price (Porter, 2008 pp. 14-16)

4. THREAT of SUBSITUTES

Porter (2008) defines a substitute as performance of the same or a similar function of an industry's product by different means. Substitutes are always present, but very different from the industry's product. Substitute products or services limit an industry's profit potential by placing a ceiling on prices. The threat of a substitute is high if:

- It offers an attractive price-performance trade-off to industry's product. The better the relative value of the substitute, the tighter is the lid on an industry's profit potential.
- The buyer's switching costs to the substitute is low.

Porter also suggested that strategists should be particularly alert to changes in other industries, especially technological changes that may make them become attractive substitutes when they were not before (Porter, 2008 pp. 17-18).

5. RIVALRY AMONG EXISTING COMPETITORS

Several familiar forms of rivalry among existing competitors mentioned by Porter (2008) comprise price discounting, new product introductions, advertising campaigns, and service improvements. High rivalry limits the profitability of an industry. According to Porter's view, the degree of rivalry depends, first, on the intensity with which companies compete and, second, on the basis on which they compete.

The intensity of rivalry is greatest if:

- Competitors are numerous or are roughly equal in size and power. In such situations, rivals find it hard to avoid poaching business.
- Industry growth is low. Slow growth causes fights for market share.
- Exit barriers are high. Exit barriers, the opposite side of entry barriers, arise because of highly specialized assets or management's devotion to a particular business. They keep companies operating even though the companies may be earning low or negative returns.
- Competitors are highly committed to the business and have aspirations for leadership, especially if they have goals that go beyond economic performance in the particular industry. (Porter, 2008 pp. 18, 19)

Price competition likely occurs if:

- Rivals offer nearly identical products or services, and there are few switching costs for buyers. This encourages competitors to cut prices to win new customers.
- Fixed costs are high and marginal costs are low. This creates intense pressure for rivals to cut prices below their average costs to steal incremental customers while still making some contribution to covering fixed costs.
- Capacity must be expanded in large increments to be efficient.

Porter (2008) concludes that when each competitor aims to serve the needs of different customer segments better, with different mixes of price, product, services, features, or brand identities, it can not only support higher average profitability but also expand the industry. Once understanding the structural underpinnings of rivalry clearly, strategists can take steps to shift the nature of competition in a more positive direction.

It is especially important to avoid common pitfalls while examining the industry's structure. Firstly, a fast-growing industry is not always attractive. The industry growth needs considering together with impact of the five competitive forces of that industry before an evaluation of the attractiveness given. Similarly, technology or innovations are not by themselves enough to make an industry structurally attractive or unattractive. Next, government is not best understood as a sixth force because its involvement is neither inherently good nor bad for industry profitability. The best way to understand the influence of government on competition is to analyze how specific government policies affect the five competitive forces. Eventually, assessing the strategic significance of complementary products and services will also be best performed through the lens of the five forces (Porter, 2008 pp. 21-24).

Porter (2008) makes a conclusion that the industry structure drives competition and profitability, not whether an industry produces product or service, is emerging or mature, high tech or low tech, regulated or unregulated. Therefore, understanding the competitive forces and their underlying causes reveals the roots of an industry's current profitability while providing a framework for anticipating and

influencing competition and profitability over time. Furthermore, understanding industry structure is also essential to effective strategic positioning.

Based on results of analyzing the industry structure above, now the attractiveness and effectiveness of target segments can be measured and evaluated following five key criteria as follows:

- *Measurable* – The size, purchasing power, and characteristics of the segments can be measured.
- *Substantial* – The segments are large and profitable enough to serve.
- *Accessible* – Suppliers can reach and serve the segments effectively.
- *Differentiable* – The segments are conceptually distinguished and respond differently to different marketing-mix elements and programs.
- *Actionable* – Marketers can formulate effective programs to attract and serve the segments (Kotler, et al., 2009 p. 250).

So far, all essential input materials for evaluating and selecting the target market segment(s) are prepared fully. Now, market segments will be evaluated and select with respect to two dimensions: market segment attractiveness and current and potential company's strengths in serving the segment as illustrated in Figure 7 and Figure 8 below respectively.

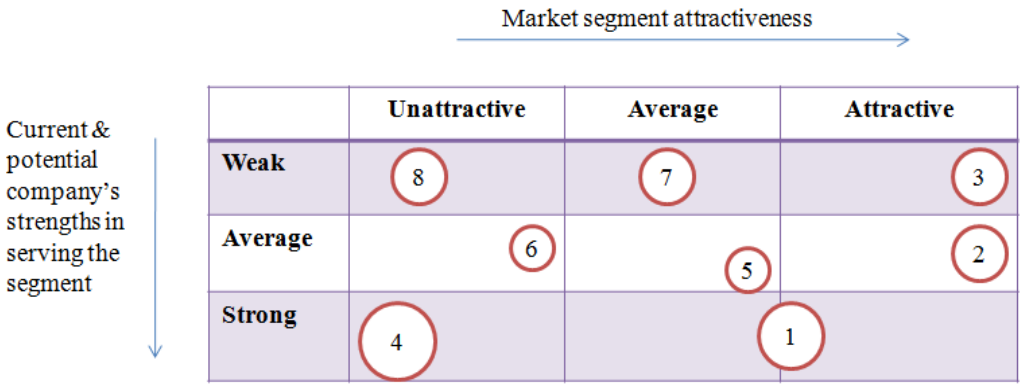

FIGURE 7. Evaluating market targets for a hypothetical company
Source: Adapted from Hooley et al., 2008 p.291

The numbers in Figure 7 above express how suitable the segment is for the company. The suitability decreases gradually from no.1 to no.8. The segment marked no.1 is the most suitable. The best segments should be ones that are attractive and fit the company's strengths.

Market segment attractiveness

Current & potential company's strengths in serving the segment

	Unattractive	Average	Attractive
Weak	Strongly avoid	Avoid	Possibilities
Average	Avoid	Possibilities	Secondary targets
Strong	Possibilities	Secondary targets	Prime targets

FIGURE 8. Target market segment selection

Source: Adapted from Hooley et al., 2008 p. 291

According to that, segments ranked no. 1 and no. 2 should be the prime and secondary targets that the company needs to serve right now. Segments ranked from 3 to 5 should be considered potential targets. The remaining ones should be avoided.

2.4 Competitor analysis

"If you know your enemy as you know yourself, you need not fear the result of a hundred battles. If you know yourself but not the enemy, for every victory you gain you will suffer a defeat. If you know neither the enemy nor yourself, you will succumb in every battle" (Sun Tzu according to Hooley et al., 2008).

Identifying competitors **-** From the market approach, Kotler et al., (2009) defined competitors as organizations that satisfy the same customer need, particularly in the same target segment.

Analyzing competitors - Lehmann and Winer (1991) suggested four main stages in competitor analysis as Figure 9 below.

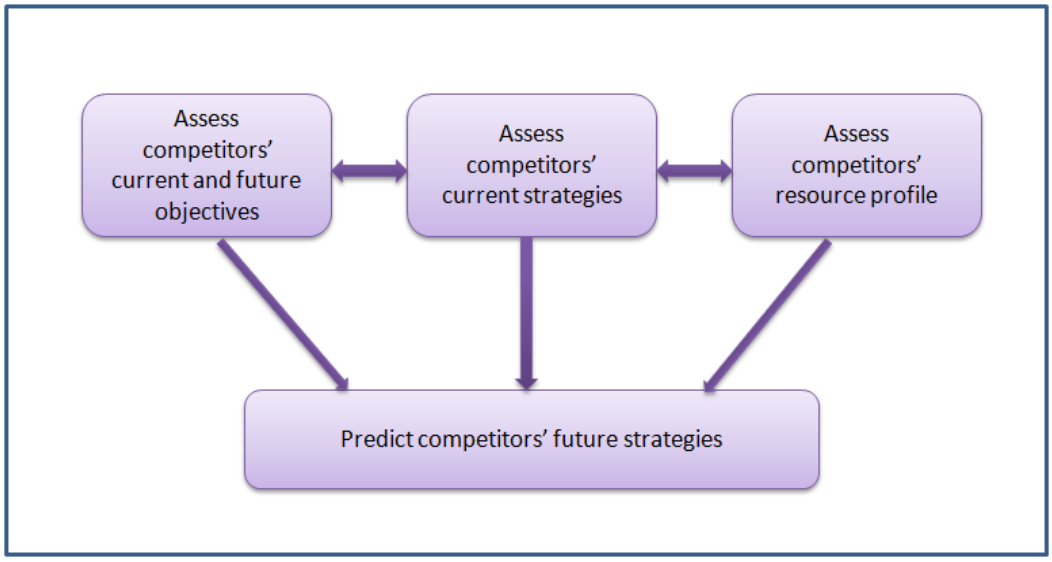

FIGURE 9. The components of competitor analysis

Source: Adapted according to Hooley et al., 2008 p.120

These activities are specifically expressed in Table 4 below.

TABLE 4. Detailed competitor analysis

	Assessing points	**Aims of analysis**
Assess competitors' current & future objectives	- What are they trying to achieve? - Why are they trying to achieve it? - What are investment priorities?	- To understand goals and objectives that competitors set out to achieve. - To estimate intensity of competitor activity and rivalry.
Assess competitors' current strate-	- What target markets are they pursuing? - What is their strategic focus?	- To identify opportunities and threats arising from competitors' ac-

gies and activities	- What marketing mix do they use? - How do they organize their marketing?	tions.
Assess competitors' capability profiles	- Ability to conceive and design: technical resources, HR resources & funding for R&D - Ability to produce - Ability to market - Ability to finance - Ability to manage	- To estimate what they are currently able to do. - How they will move in the future - How they will react to threats.
Predict competitors' future strategies	- What might the competition do? - What under-utilized resources do they have? - How will they react to our actions?	- To answer the most fundamental question in competitor analysis: what is the firm likely to do in the future?

Source: Adapted from Hooley et al., 2008 pp. 121-132

Beside, Hooley et al., (2008) also points out benefits from learning from competitors. It is extremely useful because the new player can copy success of successful rivals and improve on them, avoid and overcome unsuccessful players' pitfalls. Figure 10 below shows how to learn from rivals inside and outside the industry.

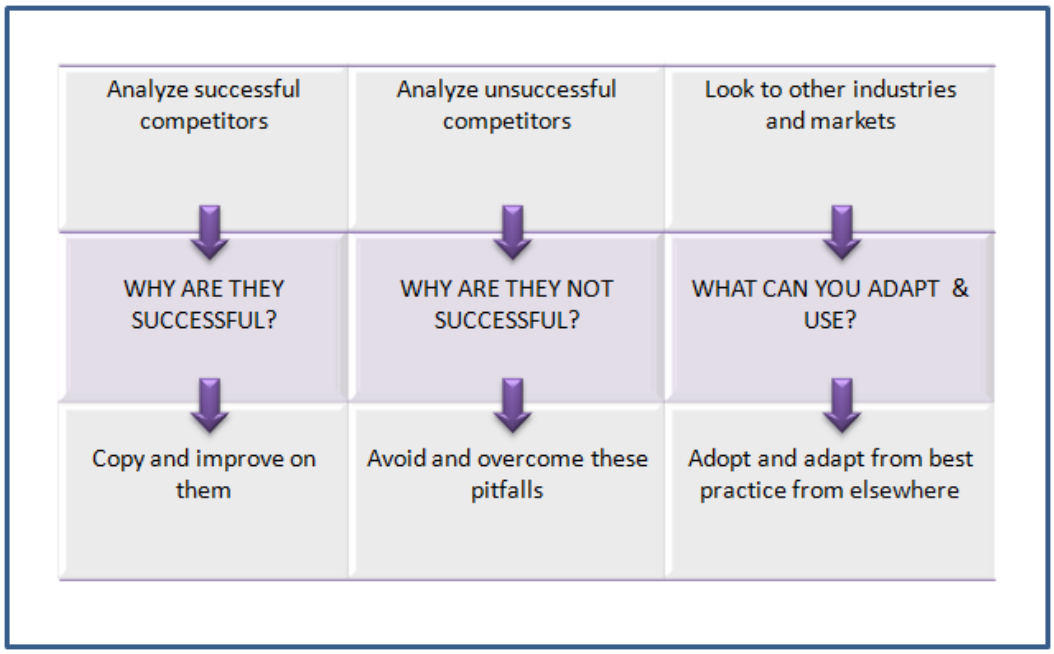

FIGURE 10. Learning from competitors

Source: Adapted from Hooley et al., 2008 p.140

Selecting competitors - After examining rivals carefully, the firm can choose appropriate competitor(s) to attack. Selection of competitors can be based on three following classes that Kotler et al., (2009) suggested:

- *Strong* vs. *Weak* – Attacking weak enemies requires fewer resources per share point gained.
- *"Good"* vs. "*Bad*": Good competitors play by the industry's rules, contrasting with bad competitors. Attacking bad competitors may be necessary to reduce or end their dysfunctional practices (Kotler, et al., 2009 p. 334).

Competitive strategy is associated with the result of selecting competitors. As a result, the newcomer can play as a market leader, market-challenger, or market-follower, depending on its own strategy and the competitor selected. The market leader frequently has to utilize expanding the total market and market share defense strategies. Meanwhile, the market-challenger is always involved in attack strategies such as frontal attack, flank attack, encirclement attack, or bypass attack. The market-follower chooses the product/service imitation strategy (Kotler, et al., 2009 pp. 335-350).

2.5 Stakeholder and risk management

A stakeholder is a person or organization who is involved in a business directly or indirectly. Stakeholder's action(s) can cause negative or positive impact on the business that the stakeholder is associated with. As a result, a stakeholder can bring risks to the business or make risks disappear, depending on that stakeholder's degree of influence on the business. It can be concluded that stakeholder(s) and risk(s) always go hand in hand together. Therefore, stakeholder and risk management becomes crucial to be successful in doing business, especially doing international business.

The stakeholder and risk management process can be made up of three main stages – identification, analysis, and reaction. First, key stakeholders involved in a business can be identified through market analysis. In particular, uncovering the organizational purchase process is the most effective way to figure out the most important stakeholders in B2B business. Analyzing the role as well as the influence of each stakeholder reveals risks that stakeholder can produce. Based on that, an action plan can be prepared to react against those threats. It would be better if both passive and active defense strategies/tactics are included in the action plan. Active defense strategies/tactics are connected with approaching key stakeholders and impacting them in the way the business desires.

In short, stakeholder and risk management cannot absolutely be missed in preparing for doing international business.

2.6 Foreign market entry

So far, all essential information for making a decision on market entry has been prepared. The decision of how to enter a foreign market has significant impact on the business and business results in the future. Modes of market entry involve a trade-off between degree of control on and commitment of resources (Burca, et al., 2004 p. 241). Let's take a look at four most common foreign market entry modes shown in Table 5 below.

TABLE 5. Comparison of foreign market entry modes

Mode	Conditions favoring this mode	Advantages	Disadvantages
Exporting	- Limited sales potential in the target country; - Little product adaptation required; - Distribution channels closed to plants; - High production costs in the target market; - Liberal import policies; - High risk level; - Hard to adapt to local business culture.	- Minimizes risk and investment; - Speed of entry; - Maximize scale by using existing facilities	- Trade barrier and tariffs add to costs; - Transport costs; - Limits access to local information; - Company viewed as an outsider.
Licensing	- Import and investment barriers; - Legal protection possible in the target environment; - Low sales in the target country; - Large culture distance; - Licensee lacks ability to become a competitor.	- Minimizes risk and investment; - Speed of entry; - Able to circumvent trade barriers; - High ROI.	- Lack of control over use of assets; - Licensee may become a competitor; - Knowledge spillovers; - License period is limited.
Joint ventures	- Import barriers; - Large culture distance; - Assets cannot be fairly priced; - High sales potential; - Some political risk; - Government restrictions on foreign ownership;	- Overcomes ownership restrictions and culture distance; - Combines resources of 2 companies; - Potential for	- Difficult to manage and control; - Greater risk than exporting and licensing; - Knowledge spillovers;

	- The local company can provide skills, resources, distribution network, brand name, etc.	learning; - Viewed as an insider; - Less investment required.	- Partner may become a competitor.
Direct investment	- Import barriers; - Small cultural distance; - Assets cannot be fairly priced; - High sales potential; - Low political risk.	- Greater knowledge of the local market; - Can better apply specialized skills; - Minimizes know-how spillovers; - Viewed as an insider.	- Higher risk than other modes; - Requires more resources and commitment; - May be difficult to manage the local resources.

Source: (QuickMBA, 2010)

Regardless of the above considerations, the mode of market entry heavily depends on long-term strategies of a business.

2.7 Canvas business model

Once the market entry mode is selected, it is vital to build a business model associated with the new business activity. Within this research, the business model Canvas is taken into consideration.

A business model describes the rationale of how a business creates, delivers and captures value (Osterwalder, et al., 2009 p. 14). The business model Canvas is made up of nine building blocks as expressed in Table 6 below.

TABLE 6. Nine building blocks of Canvas business model

	Building blocks	Main descriptions
1	Customer segment	Different groups of people or organizations an enterprise aims to reach and serve.
2	Value propositions	The bundle of products and services that create value for a specific customer segment. They solve a customer problem or satisfy a customer need. They are the reason why customers turn to one company over another.
3	Channels	How a company communicates with and reaches its customer segments to deliver a value proposition, for instance, communication, distribution and sales channels.
4	Customer relationships	Types of relationships a company establishes with its specific customer segments. Customer relationships can be driven by the motivations such as customer acquisition, customer retention or up-selling. Some categories of customer relationships consist of personal assistance, self-service, automated services, communities, etc.
5	Revenue streams	Money a company generates from each customer segment. There are some ways to generate revenue streams, for example, asset sale, usage fee, subscription fees, licensing, lending/renting/leasing.
6	Key resources	The most important assets required to make a business model work. They can be physical, financial, intellectual, or human.
7	Key activities	The most important things a company must do to make its business model work. They may be categorized production, problem solving, and platform/network.
8	Key partnerships	The network of suppliers and partners that make the

		business model work.
9	Cost structure	All costs incurred to operate a business model.

Source: (Osterwalder, et al., 2009)

Such nine building blocks are arranged as Figure 11 below to create the business model Canvas.

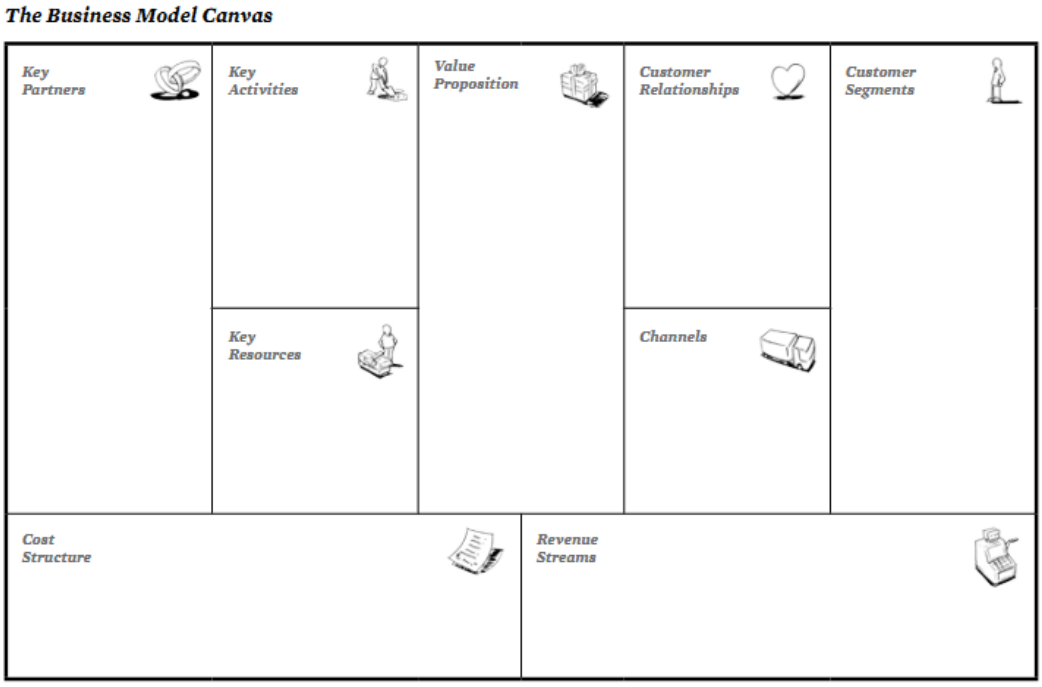

FIGURE 11. The business model Canvas

2.8 Competitive advantage and marketing mix

After completion of building the business model, the next task is to design a competitive marketing strategy to deliver value propositions to customer segments in the host country most effectively and efficiently. In addition, searching for and creating competitive advantages are the key to accelerate the success of a new entrant in a foreign market.

Competitive advantage – In markets following the market principle, a company has its own competitive advantages when it possesses resources and competencies that enable it to provide superior benefits to customers or give it a cost advantage (Mohr, et al., 2005 p. 51). However, such competitive advantages may not work in some emerging markets in which competition is not driven by the market principle. With respect to the Vietnamese technical product market, a new entrant can create competitive advantages on its own by combining its core competencies with the secret to success of the most successful competitor in that market and understanding local customers.

Marketing mix is made up of four broad groups that McCarthy called the four Ps of marketing: product, price, place, and promotion. Figure 12 below represents these components of the marketing mix.

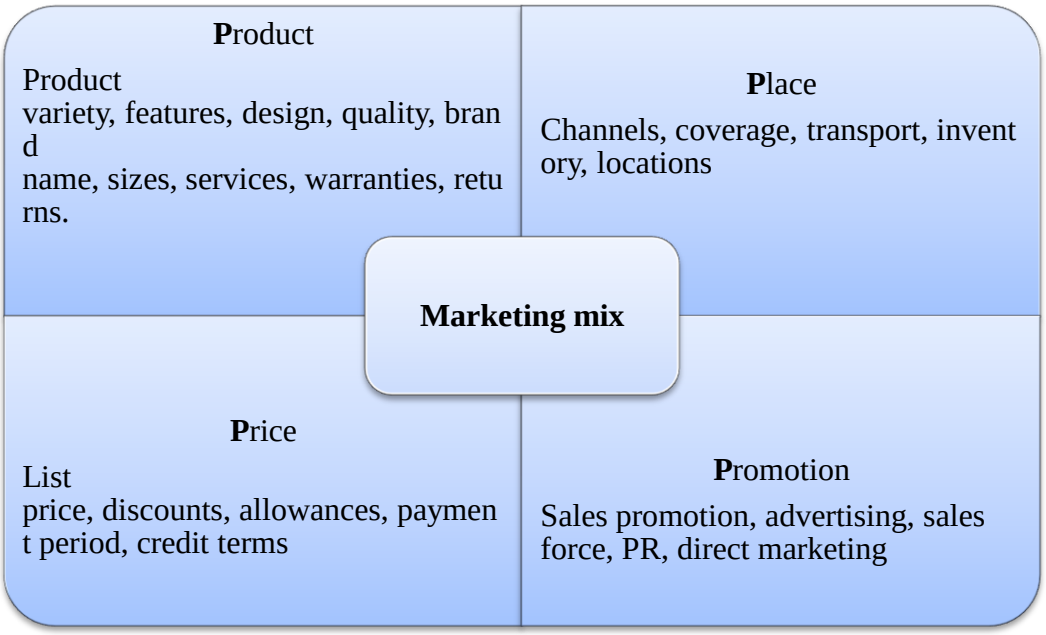

FIGURE 12. The 4 Ps of the marketing mix

Source: Adapted from (Kotler, et al., 2009 p. 23)

Product is the first and most important element of the marketing mix. Most critical dimensions of the technical product are features, performance, durability, reliability, and easy to use, maintenance and repair. In order to develop such a prod-

uct, it should be end-users need-based, and the manufacturer should think through four following levels:

- The core offer meets most fundamental requirements and resolves the key existing problem of the customer.
- The expected offer improves quality, service, warranties, etc.
- The augmented offer provides new benefits that are normally offered.
- The potential offer coprises anthing else to differentiate from existing rival's offerings (Hooley, et al., 2008 pp. 129-30).

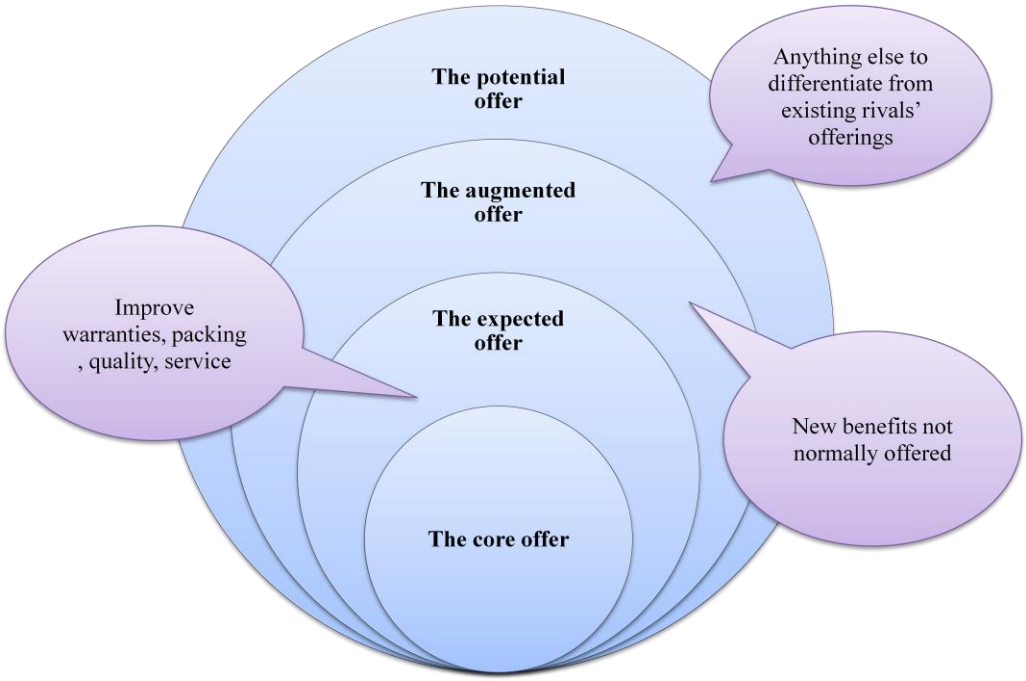

FIGURE 13. Four levels of the product
Source: Adapted from (Hooley, et al., 2008 p. 130)

Pricing is the only one of the four Ps that produces revenues. In technical product markets, the three Cs of pricing – costs, competition, and customers – are analogous to a three legged stool. If only one or two of three Cs are taken into consideration, the stool is in an unstable situation. Solid pricing strategy must be based on a systematic consideration of all three factors (Mohr, et al., 2005 pp. 289-290).

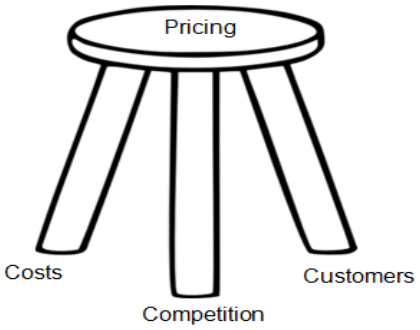

FIGURE 14. The 3 Cs of pricing technical product
Source: Adapted from (Mohr, et al., 2005 p. 290)

Costs provide a floor, generally below which marketers ought not to price. Competition provides a benchmark against which to evaluate prices. Customers' perceptions of value provide a ceiling above which marketers should not price (Mohr, et al., 2005 p. 290).

The total cost of ownership (or life cycle costing) reflects the total amount a customer expends in order to own and use a product or service. This includes the price paid for the good, as well as delivery or installation costs, service costs to maintain and repair the good, power costs to run the equipment, supplies, and other operating costs over the life of the equipment. Using the total cost of ownership in pricing strategy can help a firm position its products relative to those of competitors, as well as avoid competition of low price products (Mohr, et al., 2005 p. 291).

In summary, solid consideration of costs, competitors, and customers is vital in establishing a successful pricing strategy. Focusing on costs alone can be myopic and can cause problems. Similarly, focusing on competition can be hard in high-tech markets, when the competition for a radical innovation might be the customer's current behavior pattern. Because of the importance of a customer orientation in pricing, and because of the benefits to high-tech marketing of being customer-focused, this leg of the stool deserves additional consideration (Mohr, et al., 2005 p. 292).

Place (Distribution or marketing channels) consists of sets of interdependent organizations involved in the process of making a product available for use. Most industrial manufacturers often sell their goods to some intermediaries such as wholesalers and retailers or agents rather than sell directly to the end-users (Kotler, et al., 2009 p. 460).

Issues in distribution channel design and management are summarized in Figure 15 below. Avoiding and managing conflict among intermediaries should also be taken into consideration by the manufacturer.

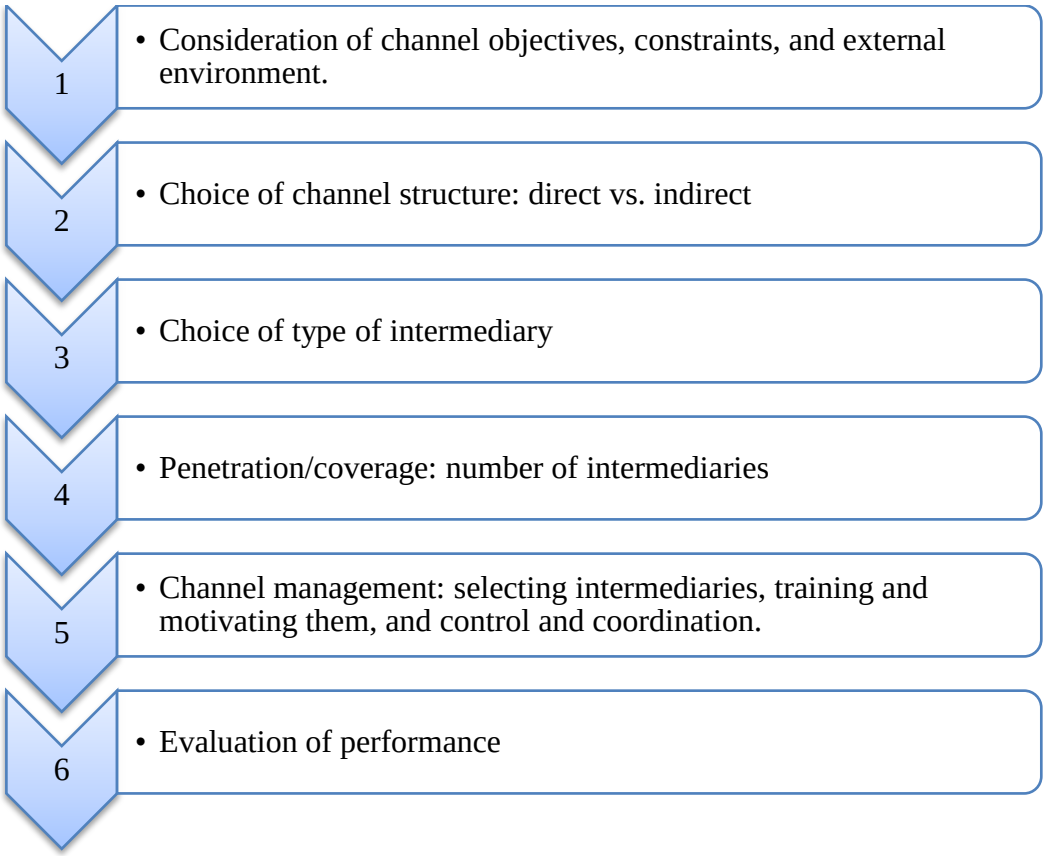

FIGURE 15. Distribution channel design and management process

Source: Adapted from (Mohr, et al., 2005 p. 255) and (Kotler, et al., 2009 p. 493)

Promotion (marketing communications) is connected with operations that help a company communicate with present and potential stakeholders, and the general public (Kotler, et al., 2009 p. 527). The marketing communications mix consists

of six major communication modes – advertising, sales promotion, events and experiences (sponsorship), public relations and publicity (PR), direct marketing and personal selling (Kotler, et al., 2009 p. 528).

In order to develop an effective marketing communications strategy, the marketer needs to: 1. Identify the target audience; 2. Determine the communication objectives; 3. Design the communication; 4. Select the communication channels; 5. Establish the total communications budget; 6. Decide on the communications mix; 7. Measure the communications' results; and 8. Manage the integrated marketing communications process (Kotler, et al., 2009 p. 556). Also, the marketer needs to consider three core following dimensions: the effect of each communication mode on the target audience, the degree of coverage of the target audience, and cost efficiency. Figure 16 and Figure 17 below depict these considerations.

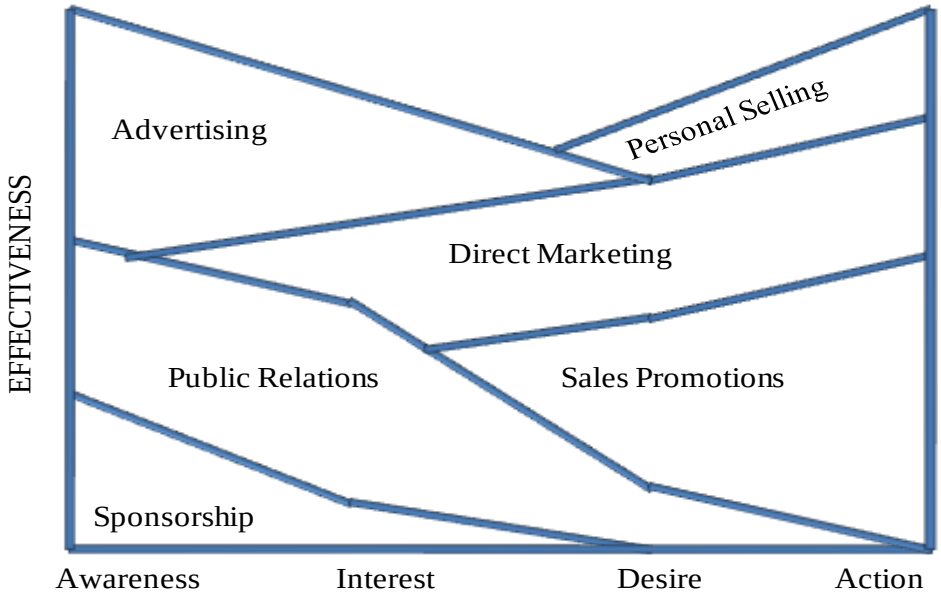

FIGURE 16. Communication effect of marketing communications mix on the target audience

Source: Adapted from (Hooley, et al., 2008 p. 358)

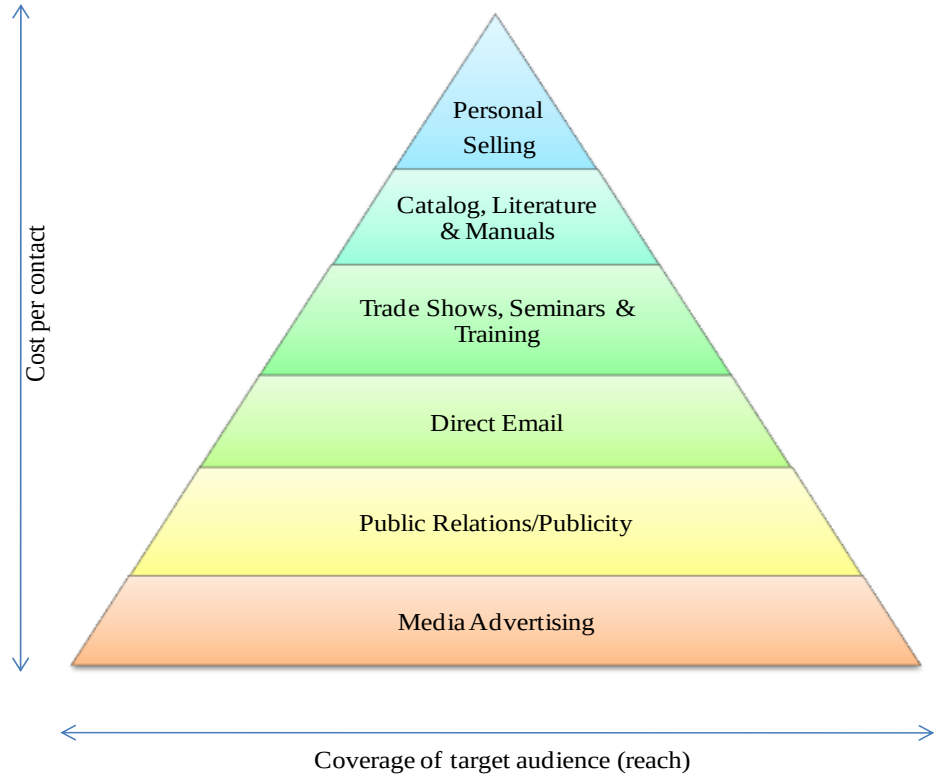

FIGURE 17. Marketing communications mix pyramid

Source: Adapted from (Mohr, et al., 2005 p. 315)

As shown above, mass media such as advertising, PR and sponsorship are effective in producing the product awareness and interest because their coverage of the target audience remains largest. Plus, they require the lowest level of payment per contact. However, to make the target audience really desire the product, direct marketing and personal selling are required more heavily. Although two these kinds reach very few target customers, their cost per contact and effectiveness are highest. Particularly, personal selling heavily affects the customer's buying decision (Kotler, et al., 2009 p. 556; Mohr, et al., 2005 pp. 315-319).

With respect to technical product B2B markets in which the organizational buying process is complicated, the integrated marketing communications (IMC) strategy works very effectively and efficiently. IMC considers all touch points, or sources of contact, and makes use of all communication methods that are relevant to prospects (Shimp, 2007 p. 10). Five key features of IMC are: 1. starting with the cus-

tomer/prospect; 2. Use of any form of relevant contact or touch point; 3. speaking with a single voice; 4. building relationships; and 5. affecting behavior.

2.9 Theoretical discussion summary

All related theoretical concepts and discussion which are utilized within the research have been expressed. They are applied to support market analysis in chapter 4 and develop recommendations in chapter 5. Marketing management expertise is more concentrated than the others.

3 RESEARCH APPROACH AND METHODS

Research approach - This research is undertaken in accordance with the inductive approach. The inductive reasoning begins with specific observations and measures, and ends at developing some general conclusions or theories on the basis of premises (Burney, 2008). In fact, this research moves from collecting secondary data first to interviewing key related stakeholders in the target market to find actual findings with respect to the research problems. After that, general conclusions relevant to the research problems are developed on the basis of the empirical premises.

Figure 18 below depicts main steps of qualitative research process applied within this research.

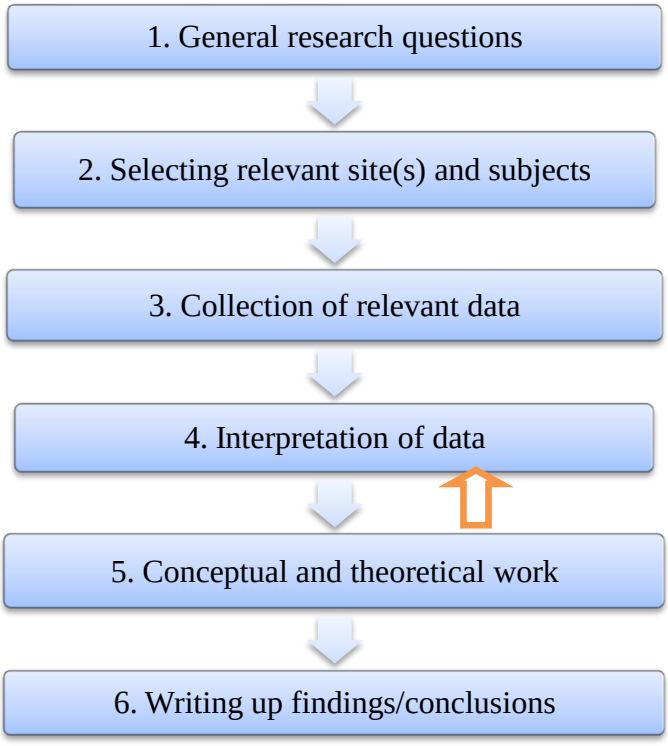

FIGURE 18. Main steps of qualitative research

Source: (Bryman, et al., 2011 p. 390)

Research methods – In order to answer the research questions given earlier, intelligence associated with both numbers and words, both static and process, both hard, reliable data and rich, deep data, as well as both generalization and contextual understanding is needed. Obviously, this requirement cannot be met by either a quantitative method or a qualitative method alone. Therefore, the mixed methods research strategy, which combines quantitative and qualitative research, is chosen.

In fact, mixed methods research has become an increasingly used and accepted method to conducting business research (Bryman, et al., 2011 p. 630). That is because it overcomes disadvantages and fills the gaps of each separate method, qualitative research or quantitative one. Now let's look at some noticeable similarities and contrasts between quantitative and qualitative research illustrated in Table 7 below. Right after that we will argue how these methods facilitate each other to solve the research problems within this research.

TABLE 7. Some noticeable similarities and contrasts between quantitative and qualitative research.

Quantitative	**Qualitative**
- Both are concerned with answering research questions. - Both are concerned with relating data analysis to the research literature. The researcher's findings take on significance in large part when they are related to the literature. - Both argue for the importance of transparency. Showing the research procedures and how findings are arrived at allows readers to judge the quality and importance of work.	
Numbers	Words
Static	Process
Structured	Unstructured and semi-structured
Hard, reliable data	Rich, deep data
Generalization	Contextual understanding

Source: Adapted from (Bryman, et al., 2011 pp. 410-413)

To uncover the market demand for hospital waste treatment solutions in Vietnam, hard and reliable figures relevant to the amount of hospital waste generated, present treating capacity, medical solid waste and wastewater treatment expenses, the number of beds in a healthcare facility, etc. are demanded. So, the interviewer needs to prepare interview questions which are very specific, and offer the interviewee a fixed range of answers. In addition, the interviewer is supposed to read out questions exactly and in the same order as they are printed on the schedule (Bryman, et al., 2011 p. 202). Based on these findings, as many as possible, the researcher can use statistical tools to generalize the context through figures. Certainly, gathering and processing these figures is one of the most typical functions of quantitative research. That is all what quantitative research serves this research.

Moreover, these figures themselves can only present a static picture of the situation at the time of the survey. Of course, they are not enough to make a conclusion for the first research problem. Understanding how healthcare establishments deal with such waste, the degree of satisfaction with and efficiency of the existing treatment solution, rooms for improvement, and roles, responsibility and response of related top management to the problem, etc. is critical to be able to answer the question fully. Clearly, collecting such rich and deep information can only be done by qualitative research through the semi-structured or unstructured interviews.

In order to undertake a semi-structured interview, the research needs a list of clear and specific questions on topics to be covered. During the interviewing period, the interviewee has a great deal of leeway in how to reply. Questions may not follow on exactly in the way outlined on the schedule. Questions that not included in the guide may be asked as the interviewer picks up on things said by interviewees. (Bryman, et al., 2011 p. 467). Within this research, the semi-structured interviews are applied for interviewing people in charge of healthcare facilities and state-owned urban environment companies. The questionnaires for the semi-structured interviews are provided in Appendix 1 & 2 at the end of this document.

Meanwhile, in an unstructured interview, the interviewer uses an interview guide to deal with a certain range of topics. There may be just a single question that the

interviewer asks, and the interviewee is then allowed to respond freely. It tends to be very similar in character to a conversation (Bryman, et al., 2011 p. 467). This kind is designed to interview staffs of DoH, DoNRE, and existing hospital waste treatment product suppliers in Vietnam. These detailed interview questions are provided in Appendix 3 at the end of the research.

Research population and ***representative sample*** - The research is conducted in three central cities and nine provinces belonging to four key regions in the southern half of Vietnam including the South Central Coast, the Central Highland, the Southeast, and Mekong Delta. Target interviewees come from state-owned and private healthcare establishments comprising city/province level hospitals, district level hospitals and medical service centres, clinics, DoH, DoNRE, local urban environment firms, existing hospital waste treatment solutions suppliers in Vietnam markets.

In summary, the inductive approach and mixed methods research are chosen to accomplish this research. The research process follows the main steps of qualitative research. Quantitative research contributes to collect and process numeral data.

4 ANALYZING EMPIRICAL RESEARCH DATA

This chapter represents solid analysis of data gathered during the empirical research in Vietnam. Consequently, the market analysis comes first to produce useful inputs for segmenting the medical waste treatment markets. After the market segments recognized, the Porter's Five Forces model is applied to figure out the nature of the rivalry within each segment. The results of analyzing the market segments become input materials for evaluating and then selecting the target segment(s). Once the target segment(s) selected, it is vital to deal with competition from the key players in this segments. So far, it is believed that all key stakeholders involved in this business have been realized. So, now is the time to review the role and influence of these stakeholders in order to prepare an action plan to manage risks from them.

4.1 Market analysis

Market analysis is highly vital to prepare for market entry. This section begins at analyzing the Vietnamese macro environment with focus on understanding the political and economic environment, and the business environment. Next sections present essential findings relevant to the Vietnam health system, current medical waste management status and the medical waste treatment equipment buying process. All these findings then become useful inputs for next analyzing processes.

4.1.1 Macro environment analysis

First, understanding the political and economic environment is extremely crucial in doing international business, particularly entering Vietnam markets.
Political outlook - Over two recent decades, Vietnam has been evaluated as one of the safest destinations for investment by foreign investors because of its political stability and government stability. These favorable conditions are based on a strong internal control by Vietnamese government. In the Vietnam Infrastructure

Report – Q4 2010, Business Monitor International (BMI) performed Vietnam Political SWOT which shows that the one- party communist system is generally conducive to short-term political stability, but will probably be unsustainable over longer term. Other potential threats might result from China due to the territory dispute.

Government policies and their impact on business – The rate of policy formulation and execution is low and limited due to the bulkiness of the public administration system. The policy instability is one of three most problematic factors for doing business in Vietnam, according to the Global Competitiveness Report 2011-2012 by WEF. That is why the federal and city/province governments promise to provide investors in the waste treatment business with incentives; this business still remains very modest so far. The issue of protecting intellectual property is still very limited. The Vietnamese Price minister, ministers and chairman of city/province People's Committee are people who can considerably influence on the business through their decisions, policies or strategies.

Economic outlook – Together with China and India, Vietnam is one of three countries whose annual GDP growth rate is highest in Asia during the last decade. The average Vietnam's economic growth rate is 7.0% per annual over last five years as illustrated in Figure 19 below.

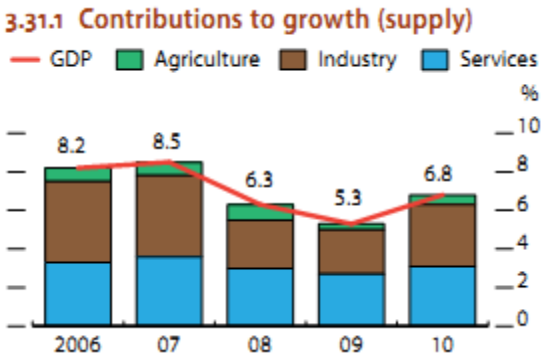

FIGURE 19. Vietnam GDP growth by the contribution sector

Source: Vietnam, Asian Development Outlook 2011, ADB, page 215

According to ADB's forecasts, Vietnam economy will continuously grow up fastest in relation to the other ASEAN countries in coming years as illustrated in Figure 20 below.

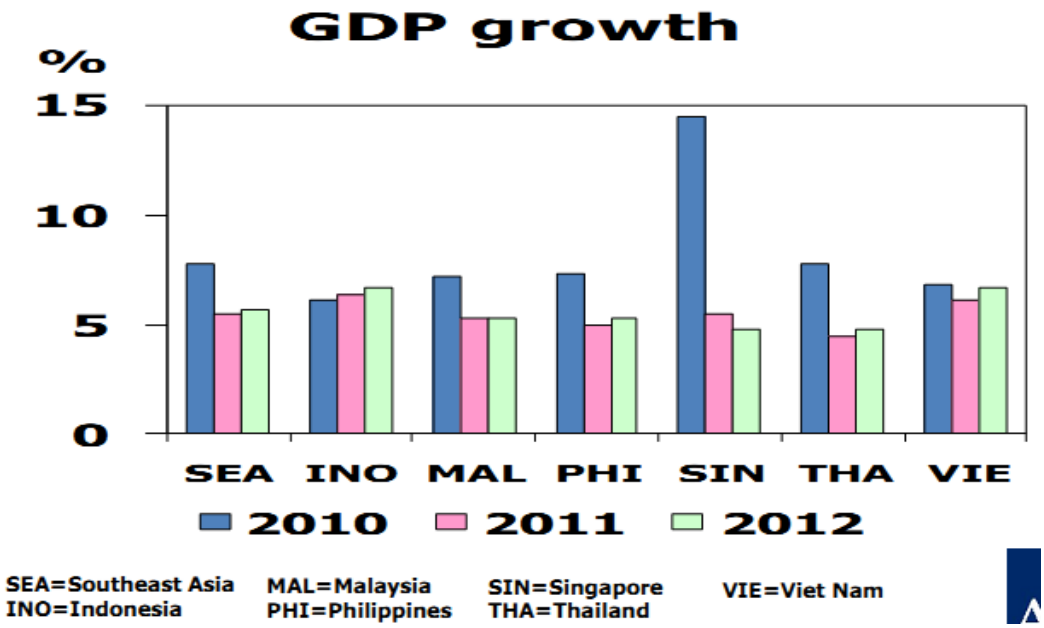

FIGURE 20. Southeast Asian countries GDP growth

Source: South-South Economic Links, Asian Development Outlook 2011, ADB

Nonetheless, signals of the macro economy instability in Vietnam have appeared and repeated in recent years. Since 2008, the inflation rate usually remains at double-digit level, the currency – Dong has been devalued, and domestic banks are in the interest rate war. Though the related authorities have stated that fiscal and monetary policies have been tightening to stabilize the macro economy, such three challenges have still repeated every year.

Figure 21 shows the inflation rate in Vietnam from 2006 to 2010 and forecasts for the years of 2011 and 2012.

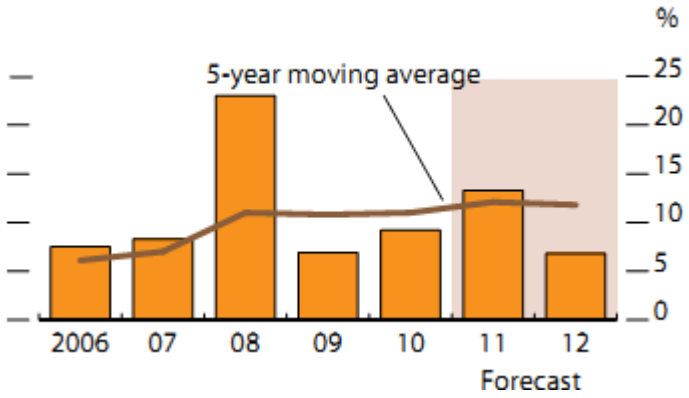

FIGURE 21. Inflation rate in Vietnam

Source: Vietnam, Asian Development Outlook 2011, ADB, page 218

Figure 22 below represents the continuous devaluation of the Dong over last three years.

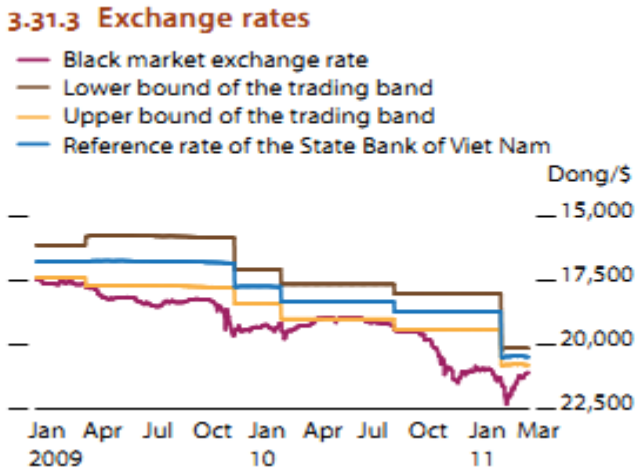

FIGURE 22. VND/USD exchange rate

Source: Vietnam, Asian Development Outlook 2011, ADB, page 218

As a result, the foreign investors', domestic businesses' and local citizens' confidence are hurt. A survey on the business climate index among 200 European companies doing business in Vietnam conducted by the European Chamber of Commerce in Vietnam (EuroCham) in October 2011 shows that these companies' confidence in Vietnam as an investment destination is declining. According to Mr.

Alain Cany – EuroCham Chairman, these corporations are increasingly concerning about the business and investment environment in Vietnam (Binh, 2011). Similarly, Vietnam's global competitiveness index goes down from 59th ranking in 2010 to 65th in 2011 (World Economic Forum, 2011). It is noteworthy that among ASEAN countries, Vietnam's competitiveness is better than Philippines's and Cambodia's only.

That is all about the Vietnamese political and economic environment. So what about the *business environment* in this country? Figure 23 below depicts the whole picture of scoring and ranking core factors of the business environment in Vietnam, according to the Global Competitiveness Report 2011-2012 by WEF.

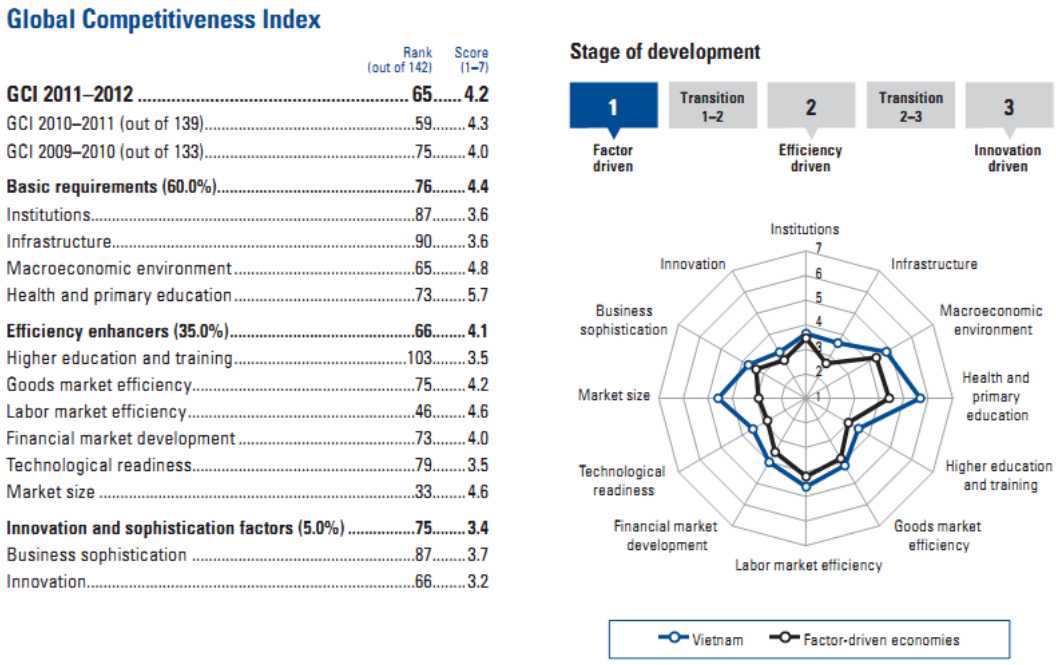

FIGURE 23. Vietnam's global competitiveness index 2011

Source: Vietnam, the Global Competitiveness Report 2011-2012, WEF

Finance market – The Vietnamese financial market development is ranked 73rd among 142 nations surveyed as in Figure 23 above. In September 2011, Moody's Investors Service assesses that the outlook for the Vietnamese banking system is negative over the next 12 to 18 months (Oanh, 2011). As shown in Figure 24 be-

low, the access to financing source is the second most problematic factors for doing business in Vietnam. Particularly, it is very hard for private SMEs to take a loan from a bank. However, it does not happen to state-owned enterprises.
So far, it is easy to transfer money within the country by ATMs or by banking staffs. Moving funds or profits in and out of Vietnam has to be transacted at the bank by banking staffs. Local banks can also help their customer open the letter of credit for an international sales transaction, and issue the bid bond letter to serve the bidding process. Potential fund sources can be tapped into the hospital waste treatment projects are from World Bank and environmental protection fund mainly, ADB, or ODA of different governments, and the public budget of the central and local governments.

FIGURE 24. The most problematic factors for doing business in Vietnam
Source: Vietnam, the Global Competitiveness Report 2011-2012, WEF

Labour market – The labour market efficiency is one of the best competitiveness indexes of Vietnam, ranked 46th/142 nations as shown in the above figure. However, the higher education and training index of this country is not really competitive, ranked 103rd/142 countries surveyed. This partly makes the inadequately educated workforce become one of the most problematic factors for doing business in Vietnam. In fact, the Vietnamese workforce is hard-working and fast-

learning. However, skills of teamwork and marketing, and professional attitude are their main weaknesses. Luckily, more and more Vietnamese students go abroad for study. The amount of foreign training and education establishments is also increasing in Vietnam by the time. In addition, local universities and vocational training schools have been also running academic programmes in environmental technologies in order to partly meet the labour market demand. Low labour cost is considered a short-term competitive advantage of Vietnam so far.

Taxation – Tax regulations are ranked 7^{th}/15 most problematic factors for doing business in Vietnam as shown in Figure 24 earlier. In spite of that, there is an extremely attractive and noteworthy point is that all equipment and machines used for collecting, storing, transporting, recycling and treating waste are exempted from import duty according to Circular No. 101/2010/TT-BTC released by the Ministry of Finance in July 2010 as an action to accelerate the environment protection activities. This is really a big incentive for foreign green businesses.

Legal framework - The Vietnamese legal system, in general, still contains inconsistencies, and overlapping and conflicting at several points, even misinterpretation in application and enforcement. At the talk held in the end of 2010 between representatives of the Vietnamese government and foreign corporations doing business in Vietnam about the degree of satisfaction with the current legal environment, the final assessment are average. The Vietnamese government has been implementing the Strategy on the Development of the Legal System until 2010 with a vision to 2020 to overcome such weaknesses. There is no discrepancy in interpretation and application of the same law throughout Vietnam. Even though Vietnamese laws such as Foreign Investment law, Anti-corruption law, Competition law, or Bidding law are comprehensive, the actual implementation still remains very limited. It would be better for foreign businesses to rely on some commercial courts to solve legal disputes relevant to the international sales contract.

Bureaucratic obstacles to businesses – The quality of public administration remains low, and government bureaucracy is still making businesses disappointed. Being patient and calm is the essential lesson for the business to deal with this

ineffective and inefficient government. Regardless of the difficulties mentioned earlier, the issues associated with "facilitating fee", customs, public administrative procedures are the biggest bureaucracies to businesses. This evaluation is given by businessmen at the meeting and talk between leaders of HCMC government and young businessmen in early October 2011 (Thanh, 2011). The "facilitating fee" has become a "typical culture" of the entire public administration system in Vietnam. Vietnamese customs staffs are regarded as "leading specialists" in this field. In the sealed bidding process, the "facilitating fee" is under the form of commission payments to key influencers in the purchase process. The actual period for business certificate registration takes 3-4 weeks, even a few months while the regulation is maximum 5-7 working days. A complicated and ineffective administration procedure system is the good condition for corruption and the lack of transparency. In the Annual Report 2010 released by the Transparency International, Vietnam is scored 2.7 and ranked 116th among 178 countries evaluated.

Infrastructure – This is the second weakest pillar of 12 ones which are used to evaluate the global competitiveness index of Vietnam by WEF. It is also one of five most problematic factors for doing business in Vietnam as illustrated in Figure 24 above. Two right hand columns in Figure 25 below depict the score and ranking of each infrastructure item conducted by WEF.

	2nd pillar: Infrastructure		
2.01	Quality of overall infrastructure	3.1	123
2.02	Quality of roads	2.6	123
2.03	Quality of railroad infrastructure	2.5	71
2.04	Quality of port infrastructure	3.4	111
2.05	Quality of air transport infrastructure	4.1	95
2.06	Available airline seat kms/week, millions*	610.8	**34**
2.07	Quality of electricity supply	3.3	109
2.08	Fixed telephone lines/100 pop.*	18.7	70
2.09	Mobile telephone subscriptions/100 pop.*	175.3	**5**

FIGURE 25. Quality of Vietnamese infrastructure 2011

Source: Vietnam, the Global Competitiveness Report 2011-2012, WEF

The researcher's experience from the empirical research trip in Vietnam shows that travelling from a region to another within Vietnam, even so from one province to another in the same region is very time-consuming. However, with respect to the hospital waste treatment equipment business, the current infrastructure does not much affect marketing communications strategy to customers because almost all districts throughout Vietnam can access to television, internet and telephone easily. Plus, heavy duty trucks can also reach even district level hospitals in all provinces when demand for transportation of hospital waste treatment equipment arises.

Foreign trade environment – Vietnam is presently the member of WTO, ASEAN, and APEC; however, free trade and non-tariff barriers are not really encouraged by Vietnamese government yet. This market does not totally follow the market principle, as well as WTO rules closely yet.

Local culture – Understanding the local culture plays an important role in doing business successfully in Vietnam. That is because the regionalism and the cultural difference among key regions within Vietnam remain quite clear, especially between the north and the remaining of Vietnam. Such difference partly leads to differences in business culture. For the public investment or purchase projects, a close relationship with top government officials is the key to win the game.

Third, the understanding market will be carried out through analyzing the Vietnam health system.

4.1.2 Vietnam health system outlook

Vietnam health system organization overview

The majority of health facilities are under direct management of the MoH, and sixty four city and provincial departments of Health placed in sixty four separate cities and provinces. The remaining minority is under direct control of other ministries such as the Ministry of National Defence, the Ministry of Public Security,

the Ministry of Transportation, the Ministry of Construction, the Ministry of Industry and Trade, and the Ministry of Agriculture and Rural Development (Ministry of Health, 2011).

The MoH manages 64 city and provincial departments of Health in the whole country. Simultaneously, it also manages health organizations under its direct management, for example a few national-level-large-scale hospitals, some specialized hospitals, medical research and hygiene institutes, etc. Each city/provincial DoH is responsible for all health establishments which are both located in that city/province and not under direct management of the Ministry of Health as well as the other ministries. All city/provincial health departments must directly report to the Ministry of Health.

On the standpoints of scale and distribution, the health establishments are classified as hospitals, regional polyclinics, sanatorium and rehabilitation hospitals, ward/commune-level medical service units, and others. At present, Vietnam has five central cities - Hanoi & Hai Phong in the north, Da Nang in the central, HCMC and Can Tho in the south, and fifty nine other separate provinces. Hospitals which are under direct management of city or provincial DoH, in terms of the administrative management level, are divided into city-level hospitals (or city hospitals) which are located in such five cities, or provincial-level hospitals (or provincial hospitals) which are placed in such fifty nine provinces and district-level ones (or district hospitals). Figure 26 depicts the organization chart of Vietnam Health system generally, from the highest - ministry level, to the lowest - ward/commune level.

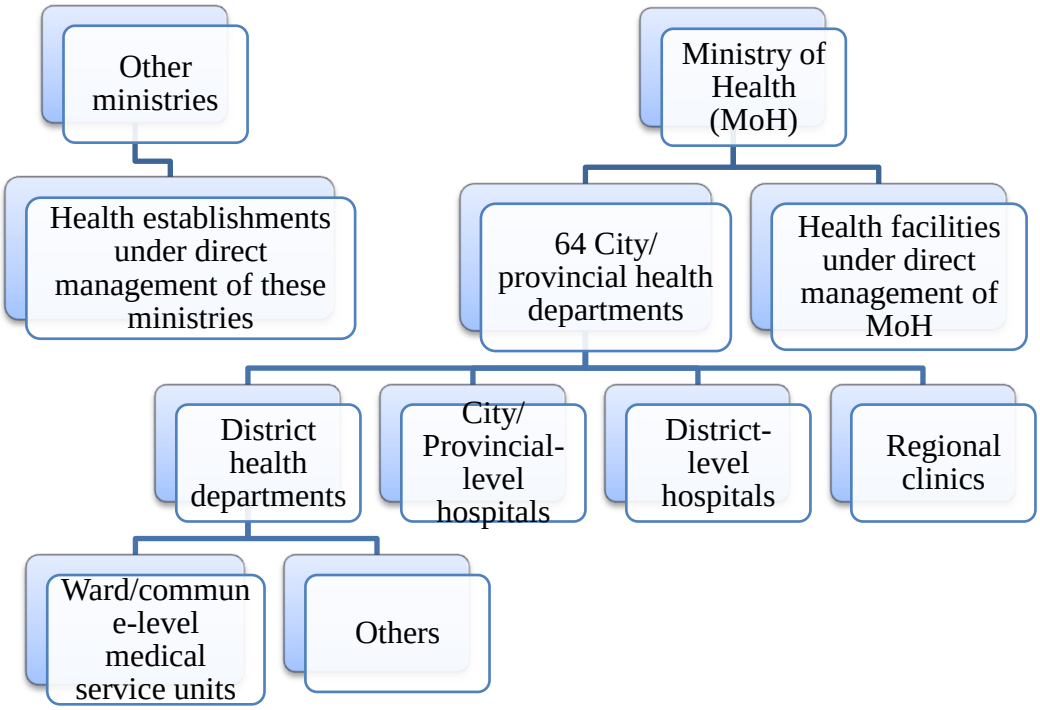

FIGURE 26. Vietnam Health system organization chart

From the viewpoint of ownership sector, the Vietnam health system is currently dominated by the public sector. The majority of hospitals, from the city/provincial to the district level, are state-owned ones. Even though the Vietnamese government has called for socializing the healthcare industry to be able to reduce the overloaded status in public health facilities and to improve the quality of healthcare service, the private sector still remains minor, mostly in the form of regional clinics. A few private hospitals are usually found in the central cities such as Hanoi, HCMC, and in tourism cities like Hoi An and Nha Trang where demand for high quality of medical services has been increasing.

The quantity of public health establishments from Vietnam General Statistics Office illustrated in Table 8 below.

TABLE 8. Quantity of public health establishments in Vietnam (end of 2009)

	Under direct management of Ministry of Health	Under direct management of 64 city/provincial Departments of Health	Under direct management of other Ministries
Total (end of 2009)	**44**	**12.654**	**752**
Hospitals	**39**	**940**	**23**
Regional Polyclinics	**2**	**670**	**10**
Sanatorium and rehabilitation hospitals	**1**	**33**	**9**
Medical service units in precincts, communes	**0**	**10.979**	**0**
Others	**2**	**32**	**710**

Source: (General Statistics Office, 2011), excluded private facilities

These are the latest statistics that are open to the public. Although they were carried out about two years ago, their credibility for estimating the present health sector market size is still high, particularly for the amount of hospitals. That is because of following reasons: 1. the amount of public provincial and district hospitals is built in accordance with the amount of cities, provinces and districts in the whole country while no new city or province is established more since end of 2009. According to that, each district does have one public district hospital; each province has from one to a few provincial hospitals, depending on scale and quantity of new urban cities the province has. In the five central cities, building a new public city hospital is time and money consuming as well as not enough space. Hence, existing city hospitals are often expanded or renovated rather than building new ones; 2. Up to end of 2009, 64 cities and provinces have been fulfilled by a public city, provincial, and district hospital grid basically; 3. Vietnamese govern-

ment calls for tightly controlling and reducing public payment due to the macro economic instability in 2010 and 2011. For that reason, there might be only a slight increase in the quantity of hospitals since end of 2009; 4. These numbers can be double-checked by visiting websites of 64 city and province departments of health and then making a comparison.

Due to a variety of both subjective and objective causes, the researcher could not reach the healthcare facilities under direct management of Ministry of Health and the other ministries during the field trip in Vietnam. Therefore, the research concentrates on the establishments managed directly by city and provincial departments of health only.

Managing the health sector

In Vietnam, all healthcare establishments are under vertical management and horizontal management at the same time. In this case, the vertical management refers to relationships within the health sector, while the horizontal management comes from the outside of this.

For city, provincial and district hospitals and regional clinics, they are under vertical management of the city/provincial DoH where they are operating. Simultaneously, these medical organizations are under administrative control of the city/provincial People's committee and other departments, and environmental inspection and monitoring of the city/provincial department of Natural Resources and Environment (DoNRE). Each healthcare facility is requested to have a notebook called "the waste and wastewater generation sources monitoring and registering notebook" to record and monitor the state of waste and wastewater management and generation in its own facility. Every six months, all medical organizations must report the circumstance of waste management and generation in their places to the city/provincial DoH that manages them directly.

For each city/provincial DoH, it is under vertical management of MoH, under horizontal management of the city/provincial People Committee in terms of operation budget as well as administrative control, and horizontally monitored by the city/provincial DoNRE in terms of environmental management.

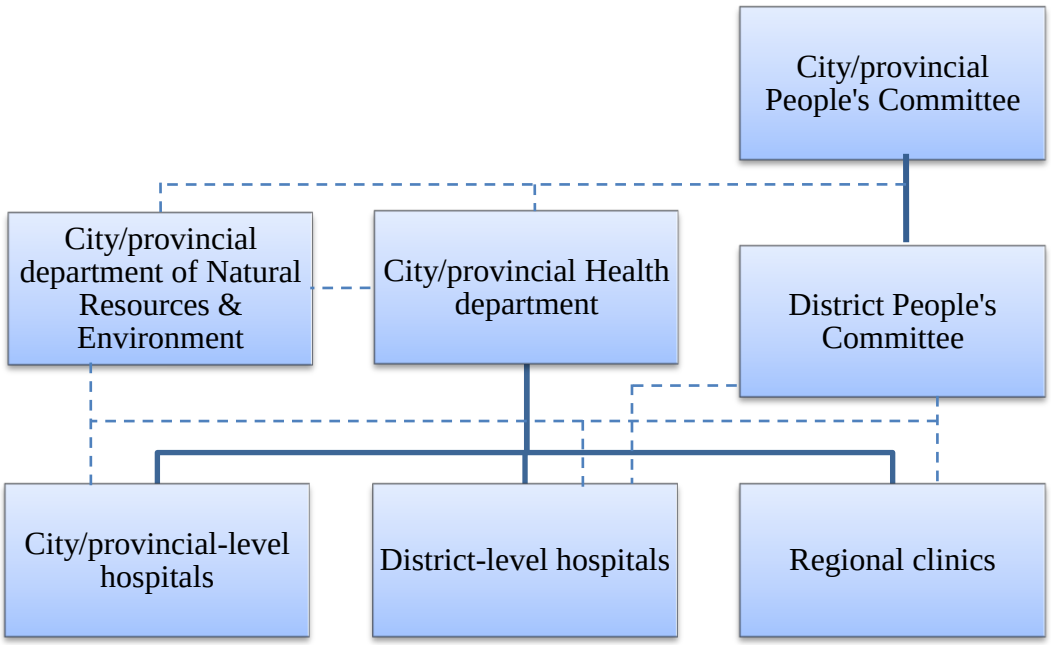

FIGURE 27. Managerial principle for health establishments

Healthcare facilities finance

The financial issue for operations in healthcare organizations is definitely determined by the ownership element. Private medical facilities are simply financed by individuals or private organizations who own them. Their income sources are from clients and patients who get treatment and/or examination services from them. These operate as private businesses in accordance with the market principle. Therefore, they are responsible for budgeting for all their operations themselves, from staffs' salaries to purchasing equipment and to investing waste and wastewater management and treatment systems.

Meanwhile, the budget for public ones is more complicated. Money for initial investment such as building facilities, purchasing equipment and installing solid waste and wastewater treatment systems, etc. is from the public budget. This budget may be composed of tax incomes, loans or sponsorships from international organizations or public investment from the national budget. When a public medi-

cal establishment is in operation, its budget is made up of the local city/provincial budget for the health sector and patients' payments, or the MoH's budget.

The financial allocation from the local city/provincial budget to a public health organization is decided by the city/provincial People's Committee where it is placed. Money is given in the form of an annual operation budget package in the early year. The size of the package per establishment might be different, depending on how much the city/provincial budget for the health sector is, how many beds and staffs the hospital has, degree of its operations, environment protection, etc. The city/provincial DoH is responsible for evaluating the scale and degree of operations of health facilities at the end of each year, then reporting to the city/provincial People's Committee to consider the financial allocation for the following year.
Whereas the limited public financial source is mainly to maintain the organization's operations at the basic level, the patients' payments help it become more active in improving the quality of daily activities and services, as well as carrying out small-scale equipment or device purchase orders by itself.

In general, the private healthcare establishments finance their operations themselves, including medical waste treatment equipment investment capital. Meanwhile, the activities of the public medical organizations are funded by the public budget and patients' payments. When a public healthcare facility needs medical waste treatment equipment, it must call for the investment from the city/provincial DoH that manages it directly.

Notable characteristics of healthcare establishments

The city/provincial-level hospitals are either general hospitals or special ones. Treatment of diseases that require advanced medical technologies or complicated and difficult surgeries usually takes place in these health facilities. These hospitals usually have a few hundred beds, even more than 1000. For that reason, they are the major medical solid waste and wastewater generators along with some national-level hospitals under direct management of the MoH.

From the side of geographical distribution, they are frequently located in down-town of cities and in urban centers of provinces. Hanoi city and HCMC are two cities where there are most such hospitals in Vietnam, even a few dozens of them. In the other cities and provinces, there are usually at least one provincial hospital, and maximum three or four units per city/province depending on development degree of that city or province.

On the basis of the ownership element, some private city-level hospitals have been in operation in parallel with many other state-owned hospitals, particularly in the central cities like HCMC and Hanoi. The private sector in the healthcare business has been increasing recent years as living standards of the local improved, while most of state-owned hospitals are in the overloaded status all the time. However, the majority of provincial hospitals are state-owned facilities

Meanwhile, the district-level hospitals are general ones only. The number of beds in these hospitals is in the most common range of 50 - 150, depending on local demand and development degree of that district. Due to lack of equipment and qualified doctors, the district hospitals often treat diseases not leading to serious or dangerous situations for patients. Hence, the quantity of medical solid waste and wastewater generated by these hospitals are much less than city/provincial-level hospital.

TABLE 9. Notable characteristics of healthcare establishments

Characteristics	**City/provincial level hospitals**	**District-level hospitals**	**Regional clinics**
Public sector	Yes & majority	Yes & majority	Yes
Private sector	Yes but minority	Yes but minority	Yes & majority
Quantity of beds	A few hundred, even more than 1000	Most common range of 50 - 150	N/A because they serve outpatients only.
Medical solid waste generation	Major generators	Average generators	Minor generators

degree			
Medical waste-water generation Degree	Major generators	Average generators	Average generators
Located in cities	Yes & majority	Yes	Yes
Located in provinces	Yes	Yes	Yes but minority

4.1.3 Current medical waste mangement status in Vietnam

The survey has been carried out in the southern half of Vietnam, including four regions: the South Central Coast, the Central Highland, the Southeast and Mekong Delta. The interviewees comprise people in charge in city/provincial level hospitals and district level ones, both public and private healthcare facilities, city/provincial departments of Health, of Natural Resources and Environment, and of Science and Technology, and urban environment companies in some provinces and cities belonging to such regions. Therefore, findings from analyzing collected data in the survey are highly reliable and objective enough to be able to generalize the current medical waste management status in whole Vietnam so far. Detailed information of the survey provided in Appendix 4 at the end of the research.

From the viewpoint of the medical waste treatment model, there is an increasing tendency to treat medical solid waste at centralized treatment units by using medium or large-scale incinerators. At present, the centralized treatment unit of each city or province is either a facility of a local urban environment firm or a city/provincial general hospital equipped with an incinerator having appropriate capacity. So far, HCMC, Da Nang city and Quang Nam province are the only three of the surveyed provinces and cities in which the entire of medical solid waste is collected, transported and treated at the centralized treatment units of three local urban environment firms. In the other provinces, only the amount of medical solid waste generated by healthcare facilities located in urban areas are treated in the centralized treatment units. Most of district level hospitals which are

placed in the rural or remote areas still retain treatment of such waste by small-scale incinerators or unsafe landfill.

To wastewater produced by healthcare establishments, the only solution being applied in these ones is to construct the wastewater treatment system right in the hospital's space. The existing systems are mainly utilizing biological and chemical technologies. However, the majority of the present wastewater systems fail to meet requirements of both treatment capacity and the quality of output wastewater. Even some city/provincial level hospitals and variety of district level ones have not installed the wastewater treatment systems yet. Then their wastewater is directly discharged into the common pipes under the ground without treatment.

Let's take a look at the detailed facts relevant to the medical waste management circumstance in healthcare facilities. First of all, it is about findings in city/provincial level hospitals. These hospitals are the major medical waste generation sources. Medical solid waste is treated by either the incinerator placed in the hospital or delivering to a local urban environment firm, depending on policies of each local city/provincial government. The quantity of healthcare solid waste generated by city/provincial level hospitals spreads through a long range, most common from 100 to 500 kilos per day. Figure 28 below shows the statistics of the medical solid waste generation in several city/provincial level general hospitals surveyed.

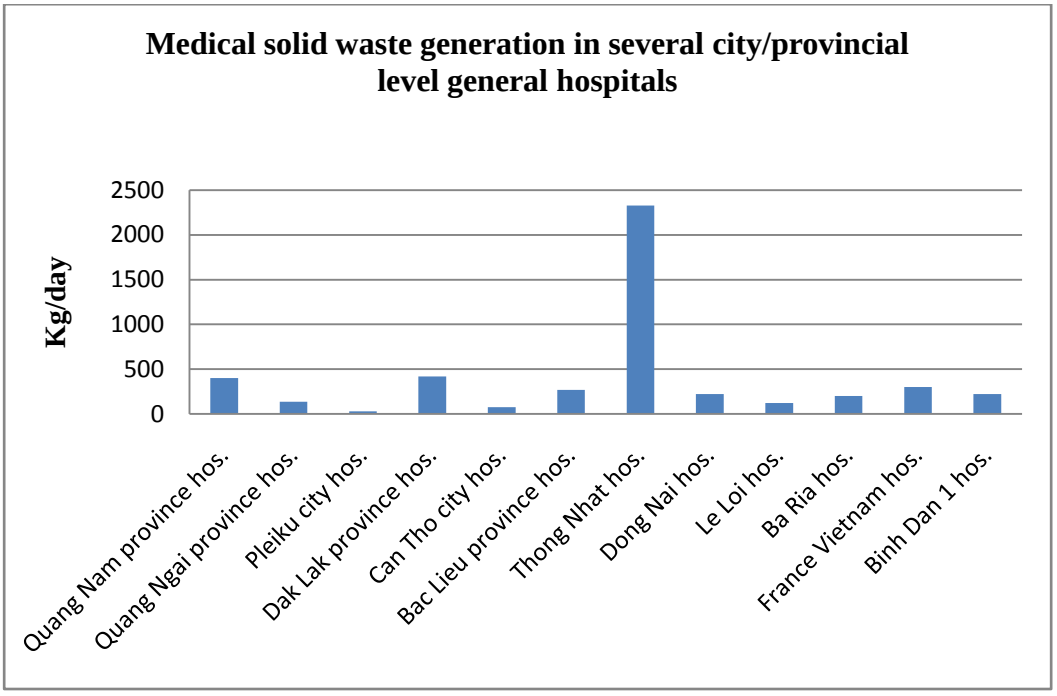

FIGURE 28. Medical solid waste generation in several city/provincial level general hospitals

Among them, the general hospitals of Le Loi, Pleiku city, Quang Nam, Quang Ngai, Bac Lieu, Ba Ria provinces have been equipped with incinerators having treatment capacity of a few hundred kilos per day so that they can burn such waste generated not only by themselves but also by surrounding healthcare facilities in accordance with the encouragement of local governments. At the interviewing time, Quang Nam province general hospital is planning to stop operating its existing incinerator because a new centralized hazardous waste treatment factory which is responsible for treating medical waste in the whole province is launched in August 2011 in this province. Dak Lak province general hospital has been utilizing the steam sterilization technology to treat such waste. The waste after sterilizing is delivered to a local urban environment company for landfill. The remaining ones are in contracts with local urban environment firms for treating this kind of waste.

Therefore, from the viewpoint of treatment capacity, the amount of medical solid waste in these hospitals is almost resolved. However, the issues relevant to the quality and efficiency of existing treatment methods are in doubt. This assessment results from the complaints of and dissatisfaction with the ability to control smoke

and smell generation, burning ash, as well as fuel costs for the incinerators shared by most of people who are responsible for monitoring or operating the incinerators. Figure 29 below represents monthly payment for treating medical solid waste in several city/provincial general hospitals.

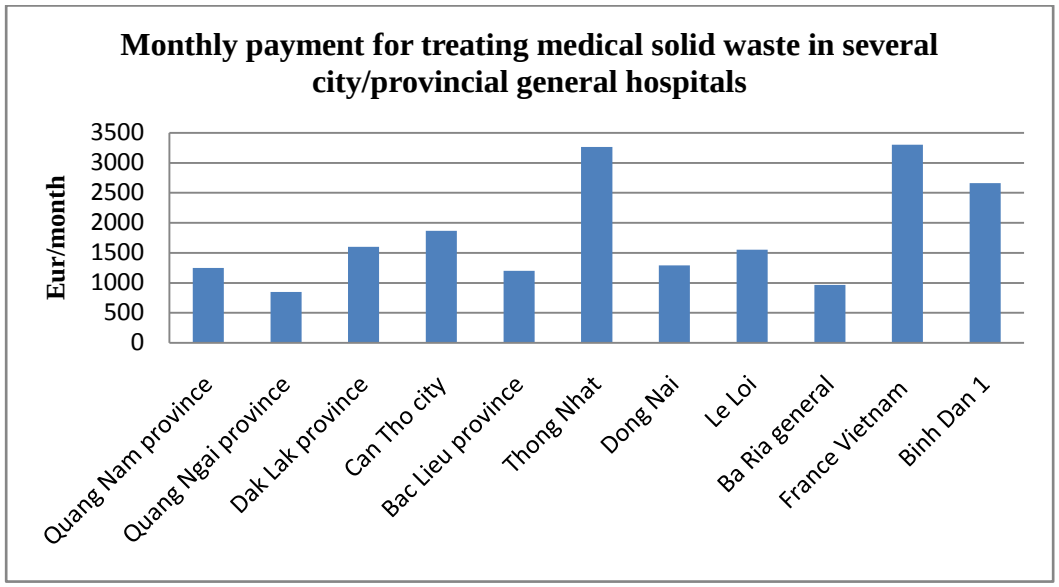

FIGURE 29. Monthly payment for treating medical solid waste by several city/provincial general hospitals

Among these, France Vietnam hospital is the only private one. These payments are either for the existing treatment equipment operation costs if the hospital treats such waste by itself or for the urban environment firm that the hospital signs the contract with. These costs are high in relation to the annual operation budget of the state-owned hospitals, according to hospitals' interviewees.

Meanwhile, the majority of the city/provincial level hospitals fail to meet demand for treating medical wastewater in terms of both treatment capacity and the quality of output wastewater. Most of the wastewater treatment systems in these hospitals have been constructed for years and mainly use the biological and chemical technologies. The quantity of wastewater produced by these hospitals is in a range of 100 – 900 cubic meters per day (24 hours) as illustrated in Figure 30 below.

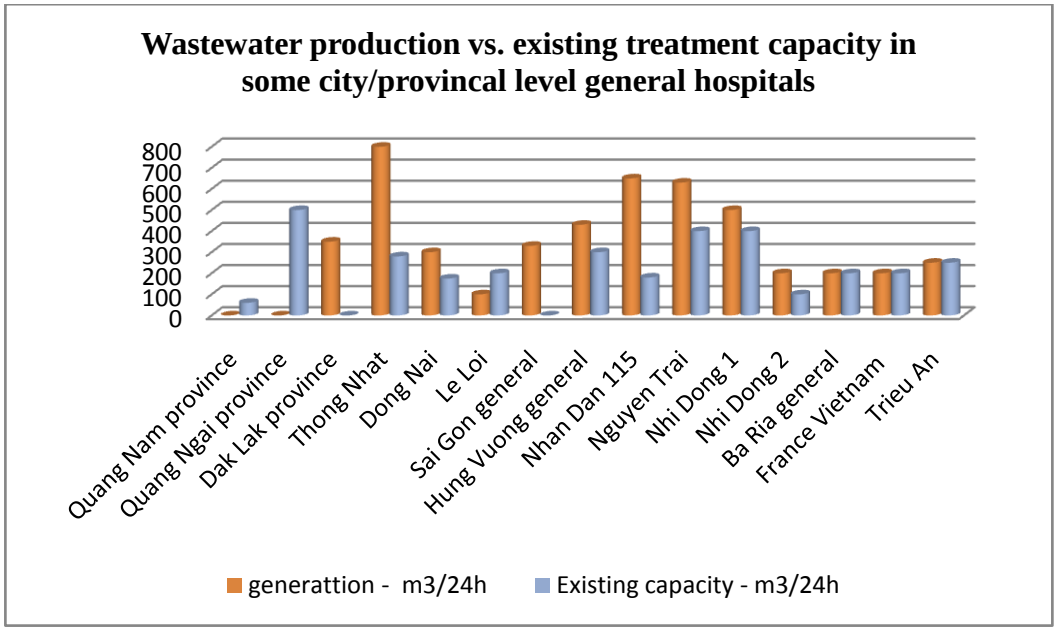

FIGURE 30. Wastewater production vs. existing treatment capacity in some city/provincial level general hospitals

Note: the amount of wastewater produced by Quang Nam province general hospital and Quang Ngai province general hospital are not provided by the interviewees in these hospitals.

Among these, only the wastewater treatment systems in Quang Ngai and Ba Ria general hospitals have enough capacity in relation to demand. Dak Lak province general hospital and Sai Gon general hospital have not equipped the treatment systems yet up to the survey time. The remaining ones have had the treatment systems but the existing treatment capacity is under the amount produced.

Other city/provincial level special hospitals are also in the similar situation. Most of these are located in urban areas, particularly in HCMC. They also produced average from 100 to 900 cubic meters of wastewater per day. However, the existing treatment capacity is under the production of wastewater. Figure 31 below depicts the gap between the amount of wastewater produced and the existing treatment capacity in some city/provincial level special hospitals.

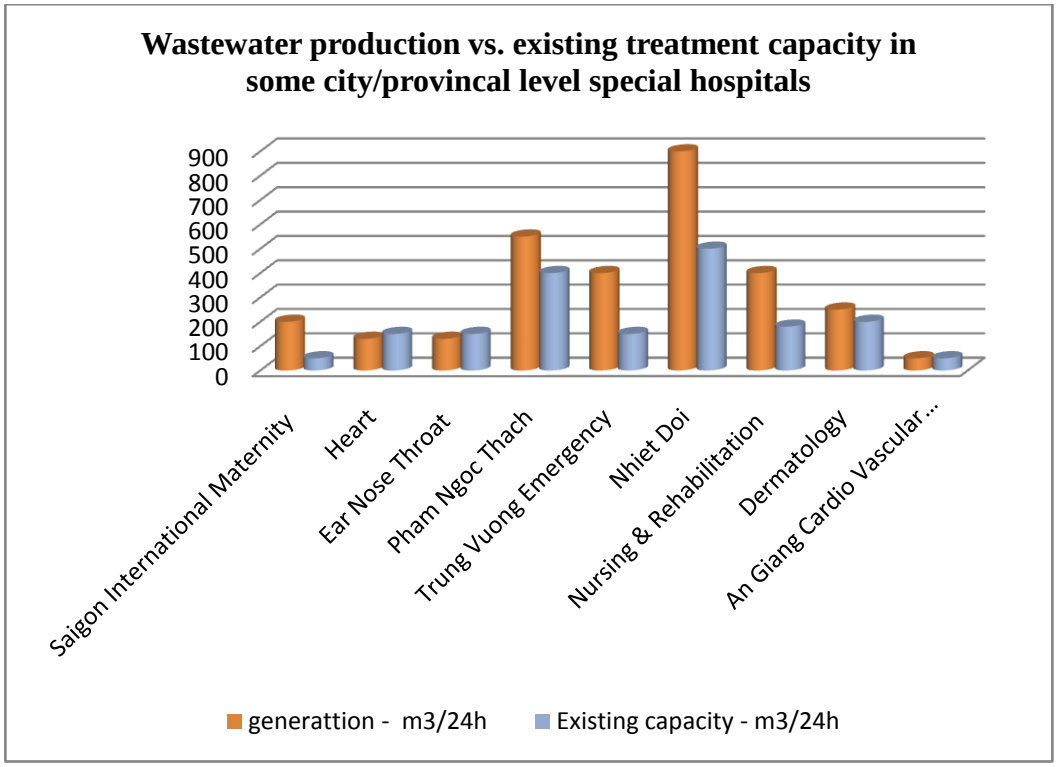

FIGURE 31. Wastewater production vs. existing treatment capacity in some city/provincial level special hospitals

In general, most of the city/provincial hospitals have serious problems with treating medical wastewater they produce.

Now is the time to take a look at the facts collected in district level hospitals and clinics. The amount of medical solid waste produced by these is around a few dozen kilos per day, the most common range of 15-40 kilos each day. Depending on policies of the local government, such waste is burnt by a small-scale incinerator placed right in the hospital's space or delivered to another unit, such as a local urban environments firm or a neighbor hospital having a better incinerator, for treating. Some hospitals still utilize the unsafe landfill treatment. Figure 32 below represents the amount of medical solid waste generated by district level hospitals in provinces.

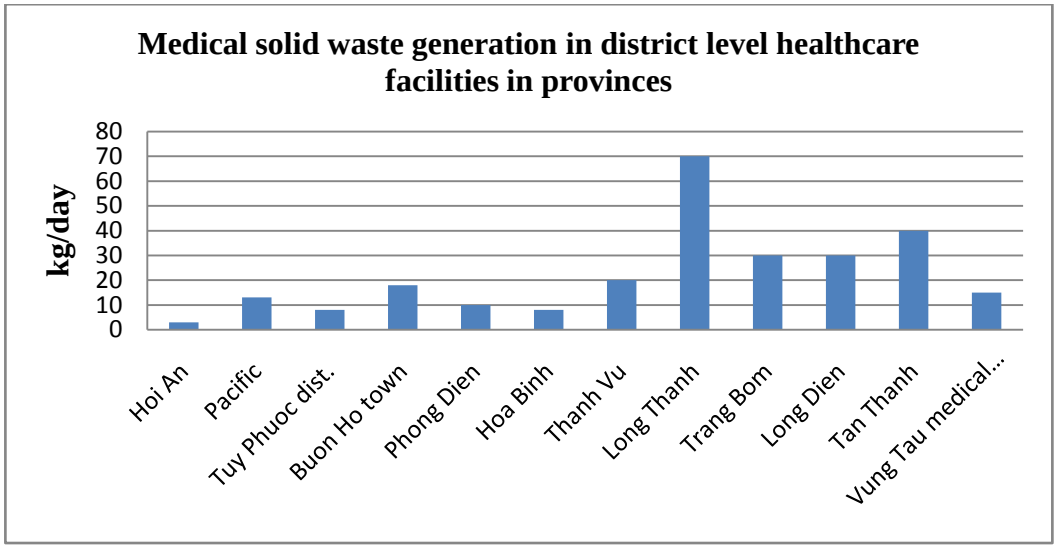

FIGURE 32. Medical solid waste generation in district level healthcare facilities

Among these district level hospitals, Hoi An hospital, Pacific hospital and Vung Tau Medical services center contract with local urban environment companies to treat their such solid waste. Thanh Vu private hospital enters a contract with Bac Lieu province general hospital for treating its such waste. Long Thanh and Trang Bom district hospitals have already been equipped with incinerators but these incinerators no longer work well. At the time of interviewing, these two hospitals are considering to contract with Dong Nai urban environment company for treating their waste. The remaining ones are using small-scale incinerators but the quality of these incinerators remains very limited, even worse than those in the city/provincial level hospitals. Most of the small-scale incinerators are in serious problems with the air emission and smell control, burning ash and fuel costs to burn such waste, according to the interviewees' complaints.

As an inevitable result of using low quality incinerators, the district level hospitals encounter the high cost for buying diesel to feed the incinerators. According to the interviewees, this waste treatment cost is high in relation to their annual operation budget. Figure 33 below represents the monthly payment for treating medical solid waste in district level hospitals.

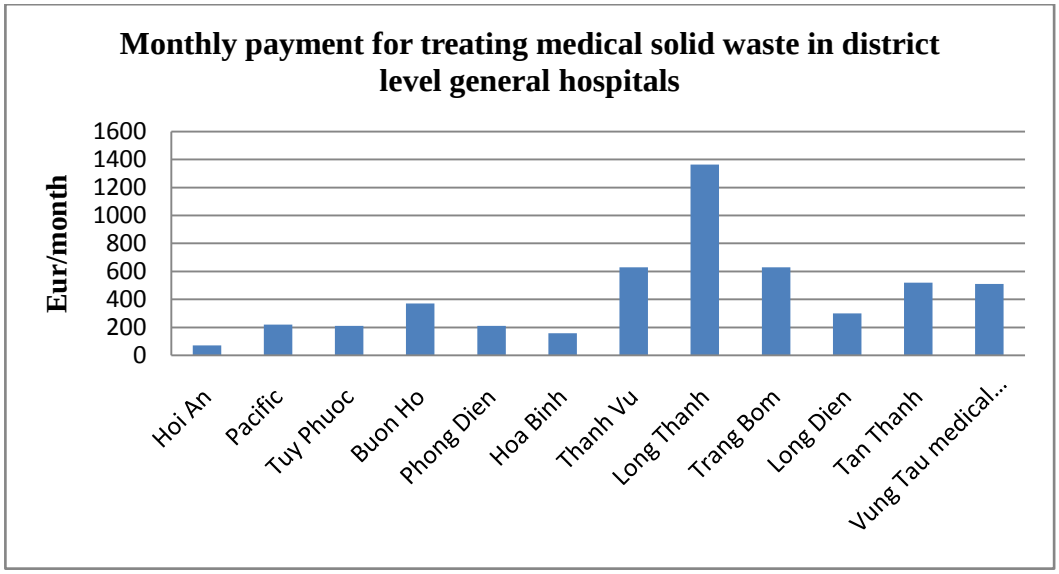

FIGURE 33. Monthly payment for treating medical solid waste in district level general hospitals

For the hospitals which treat such waste by their own incinerators, for instance Tuy Phuoc, Buon Ho, Phong Dien, Hoa Binh, Long Thanh, Long Dien and Tan Thanh, this payment is for buying diesel only, excluding other costs such as maintenance, repairing or operator's salary. Meanwhile, the remaining which enter contracts with other partners for treating such waste, this payment is total cost for treating their medical solid waste.

Meanwhile, apart from Can Gio district hospital and An Nghia clinic which are located in Can Gio island district isolated from the rest of HCMC and treat medical solid waste by small-scale incinerator, almost all of district level hospitals and clinics in HCMC deliver their medical solid waste to CITENCO so that this company burns such waste at its centralized treatment unit by one large-scale incinerator in accordance with the encouragement of HCMC government. The quantity of medical solid waste produced by these hospitals is average between 10 and 50 kilos per day, some ones such as Hooc Mon district hospital, District 6 and District 10 generate around 100 kilos each day, as much as some city/provincial level special hospitals. CITENCO charges these healthcare facilities €0.4 per kilo of medical solid waste. Statistics of the amount of medical solid waste produced and

monthly payment for treating such waste by these organizations illustrated in Figure 34 and Figure 35 below respectively.

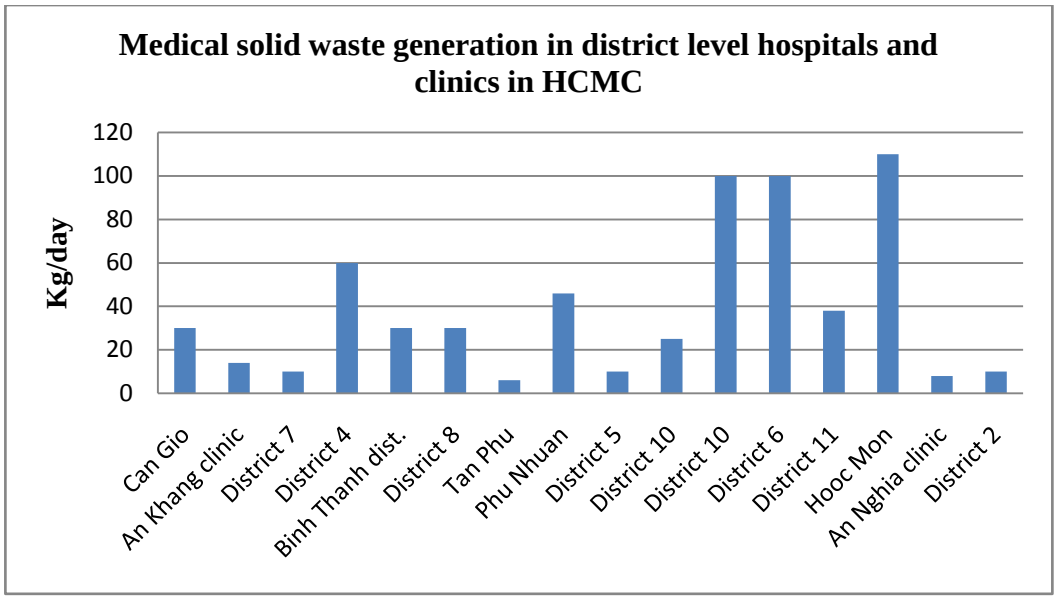

FIGURE 34. The amount of medical solid waste generated by district level hospitals and clinics in HCMC

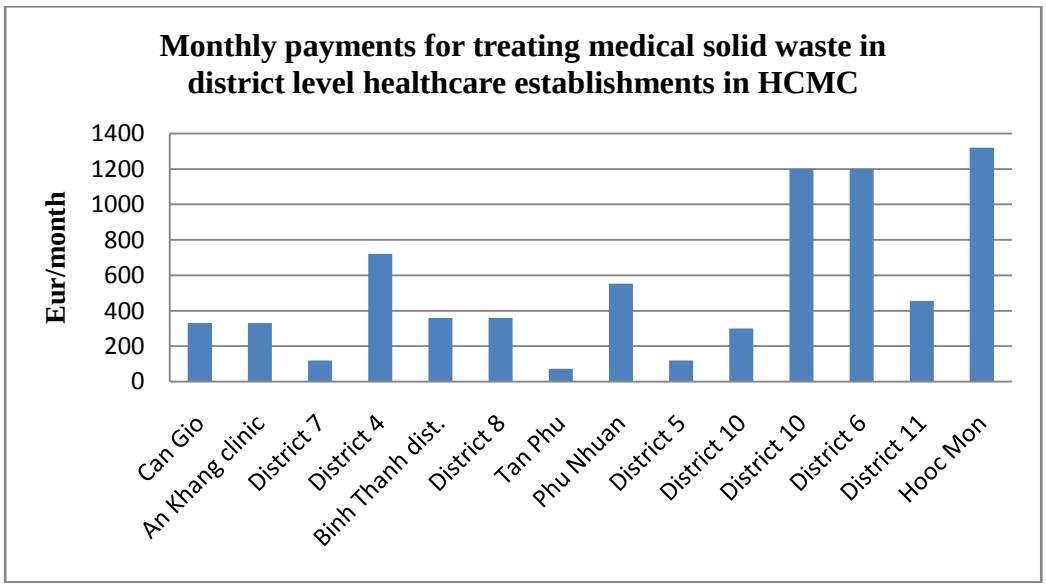

FIGURE 35. Monthly payments for treating medical solid waste in district level healthcare establishments in HCMC

Similar to the city/provincial level hospitals, the production of wastewater in district level hospitals is also in a long range of 5 – 60 cubic meters per day (24 hours), depending on the developing level of the district in which the hospital is operating. Among hospitals illustrated in Figure 36 below, only the Pacific private hospital's wastewater treatment system meets requirements. The Hoi An hospital's treatment system is under construction at the time of the interview. Some other hospitals such as Phong Vu, Phong Dien, Long Thanh, Trang Bom, Nhon Trach and Long Dien do not operate effectively and failed to meet requirements of the output wastewater. The others have not had the wastewater treatment systems yet. Figures 36 & 37 below show the amount of medical wastewater produced by district level hospitals in provinces and in HCMC respectively.

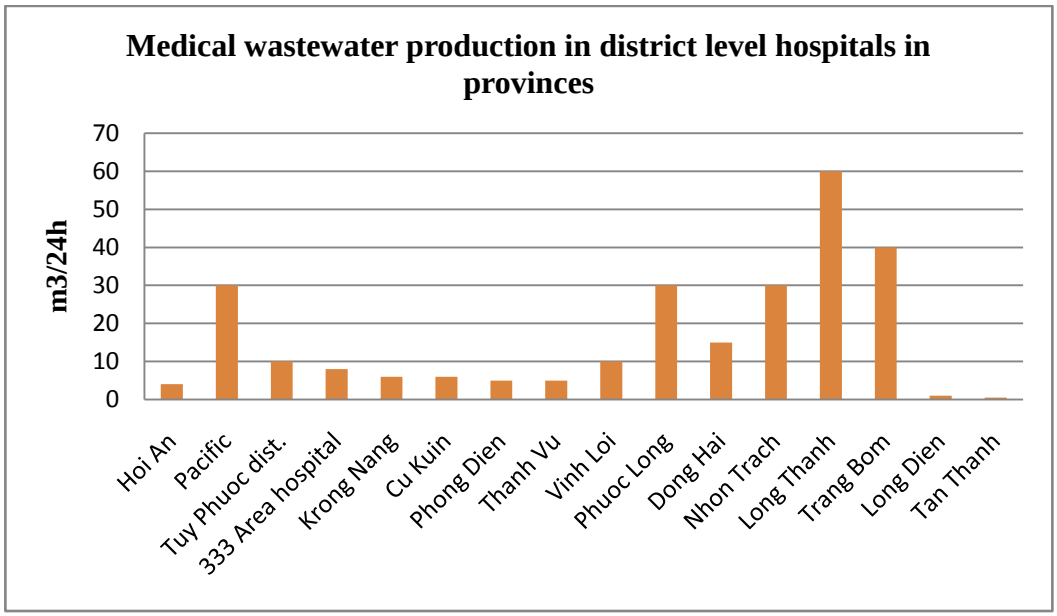

FIGURE 36. Medical wastewater production in district level hospitals in provinces

The amount of medical wastewater produced by district level hospitals in HCMC is illustrated in Figure 37 below.

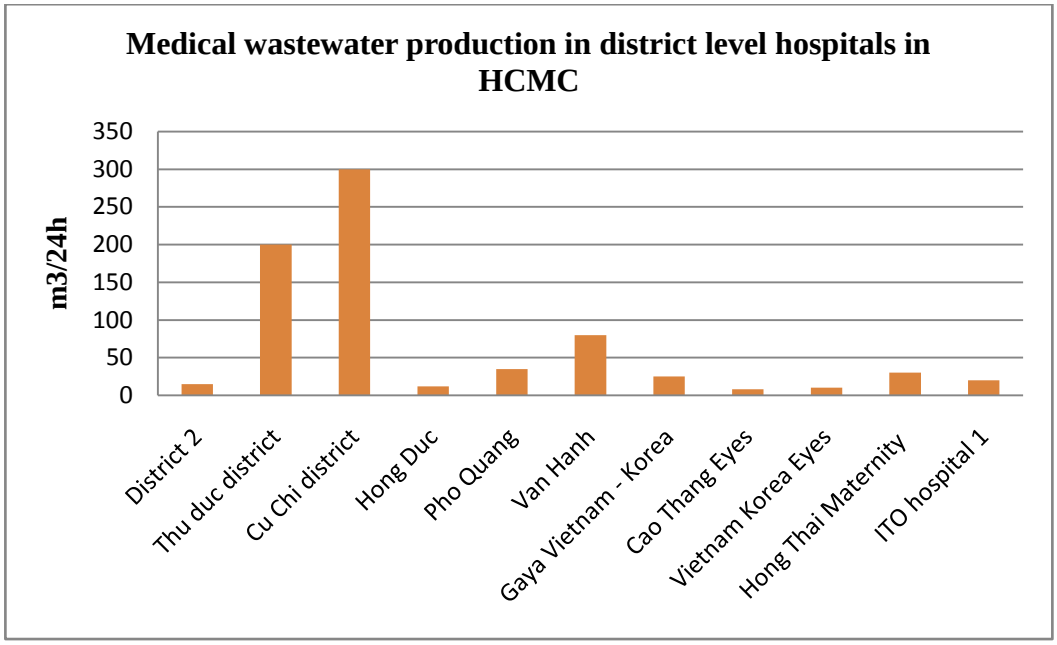

FIGURE 37. Medical wastewater production in district level hospitals in HCMC

The most striking point from Figure 37 is that apart from two publicly owned hospitals – Thu Duc district and Cu Chi district hospitals which produce as much wastewater as some city/provincial level hospitals, the remaining private health-care facilities generate the most common range of 10-40 cubic meters of medical wastewater.

According to Mr. Phan Thanh Liem, HCMC DoH and Mr. Nguyen Huu Huyen, Dak Lak province DoH, a lot of hospitals do decide on either stopping running or only putting their wastewater treatment systems in operation when public inspectors visit. They are willing to pay fines to Environment Police because the wastewater treatment system operation costs are much higher than total value of fines. In addition, most of interviewees in hospitals usually refuse to provide payments for operating the wastewater treatment system because they are quite complicated and sensitive. That is the reason why statistics of payments for treating medical wastewater in healthcare facilities cannot be performed.

In short, the overall evaluation of the present medical waste management context in such four regions can be generalized in Table 10 below.

TABLE 10. Overall evaluation of the current medical waste management state

	Regions	**Medical solid waste treatment state**	**Medical wastewater treatment state**
1	The South Central Coast	- There is a tendency to treat medical solid waste generated by healthcare facilities located in urban area at a centralized treatment unit by medium-scale incinerators; - Most of district hospitals are using small-scale incinerators; - Allocation of and treatment capacity of incinerators meet demand; - Existing incinerators have trouble with air emission, smoke and smell control, hazardous burning ash and fuel costs.	- The majority of existing medical wastewater treatment systems in both city/provincial level and district level hospitals fail to meet requirements of treatment capacity and the quality of output wastewater. - Mainly biological and chemical technologies are being applied. - Operation costs for the systems remain high.
2	The Central Highland	- Some hospitals equipped with incinerators to treat such waste by themselves; - Many district level healthcare facilities are still treating such waste by open-burning or unsafe landfill.	- A lot of district level hospitals and commune level medical services units do not have wastewater treatment systems, even Dak Lak province general hospital.
3	The Southeast	- Similar to the South Central Coast region status; - But some district level hospitals are still treating such waste by open-burning or unsafe landfill.	The same as the South Central Coast region situation, even more serious because the quantity of healthcare establishments in the southeast region is far more.

4	Mekong Delta	Similar to the Central Highland area.	The same as the Central Highland circumstance, even more serious.

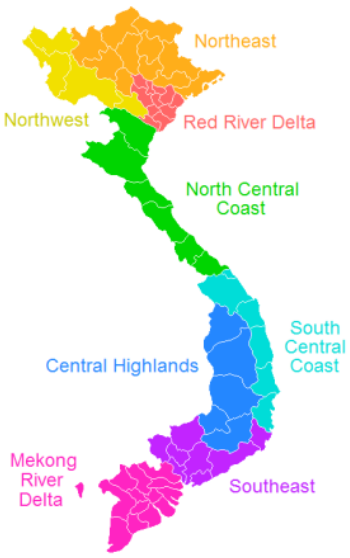

FIGURE 38. Map of key regions in Vietnam

4.1.4 Medical waste treatment equipment buying process

As mentioned earlier, the buying process of medical solid waste and wastewater treatment equipment is absolutely driven by the ownership element. This process is totally different from the public to the private health facilities.

Buying process in the state-owned healthcare organizations

After face-to-face interviews with people in charge in state-owned hospitals, city/provincial DoH, DoNRE, DoST, as well as People's Committee in different cities and provinces, it is concluded that purchase of medical solid waste equipment or installation of a medical wastewater system is considered a big purchase order and over the annual operation budget of any public healthcare facility in Vietnam. Hence, all state-owned healthcare facilities always have to ask for investment assistance from the city/provincial DoH rather than it organizes the hospital waste treatment equipment buying process itself. In this purchase process,

therefore, the city/provincial DoH plays the role of the customer/buyer while state-owned hospitals are end-users only.

Due to an overlapping managerial system being applied to the public healthcare units, the buying process is very time-consuming and involves a lot of stakeholders. The specific purchase process with participants and their roles, influence and behavior is summarized in Table 11 below.

TABLE 11. Medical waste treatment equipment buying process in state-owned healthcare establishments

		Participant/Person in charge	Remarks
Major stages	1. Problem recognition	- Incinerator operator or waste-water treatment system operator in hospital; or - Inspector of city/province health department and/or DoNRE. - Environment policeman	- Infection Control faculty in hospital. - Medical waste management unit of DoH and/or DoNRE - Environment Police department
	2. General need description	- Operator or Head of Infection Control faculty; or - Staff of Administrative Organization unit; or - Inspector of DoH.	
	3. Product specifications	- In some cases, staff of Medical Equipment unit in hospital may recommend some specific model if it can; or - Usually by a member of city/province medical project management board who is an engineering expert from department or institutes of Science & Technology. - For HCMC, Medical Equipment &Technology firm which is under direct management of HCMC DoH is responsible for this task.	
	4. Supplier research	- Member(s) of city/province medical project management board.	

	- For HCMC, Medical Equipment &Technology firm.	
5. Preparing project documentations	- City/province medical project management board; or - City/province DoH hires a consulting agency.	
6. Financial consideration	- City/province department of finance considers investment capital requirements of the project submitted by DoH, and then compares with the budget of the city/province. After that, it reports to city/province People's Committee for approval.	
7. Approve the project	City/province People's Committee makes the final decision on the project on the basis of the report of department of finance.	
8. Tender proposal solicitation	- City/province DoH is in the role of the project investor. From now on, the medical project management board is assigned to be responsible for conducting the remaining stages. - For HCMC, Medical Equipment &Technology firm does this task.	
9. Evaluate bid proposals	- The medical project management board; - For HCMC, Medical Equipment &Technology firm does this task.	Criteria evaluation: first technical statement, and second finance.
10. Supplier selection	- The medical project management board; - For HCMC, Medical Equipment &Technology firm does this task.	

The medical project management board functions to assist city/province DoH with managing projects, for examples building new hospitals, purchasing equipment to serve medical facilities, etc. that DoH is the investor. Doctor Truong Dinh Truc – Head of General Plan unit, Ba Ria – Vung Tau province DoH says that on behalf of the investor, this board will be responsible for all stages in the project lifetime,

from preparing project documentations for approval, to tender proposal solicitation, to choice of supplier or contractor, to supervision of construction or installation, and to handover to end-users. Members of this board might comprise some technical specialist from the city/provincial DoST, according to Mr. Hau – the inspector of Gia Lai province DoST.

Unlike other cities or provinces, Mr. Liem – HCMC DoH reveals that HCMC DoH has its own firm - Medical Equipment &Technology firm to be responsible for buying and equipping healthcare organizations under its direct management with demanded equipment rather than establishing the medical project management board. HCMC DoH usually co-operates with some institutes for work that requires deep technical expertise.

Buying process in private healthcare establishments

The hospital waste treatment product buying process in private healthcare establishments is expressed in Table 12 below.

TABLE 12. Medical waste treatment equipment buying process in private medical facilities

		Participant/Person in charge
Major stages	1. Problem recognition	- Incinerator operator or wastewater treatment system operator in hospital. - Nurse in Infection Control faculty
	2. General need description	- Operator or Head of Infection Control faculty; or - Staff in General Plan unit; or - Staff in Administrative Organization unit.
	3. Product specifications	Equipment operator and staff in medical equipment management & technical unit.
	4. Supplier research	- Equipment procurement unit; or - Medical equipment management unit.
	5. Preparing	- Equipment procurement unit; or

	project documentations	- Medical equipment management unit; or - Hire a consulting agency.
	6. Approve the project	City/province DoNRE
	7. Proposal solicitation	- Equipment procurement unit; or - Medical equipment management unit.
	8. Supplier selection	Director of the healthcare facility.

4.2 Segmenting medical waste treatment markets

On the basis of findings from the interviews and from market analysis above, segmenting medical waste treatment business markets in Vietnam should be based on the combination of four most vital variable groups at the same time: purchasing approaches, situational facts, demographic and operating characteristics. According to that, the author suggests three market segments as follow: segment 1 – City/province departments of health, segment 2 – Private healthcare establishments, and segment 3 – State-owned URENCOs. Figure 39 below depicts most striking characteristics of these segments.

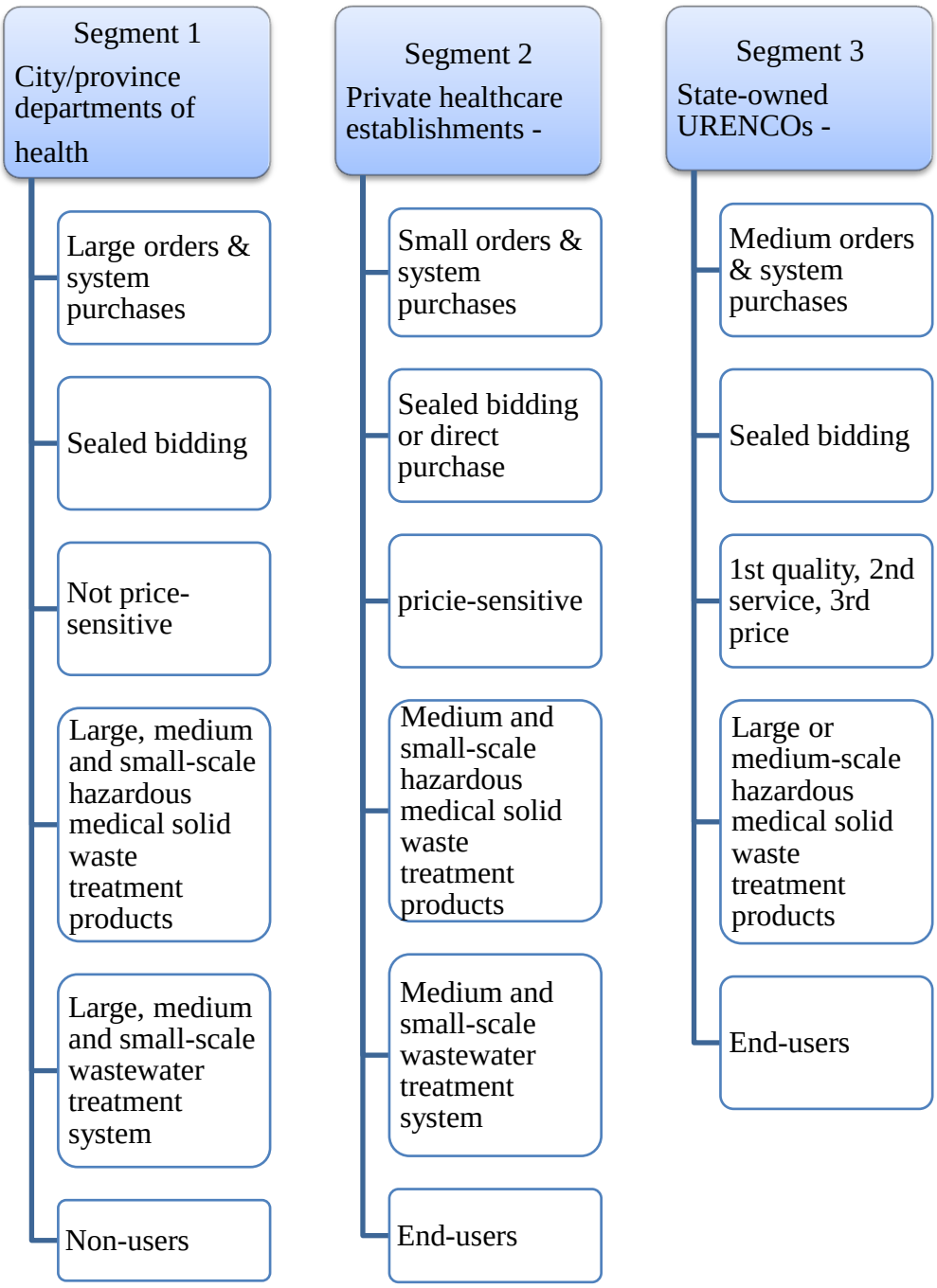

FIGURE 39. Market segments in medical waste treatment industry

Now let's discover the industry structure of medical solid waste and wastewater treatment industries through analyzing five forces inside them.

4.3 Analyzing medical waste treatment industry in Vietnam

So far, the market segments have been identified. Now is the time to analyze the industry structure to figure out the nature of five forces - threats of entrant, power of suppliers, power of buyers, threat of substitutes and the rivalry among competitors. Then findings from analyzing the industry structure become the critical inputs to support evaluating and selecting the target segment(s) in a more proper and rational manner.

4.3.1 Analyzing medical solid waste treatment industry

The medical solid waste treatment industry structure in accordance with Porter's Five Forces model is summarized in Table 13 below.

TABLE 13. Medical solid waste treatment industry structure analysis

Threat of entry: below AVERAGE
- Supply-side economies of scale remain average. That is because the existing players in Vietnam markets are either representatives/distributors of some manufacturers from UK, Germany, Japan and Korea or few domestic small-sized producers, for instance Vietnam Russia Tropical Center, HCMC University of Technology, Institute of Chemical Technology, etc. Therefore, new entrants are not forced to come in on a large scale. - Customer switching costs are average although the initial investment for an incinerator is pretty high, depending on its capacity. It results from the fact that capital for equipping a hospital with an incinerator is from the public budget while the efficiency of the investment, the quality of the incinerator in this case, seems never to be the investors' concern. The city/province departments of health are the investors or buyers while the end-users are healthcare facilities. As a result, end-users encounter either an inefficiently high level of incinerator operation costs or serious smoke and smell generation, even when the new incinerator is still in the guarantee period like in Phong Dien district general hospital and Pleiku city general hospital. Private

healthcare organizations usually contract with outside partners for treating its medical solid waste rather than buy incinerators.

- Product differentiation is low. The evidence for this is that there are not any existing incinerators in Vietnam to deal with ash, smell and smoke emission well, even Chuwastar branded incinerators made in Japan and supplied by AIC.
- Capital requirements are rather low. This is easily realized because such domestic incinerator manufacturers, who never have strong financial resources, can still join this game.
- Access to distribution channels is equal to all players.
- Government policies encourage every business without concern of domestic or international, private or public sector to solve the pollution caused by such waste. The Decision No.43/2007/QD-BYT on Health Care Waste Management Regulations issued by MoH in 2007 and the Decision No. 328/2005/QD-TTg on Approval for the National Plan of Controlling the Environment Pollution up to 2010 by Prime Minister in 2005, which aims that 100% of hazardous medical solid waste have to be treated, are the factors to accelerate the growth rate of this industry. Meanwhile, the MoNRE imposed QCVN 02:2008/BTNMT - National Technical Regulation on the Emission of Health Care Solid Waste Incinerators, and TCVN 7380-2004 - Technical Requirements of Health Care Solid Waste Incinerators which are regarded as barriers for medical solid waste incinerator suppliers. However, the implementation of these legal documents is very limited. That is why the majority of installed incinerators have been having problems with smell and emission control and fail to meet these standards, but city/province departments of health still plan to utilize them as a possible solution for treating medical solid waste. Therefore, such legal instruments seem never to be real barriers for existing players in this business.

Power of suppliers: WEAK

The amount of incinerator suppliers remains far fewer than the quantity of buyers. The growth rate of the industry remains low. In addition, their products are not differentiated. Switching costs are average. All these factors weaken the power of suppliers.

Power of buyers/customers: POWERFUL

- Much more concentrated than suppliers and purchase in large volume;
- Products not differentiated, buyers are easy to find alternative suppliers;
- The buyers are in the healthcare business while the buyer's product is to protect the environment, so quality of product is not really considered.

Thus, these strengthen the power of buyers/customers considerably.

Threat of substitutes: LOW to MEDIUM

- Even though some alternatives such as steam sterilization, microwave treatment, dry heat treatment, alkaline hydrolysis, and biological treatment recommended as long-term medical solid waste treatment solutions, it is very hard to be able to apply them in the current context of Vietnam. That is because these alternative methods require: 1. large capital for initial investment; 2. one more separate processing stage to deal with such waste as municipal waste. Meanwhile, the current capability of treating municipal waste of Vietnam remains limited, mostly landfill.

In fact, Dak Lak province general hospital is the first and the only one in Vietnam applying the steam sterilization technology rather than incinerator. This treatment system is evaluated simple, and easy to operate; however its operational costs are too high. It is worth about €166,666.67 (VND 5 billion) at the year of installation 2000. After being sterilized by this system, medical solid waste is delivered to a local urban environment firm to be treated as municipal waste. However, landfill is the only municipal waste treatment method in this province. So, the steam sterilization technology does not work efficiently at this moment in Vietnam.

Rivalry among existing competitors: below AVERAGE

- Few other domestic manufacturers are roughly equal in size and power, mainly produce small-scale incinerators. In addition, the industry growth is low because the amount of new state-owned healthcare facilities increases very little annually. The amount of the private sector increase faster, but they mostly sign contracts with local urban environment firms for treating their waste. Exit barriers are also low because existing players are either representatives or small-sized outsourcing producers.
- The price competition in this game in Vietnam seems not to follow any

business theories or market principles. Managers of some domestic incinerator suppliers complain that although their incinerators are as qualified as AIC's products and their prices are twice or three times lower than AIC's, AIC has still won plenty of projects in different provinces. However, according to some scientists in Vietnam Science and Technology Institute, the quality of AIC's incinerators is still in doubt (Phong, 2010; KN, 2010).
Up to 2010, among 380 incinerators installed according to the Ministry of Health, about 200 ones are supplied by AIC. Certainly, AIC is the strongest player in this business.

The next section will present the analysis of the medical wastewater treatment industry.

4.3.2 Analyzing medical wastewater treatment industry

The medical wastewater treatment industry structure in accordance with Porter's Five Forces model is summarized in Table 14 below.

TABLE 14. Medical wastewater treatment industry structure analysis

Threat of entry: HIGH
- Supply-side economies of scale are low. That is because most existing wastewater treatment systems are using very simple technology and even any domestic small-scale companies can also join this industry. - Customer switching costs remain average for the public buyer, and pretty considerable for the private. Although no advanced technology is required, construction of a medical wastewater treatment system is time-consuming and relevant to other processes. It makes total price of installing a wastewater treatment system become much higher while the private investor's budget is often limited. However, the public buyer's investment capital comes from the public budget, and this buyer's leading concern seems never to be the efficiency of the investment or the quality of the goods. There-

fore, the public investor usually does not care about switching costs much.
- Product differentiation is low. Evidences for it are that the majority of existing wastewater treatment systems usually consist of simple concrete sedimentation and filter tanks, and pumps to pump chemical to disinfect output wastewater. These systems utilize biological and chemical technologies.
- Capital requirements to produce a medical wastewater treatment system in Vietnam are low because the issues of environment protection, doing responsible business and implementation of laws seem not to be concerned so far.
- Access to distribution channels is equal to every competitor.
- Government policies: Decision No.43/2007/QD-BYT on Health Care Waste Management Regulations issued by the MoH can accelerate business opportunities in the medical wastewater treatment industry. Meanwhile, QCVN 28:2010/BTNMT - National Technical Regulations on Health Care Wastewater imposed by the MoNRE may be regarded as an entry barrier on new entrants. However, there is the fact that the implementation of this law has never been strict up to now.

Power of suppliers: LOW

There are more than 100 wastewater treatment solution suppliers while their products are not differentiated. Hence, the buyer easily finds out alternatives. Additionally, each purchase volume is usually quite considerable. All these things weaken the power of suppliers considerably.

Power of buyers/customers: POWERFUL

- Purchases in large volume;
- Products not differentiated, buyers are easy able to find alternative suppliers;
- The buyers are in the healthcare business while the buyer's product is to protect the environment, so quality of product is not really considered.

Threat of substitutes: AVERAGE

A treatment system seems to be the only way to deal with hospital wastewater. The biological and chemical technologies may be the most appropriate to treat this kind of wastewater. Thus, threat mostly results from improving equipment to be able to apply these technologies more and more effectively.

Rivalry among existing competitors: HIGH
- There are so many players in this industry while they are roughly equal in size and power, mainly domestic SMEs. In addition, the industry growth is low because the amount of new state-owned healthcare facilities increases very little annually. Exit barriers are also low because this industry does not require much capital or fixed assets or human resources. - Partly like the case of the medical solid waste treatment industry, the price competition among rivals does not follow the market principle. It seems to be replaced with how much the seller may pay the buyer in the form of commission, especially if the buyer is the public sector.

Now let's move toward to the section of evaluating and selecting target segment(s).

4.4 Evaluating and selecting target segments

On the basis of findings from analyzing the current medical waste management state, segmenting markets and analyzing the industry structure illustrated above, now is the time to evaluate the effectiveness and usefulness of segments in respect to five key criteria – measurable, substantial, assessable, differentiable, and actionable. Table 15 and Table 16 below show the evaluation of market segments in both the medical solid waste and wastewater treatment industries respectively.

TABLE 15. Evaluating market segments in the medical solid waste treatment industry

Segments / Criteria	City/province departments of health – S1	Private healthcare establishments – S2	Public URENCOs – S3
Measurable	No.1 Most attractive be-	No.3 Not attractive be-	No.2 Less attractive

	cause of the large size, strong purchasing power and easy to measure.	cause both the size and purchasing power remain far smaller and weaker.	than S1 because both the size and purchasing power remain far smaller.
Substantial	No.1 Current market size is large, but the growth rate is predicted quite low.	No.3 Current market size is small, but the growth rate is highest.	No.2 Current market size is small, but potential. The growth rate is predicted high.
Accessible	No.2 Open but time-consuming to reach and serve.	No.1 Totally open and easy to reach and serve.	No.2 Open but pretty time-consuming to reach and serve.
Differentiable	Yes	Yes	Yes
Actionable	No.1	No.1	No.1
Ranking	**No.1 – Attractive**	No.3 – Unattractive	No.2 – Average

Now we come with the evaluation of market segments in the medical wastewater treatment industry.

TABLE 16. Evaluating market segments in the medical wastewater treatment industry

Segments / Criteria	City/province departments of health	Private healthcare establishments
Measurable	No.1 Most attractive because of the large size, strong purchasing	No.2 Less attractive than S1 because both the size and pur-

	power and easy to measure.	chasing power remain far smaller.
Substantial	No.1 Current market size is large, but the growth rate is predicted quite low.	No.2 Current market size is small, but the growth rate is high.
Accessible	No.2 Open but time-consuming to reach and serve.	No.1 Totally open and easy to reach and serve.
Differentiable	Yes	Yes
Actionable	No.1	No.1
Ranking	**No.1 – Attractive**	No.2 – Average

The evaluating results do show that in both the medical solid and wastewater treatment industries, the "City/provincial departments of Health" is the most attractive segment the new entrant should target to serve. Table 17 below summarises the ranking of the attractiveness of segments in both industries at the same time.

TABLE 17. Ranking the attractiveness of segments

	Attractiveness / Segments	**Unattractive**	**Average**	**Attractive**
Medical solid waste treatment industry	City/province departments of health			1
	Private healthcare establishments	3		
	Public URENCOs		2	
Medical wastewa-	City/province departments of health			1

	Private healthcare establishments		2	

Up to now, the segment "Public URENCOs" still remains potential. It will become attractive only when the policy of treating medical solid waste at the centralized treatment units of the public URENCOs comes into effect. That is the reason why this segment is ranked number 2, equivalent to the average attractiveness in the medical solid waste treatment industry. Similarly, the segment "Private healthcare establishments" is ranked number 2 in the medical wastewater treatment industry because of the small market size. In addition, this segment is evaluated unattractive because they rarely treat medical solid waste themselves.

Now the segment "City/province departments of health" is selected. Due to the organizational characteristic of the Vietnam Health system, each city and province has its own DoH. This makes this segment spread throughout the whole country. Meanwhile, as shown earlier, the demand for medical solid waste and wastewater treatment products is different from one region to another. Therefore, it would be essential to point out specific product lines demanded by each geographical area.

TABLE 18. Product lines recommendation for different areas within the target segment

Products / Regions	Large or medium-scale medical solid waste treatment product	Small-scale medical solid waste treatment product	Wastewater treatment system
Da Nang, HCMC, Can Tho cities	2		1
The Central Coast	2		1

The Central High-land	3	1	1
The Southeast	2	2	1
Mekong Delta	3	1	1

Legends:

1: Urgent need 2: Growing need 3: Potential need

This assessment is based on the overall evaluation of the current medical waste management state expressed in Table 10 earlier (page 93). It is obvious that medical wastewater treatment equipment lines are urgently needed by healthcare facilities in all regions. Besides that, demand for small-scale medical solid waste treatment product is also urgent in the Central Highland and Mekong Delta regions. Perhaps, two these regions may need medium or large-scale medical solid waste treatment product in the future. Meanwhile, there is a growing need for medium and large-scale medical solid waste treatment product in the remaining areas due to the increasing tendency of applying the centralized medical solid waste treatment model. Some district hospitals placed in poor and remote districts of the southeast region still demand for small-scale medical solid waste treatment products.

4.5 Dealing with competitors

Dealing with competitors in the medical solid waste treatment industry

The numbers of existing players in this business remains a few, including:

- Group 1 – Domestic Research Institutes. Vietnam Russia Tropical Center, Institute of Chemical Technology, and HCMC University of Technology are located in HCMC and not real businesses. They join researching and manufacturing medical solid waste incinerators, mainly small-scale ones for

district level healthcare facilities, as a part of their core funtions and also to contribute to solve the urgent demand for treating medical solid waste during recent years. The greatest advantage of their products is low price, approximately 1/3 of the price of imported equipment. Among them, the market share of Institute of Chemical Technology is largest.

- Group 2 – Local manufacturer. STEPRO Co. Ltd is located in Hanoi and has a branch in HCMC. This company manufactures medical solid waste incinerators with a long treatment capacity range of 5 – 1000 kilos per hour. However, there is the small quantity of projects relevant to provision of medical solid waste incinerators that this firm have done , according to information provided on its website (Yahoo Vietnam, 2009; STEPRO Co., Ltd., 2011). Thus, this is not really an effective player in this game.

- Group 3 – Importer and distributor. There are HDN Equipment and Technology Co., Ltd, and Nam A Environmental Technology Co., Ltd in this group. They predominantly import and distribute incinerators manufactured by INCINER8 from the United Kingdom. However, through their capability profile and experience in supplying this kind of product, they are also not considerable rivals.

- Group 4 - AIC and Vinaseco – the considerable competitors in this business so far. Indeed, AIC imports and distributes Chuwastar-branded medical solid waste incinerators from a Japanese partner. Meanwhile, Vinaseco is a local anufacturer cum distributor of INCINER8 and one Korean manufacturer.

Now let’s have a look at Table 19 which represents the comparison among and evaluation of three most considerable competitors in this business.

TABLE 19. Most considerable competitors comparison and evaluation

	AIC	Institute of Chemical Technology	Vinaseco
Experience in supplying the incinerator	Around 200 incinerators throughout Vietnam	Around 20 small-scale incinerators	50 projects throughout Vietnam
Current & future objectives	- Market penetration; - Enhance the position	N/A	Market penetration
Current strategy	- Developing domestic markets; - Widening the cooperation with famous manufacturers in the world; - Training staffs	N/A	Positioning by improving the quality of products and services and the efficiency of operation costs.
Product technology	Made in Japan	Made in VN	Made in Korea, UK & VN
Ability to R&D	Fair	Good	Fair
Ability to produce	No manufacture	Small	Small
Ability to market	Good	Weak	Fair
Ability to finance	Very strong	Limited	Average
Ability to manage	Good	Fair	Fair
Greatest strengths	Strong relations with top government offi-	Low price; R&D;	Low price products produced in

	cials; Japanese tech.	Publicly stated	Vietnam and import INCINER8's products.
Greatest weaknesses	Compete following the market principle	Not a real business	Ability to market
Assessment	Strongest and most successful	Average	Average

So far, it is clear that AIC is the strongest and the most successful competitor in this business. The input information of this comparison and assessment is collected from the web pages of these organizations mainly, local related newspapers and interviewing Mr. Dang Van Huyen – Sales Executive, Vinaseco via phone.

One question asked is "Why is AIC successful over other rivals?" When being asked for assessing AIC's performance and success, Mr. Huyen - Vinaseco makes a conclusion that being a state-owned company with strong and close relations with central governmental officials is the key to AIC's success, as well as makes it become the most powerful players in this business. In fact, some local newspapers questioned how AIC could win a series of tender packages of supplying medical waste incinerators in northern provinces of Vietnam in 2010 while its total offer prices are always three times as high as other rivals'. From personal working experience in bidding projects in Vietnam, the writer understands well that if the buyer is a public organization, the nature of competition in sealed bidding proposals becomes how strong and close the relation between the bidder and the buyer, and how much money the bidder can pay key participants in the buying process in the form of commission.

In general, one of the most useful lessons can be learnt from AIC to be successful in this game is building a strong and close relationship with the buyer. However, AIC is only powerful in northern markets of Vietnam where it has a very close relationship with the Ministry of Transportation. Luckily, the historical elements, cultural differences and the existence of the regionalism reduce AIC's influence

on the remaining of Vietnam markets considerably. Thus, new entrants are able to make use of this fact to compete against AIC.

Dealing with competitors in the hospital wastewater treatment industry

As mentioned earlier, the number of hospital wastewater treatment suppliers remains very substantial. No player really dominates this market because they are almost the same as size and there is no differentiation in terms of technology and product among them. However, in the case of tender packages of supplying both medical solid waste and wastewater treatment equipment at the same time, Vinaseco and AIC can obtain competitive advantages in relation to other rivals because they are selling hospital wastewater treatment equipment, too. For that reason, AIC should be taken into account once again in this business.

Selecting competitive strategy

The results of analyzing competition in both medical solid waste and wastewater treatment industries illustrate that AIC is the market leader in this game. Therefore, the author suggests that the new entrant should compete as the market-challenger. The market-challenger is to attack the market leader to gain a certain market share, and establish the new entrant's image and influence on the markets.

A flanking strategy is to discover needs and satisfy them. A flank attack which is directed along two dimensions - segmental and geographic, promises the highly successful ability. The segmental attack aims to figure out and serve uncovered market needs. In fact, some end-users are not satisfied with the effectiveness and efficiency of incinerators provided by AIC. Naturally, this becomes an opportunities for the market challenger. In a geographic attack, the market challenger will attack areas where AIC is underperforming. This is totally possible because AIC is really powerful only in the northern markets of Vietnam where it has very strong and close relations with the central government officials. Beside, the historical elements, cultural and geographical differences and the existence of the regionalism reduce AIC's influence on the rest of Vietnamese markets considerably.

This fact has been shown obviously while the author interviews stakeholders in all the areas surveyed.

4.6 Stakeholder and risk management

So far, all key stakeholders involved in the medical solid waste and wastewater treatment business have been realized. As illustrated earlier, each stakeholder plays a different role, as well as affects this business in different ways. Therefore, it is vital to prepare an action plan forward to each of them so that the new entrant is able to adapt and react against the stakeholders' actions effectively. At the same time, the new entrant can also act to influence on the stakeholders back so that it can protect itself actively, as well as reduce or remove barriers and risks from the others.

TABLE 20. Necessary actions forward to key stakeholders

No.	Stakeholder	Necessary actions forward to stakeholder
1	DNURENCO & CITENCO	These are two local urban environment companies which may be potential business partners because they possess most essential characteristics to be able to produce certain competitive advantages to success in this business. So, they should be taken into consideration carefully when the foreign manufacturer makes a decision on the market entry mode.
2	Private healthcare facilities	They need to buy medical waste treatment equipment, particularly the wastewater treatment product. Although the quantity of these facilities remains quite small, they are easy and efficient to be reached and served. Thus, the new entrant should also pay attention to them in an effort to increase market share and the influence after the most attractive segments are cared well.
3	City/province	These are the main and most critical investors or buyers

	departments of Health	in this business. The most important participants in the medical waste treatment equipment buying process stay in these organizations. Hence, approaching them and developing close and strong relations with these participants is the key to the success in this game.
4	State-owned urban environment companies (URENCOs)	At present, most of them are only potential medical solid waste treatment product buyers. However, once regulations on applying the centralized medical solid waste treatment model come into effect, these firms will be big customers. Therefore, they should be considered in the market development strategy.
5	City/province DoNRE	Medical waste treatment products can be put into operation only after they get the approval from inspectors of city/province DoNRE. Keeping contact with these inspectors will help the testing and commissioning process of new equipment take place more smoothly.
6	City/province People's Committees	They decide on the model of medical solid waste treatment, make decisions on budget for investing into health projects in city/province. Plus, they directly manage the majority of public URENCOs. Hence, if approaching these successfully, the new entrant gains a lot of advantages, as well as avoids threats while planning business strategies. Beside, once the new entrant build a good relation with these and demonstrate advantages and benefits of the new medical waste treatment solution to them, he may affect decision on medical waste treatment in that city/province with respect to his own technology at that time.
7	MoH	This ministry orients kinds of medical waste treatment solutions and technologies. Actions of the MoH may accelerate the growth rate of some medical waste treatment solution business. However, they may also make some player face exiting from the race if that player's

		solution or technology is not allowed to use any more. So, if the new entrant can build a good relation with MoNRE and demonstrate advantages and benefits of the new medical waste treatment solution to this organization, even he can influence on decisions of the MoH with respect to the new entrant's own technology or solution. This ability results from the fact that the MoH usually refers to either good samples in other countries or good existing models internally, and then makes that model or sample become an orientation.
8	MoNRE	National technical standards or regulations imposed by this ministry can produce technical barriers on medical waste treatment products. Therefore, product strategies of the new entrant need to be kept close to actions of this organization. Besides that, if the new entrant can build a good relation with the MoNRE and demonstrate advantages and benefits of the new medical waste treatment solution to this organization, even he can create barriers on other competitors by supporting the MoNRE to prepare new technical standards with respect to the new entrant's products specifications. In fact, this ability is able to become true because the strategic vision and capability of the MoNRE is limited. As a result, a variety of national technical regulations or standards come after a new technology put into operation, for example the case of National Technical Regulations on Healthcare Incinerator.
9	AIC	This is the strongest competitor in this business. This player makes use of the strong relationship with the officials of the Ministry of Transportation to lead this business race. The new entrant has to pay very special attention to this to have suitable action plans to reduce its influence.

4.7 Summary of empirical research results

Results from the empirical research in Vietnam can be summarized at the following striking points:

- The Vietnamese health system is dominated by the public sector. The minority of the private medical facilities is predominantly gathered in the downtown or urban areas. Due to limited financial capability, a low perspective on the environment protection and gaps in the implementation of regulations and laws, almost all healthcare facilities in Vietnam, even ones equipped with medical solid waste and wastewater systems, have been polluting the environment seriously. The city/provincial level hospitals are the major medical waste generators, followed by district level hospitals. Next is preventive medicine centers and medical services centers.
- So far, hazardous medical waste is burnt by incinerators or unsafely landfilled. All these incinerators have problems with smell and smoke control. Most of them do not work effectively and efficiently because they consume too much diesel to burn the waste, and the hazardous ash remains after burning. The existing medical wastewater treatment systems use the biological technology and chemical to disinfect the output wastewater. The majority of them are old and fail to meet requirements of treatment capacity or the environment regulations.
- The medical waste treatment equipment pruchase process in the public healthcare establishments is complicated and organized in the form of inviting to bid. The city/provincial department of health be in the role of the investor while the healcare facilities are the end-users. However, the private medical sector is free to purchase such equipment and finance itself.

5 RECOMMENDATION

5.1 Market entry mode

Why is the entry mode of agent recommended*?*

On the basis of the theoretical discussion about market entry mode and practical findings from the market analysis process earlier, the author does recommend that the new entrant should looking for an appropriate agent(s) in the Vietnam market-place. This recommendation is based on four following dimensions: fitting the current market context, the ability of monitoring and controlling markets, over-coming operation costs and business efficiency trade-off, and minimizing risks for the foreign entrant.

First, fitting the current market context concerns the following issues:

- Some city/provincial governments have action plans to either equip healthcare facilities with new medical solid waste and wastewater treatment systems or upgrade the existing systems heavily in the very near future. Meanwhile the establishment of a business place or a representative office in Vietnam, re-cruitment of suitable staffs and then putting the system in smooth operation may be long time, energy and cost-consuming for a foreign entrant if it is not in good relations with qualified and appropriate intermediaries. In this case, the cooperation with a local qualified agent(s) can help the newcomer over-come these obstacles to catch business opportunities in time.
- Next, the medical waste treatment equipment buying process in both public and private healthcare organizations must be carried out in the form of an invi-tation to bid in accordance with Vietnamese Bidding Law 2005. Several clauses related to the bidding process, legal identification of the bidder, quali-fications of the bidder, bid bond, etc. of this law can be challenges for foreign bidders. In addition, the investor usually prefers to invite domestic bidders be-cause of being afraid of linguistic obstacles, differences in business culture

and others. Therefore, an agent experienced in bidding procedures and in the medical waste treatment field is the best choice to deal with these challenges.

Second, the agent(s) can still help the foreign manufacturer retain the ability of monitoring and controlling markets at a high level. From the personal experience while working as an agent/distributor of foreign suppliers from Singapore and Japan in Vietnam, the author realizes that the ability of monitoring and controlling the foreign market heavily depends on how strong and close the relationship between the foreign manufacturer and its agent is, and how effectively that agent plays in this field. For most Vietnamese people, they always appreciate a good friendship. They become very honest and responsible, even willing to assist their close friends without money concern. In the case of this business, the foreign manufacturer is able to build a close friendship with its local agent(s) by keeping in touch, combining visits with introducing and training technology and products in the related field, assisting them to improve productivity and marketing skills and sharing experience with each other.

Third, this market entry mode overcomes operation costs and business efficiency trade-off because payments for building and maintaining a strong relationship with the agent(s) are likely far less than that for setting up and operating a representative or a branch in Vietnam at this moment, while the agent(s) can resolve current barriers in business operations more effectively in relation to the others as analyzed above.

Finally, though the current market demand for medical waste treatment equipment remains very substantial, the growth rate of the medical waste treatment industry is quite low, and heavily depends on the MoH's specific orientation and action plans which are unpredictable and never clear so far. So a suitable entry mode should also minimize exit barriers. In addition, the most severe problems for business and trade in Vietnam are corruption, complicated bureaucracy, poor quality of legislation and unsatisfactory intellectual property rights. That is because the implementation of related laws such as Vietnamese Bidding Law 2005, Anti-Corruption Law, Intellectual Law, etc. has so far been very limited though their

contents are comprehensive. Once again, cooperating with the agent can help the foreign manufacturer overcome all risks illustrated above.

In conclusion, the market entry mode of agent has demonstrated its advantages in not missing business opportunities, adapting to the current circumstance of Vietnam, at the same time minimizing risks the foreign manufacturer may encounter.

5.2 Recommended business model

In order to support the new entrant more, the author recommends the Canvas business model which describes the rationale of how the foreign hospital waste treatment equipment manufacturer creates, delivers and captures value from this business opportunity in Vietnamese markets.

TABLE 21. Canvas business model for selling hospital waste treatment equipment to the customers in Vietnamese markets

<table>
<tr>
<td rowspan="2">Key partners:
- Raw materials or components to support manufacture;
- Logistic partner or forwarder.</td>
<td>Key activities:
- Production;
- Selling products;
- Building and developing relations with the agent;
- Customer services after sales.</td>
<td rowspan="2">Value propositions:
- Hospital waste are treated in an environmentally friendly and sustainable manner;
- Low operation and maintenance costs;
- Reliable and easy to use and repair;
- Saving space</td>
<td>Customer relationships:
- Personal assistance;
- Up-selling driven.</td>
<td rowspan="2">Customer segment:
City/province departments of health.</td>
</tr>
<tr>
<td>Key resources:
- Manufacturing facilities;
- Intellectual</td>
<td>Channels:
- Agent(s)
- Website of the manufacturer/supplier;</td>
</tr>
</table>

	properties; - Human resource; - Financial capability.	for installing and operating equipment; - Treatment capacity is upgradable.	- Sales force; - Post-purchase services team.	
Cost structure: - Entering the host market; - Developing and maintaining the close relationship with the distributors; - Shipping goods to the target market.			*Revenue stream:* - Selling hazardous medical solid waste and wastewater treatment products to city/province departments of health in Vietnam; - Selling spare parts and maintenance services in the future.	

According to that, ***customers*** of this business are city/province departments of health in Vietnam.

Value propositions of this business model comprise:

- Hospital waste is treated in a more environmentally friendly and sustainable manner;
- Low equipment operation and maintenance costs;
- Products are reliable and easy to use and repair;
- Saving space for installing and operating equipment;
- Product's treatment capacity is upgradable.

To communicate with and reach the customers to deliver the above value propositions, the foreign manufacturer needs the following ***channels:*** agent(s) in Vietnam, the manufacturer's website, sales force and post-purchase services team. The agent(s) is the most important channel to lead to the success of this business. On behalf of the manufacturer, the agent(s) is responsible for all activities so that

medical solid waste and wastewater treatment equipment is sold to city/province departments of health in Vietnamese markets. The manufacturer's website should be full of essential information, in particular full product catalogs so that the agent(s) knows about the manufacturer and its products or services, and evaluates the above value propositions. In addition, the manufacturer's sales force is the key channel to bring the value propositions and physical products to the agent(s) in Vietnam. Also, the post-purchase team is needed because medical solid waste and wastewater treatment equipment surely demands for guarantee, maintenance and repair services. Detailed contact addresses of sales force and the after sales services team should be provided fully so that the agent's staffs can contact the right person in charge during the sales process and post-purchase.

Customer relationships should be personal assistance and up-selling-driven. On behalf of the manufacturer, the agent(s) will approach and build as strong relationships with city/province departments of health as possible. Plus, the agent(s) should provide customers with assistance during the sales process and services after sales.

The only ***revenue stream*** of this business model is from selling hazardous medical solid waste and wastewater treatment equipment to city/province departments of health so far. This will be presented more clearly in the price strategy below. However, the manufacturer is expected to earn additional money from selling spare parts and maintenance services.

Key resources needed to be successful in this business consist of manufacturing facilities and distribution network, intellectual properties, skillful staffs, and financial capability. In fact, two most vital components of the intellectual properties are the product brand and experience of the new entrant in the hospital waste treatment solution supply field. This will help the agent(s) convince the investors more effectively, as well as compete against AIC's products in the host market. Secondly, manufacturing and selling these technical products to B2B customer requires skillful staffs who are able to handle with both technical and marketing issues effectively and efficiently. Finally, the player has to have enough the financial capability to manufacture, cover overhead and business operation costs to

keep the business running, as well as to build and maintain the relationship with the agent(s).

Key activities to keep the business model working are comprised of production, selling products and customer services after sales. Perhaps, the first activity is the most time and resource-consuming one in this business. Selling products is the most important activity in this business model. It must be associated with and supported by building and developing strong and close relationships with the agent(s). Also, this activity requires the manufacturer to be involved with some logistic company or forwarder. Because medical waste treatment products are going to be installed and operated in Vietnam, the foreign producer must deliver the after sales services such as guarantee, maintenance, etc.

The foreign manufacturer should establish ***key partnerships*** with three main partner categories as follows:

- Suppliers who provide input materials or components for the hospital waste treatment equipment manufacturing process. Successfully managing these suppliers helps the manufacturer not only become active in his manufacture plan, but create certain advantages in terms of price and product quality as well.
- Logistic companies or forwarders are needed to support the manufacturer because it is recommended to sell such products to the customers via the direct export.

The ***cost structure*** arising from this business model may be made up of three main following activities:

- Entering the host market – This includes payments for the first two business trips to Vietnam and marketing communication activities at the beginning. Detailed information about these operations will be provided in the integrated marketing communication strategy later on. Total expenses for this job are estimated between 7,000 and 9,000 euros.

- Developing and maintaining the close relationship with the agent(s) – Total costs for a four-day business trip to work with the agent(s) in Vietnam are around 1000 euros/person.
- Shipping goods to the target market – Once a sales contract of medical waste treatment equipment is signed, the manufacturer has to pay for shipping goods from its facility to a destination mentioned in the contract. This payment depends on the specific trade term applied in the contract.

5.3 Competitive strategy through the new marketing mix

Now is the time to think of how to compete against the existing rivals in this business, how to create the value propositions to meet market demand, how to price the products most reasonably, how to deliver the products to the customers, and how to communicate with target customers in Vietnamese markets. To answer all these questions, the writer does design a competitive marketing strategy through the new marketing mix represented in the next sections.

5.3.1 Competitive advantages

Analyzing the success of AIC - the dominant in this business shows clearly that the formula of success in this business equals strong relations with city/province departments of health plus the high commission payment per purchase contract signed. Therefore, the newcomer can gain this competitive advantage by cooperating with local partners who are able to build strong relations with the investors.

Next, in most Vietnamese people's mind, some technology or product from the West and Japan is usually advanced, reliable and of high quality. Indeed, this has been confirmed once again through positive reactions, warm welcome and appreciation of all stakeholders that the researcher interviewed during the field trip in Vietnam when they know that the researcher comes from Lahti - the Cleantech city of Finland. Thus, medical waste treatment products manufactured by the western countries, especially members of the Cleantech Cluster, naturally obtain

the second vital competitive advantage in this game to compete against products "made in Japan" supplied by AIC.

5.3.2 Product strategy

Medical solid waste treatment product strategy

Based on analysis earlier, the author suggests developing end-user's needs-oriented medical solid waste treatment products. Most critical attributes of the products should be taken into account are the treatment capacity and key desired benefits.

Medical solid waste treatment product's capacity

As shown in the section of segmenting markets earlier, district level hospitals need small-scale products while city/provincial level hospitals demand medium and large-scale ones. Findings from analyzing collected data during the field trip reveal an appropriate range of capacity desired by each segment.

For provincial level hospitals designed as centralized medical solid waste treatment units, for example Quang Ngai province general hospital, Bac Lieu province general hospital, Le Loi hospital, Ba Ria general hospital, etc. the desired product's treatment capacity should equal total amount of such waste produced by it and other surrounding medical facilities located in the urban area in which they serve. So it could be concluded that the adequate product's range of treatment capacity for these end-users is between 500 and 800 kilos per day. This range is regarded as medium-scale in this research.

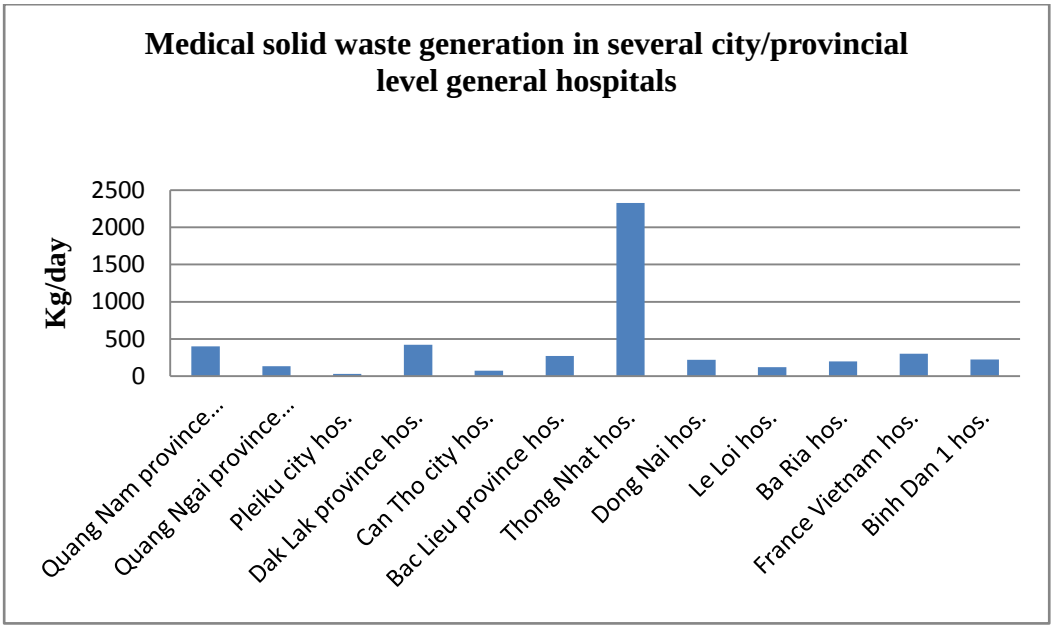

FIGURE 40. The amount of medical solid waste generated by several city/provincial level general hospitals

Meanwhile, district level healthcare facilities demand much smaller scale products. Statistics from collected data show that the appropriate treatment capacity for these facilities spreads over the range of 20 to 100 kilos per day. Figure 41 and Figure 42 below depict the amount of medical solid waste generated by district level healthcare establishments in provinces and HCMC respectively.

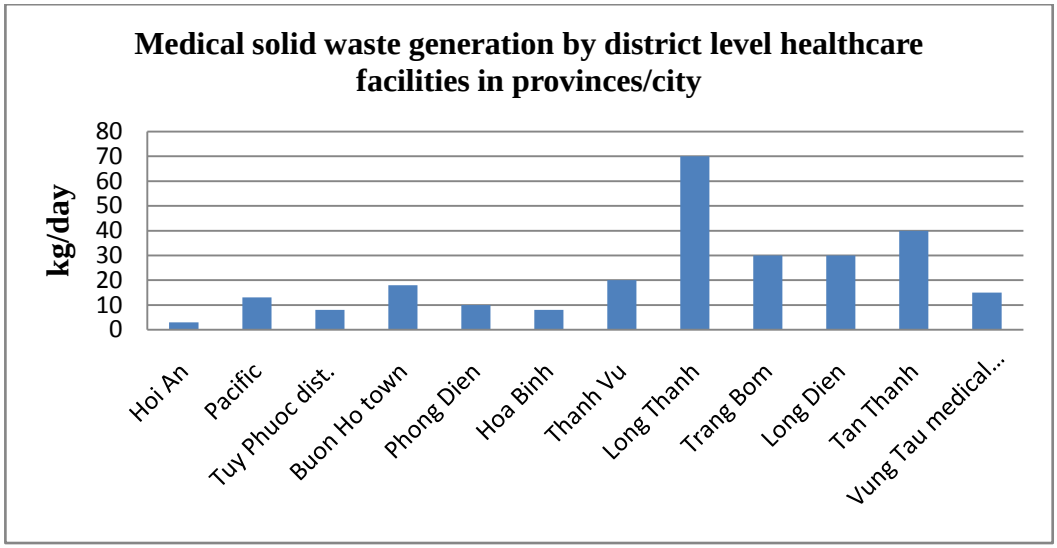

FIGURE 41. The quantity of medical solid waste generated by district level hospitals in provinces/city

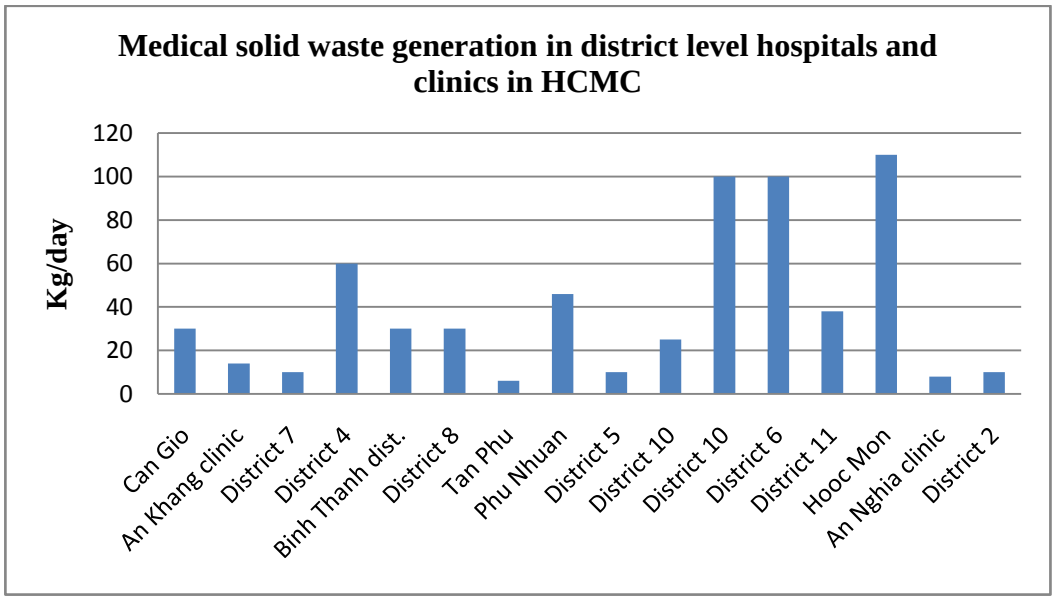

FIGURE 42. The quantity of medical solid waste generated by district level hospitals and clinics in HCMC

In general, the product capacity can be categorized into three scales as illustrated in Table 22 below.

TABLE 22. Summary of medical solid waste treatment product's capacity

	Desired treating capacity (kg/day)	Target end-users
Small-scale	20 ~ 100	- District level healthcare facilities; - City/provincial level special hospitals.
Medium-scale	500 ~ 1000	- City/provincial level general hospitals working as centralized medical solid waste treatment units.
=> It is clear that desired treatment capacities of products spread through a wide range for each scale. Therefore, it will be an advantage if the products are designed under forms of modules so that their treating capacities can be changed easily and adapt to each specific case.		

Medical solid waste treatment products' key desired benefits

To be able to convince customers, the new entrant has to deliver them key desired benefits of products that they need. Based on end-users' complaints and expectation through interviews, the researcher recommends key desired benefits of medical solid waste treatment products in forms of four offer levels as described in Figure 43 below.

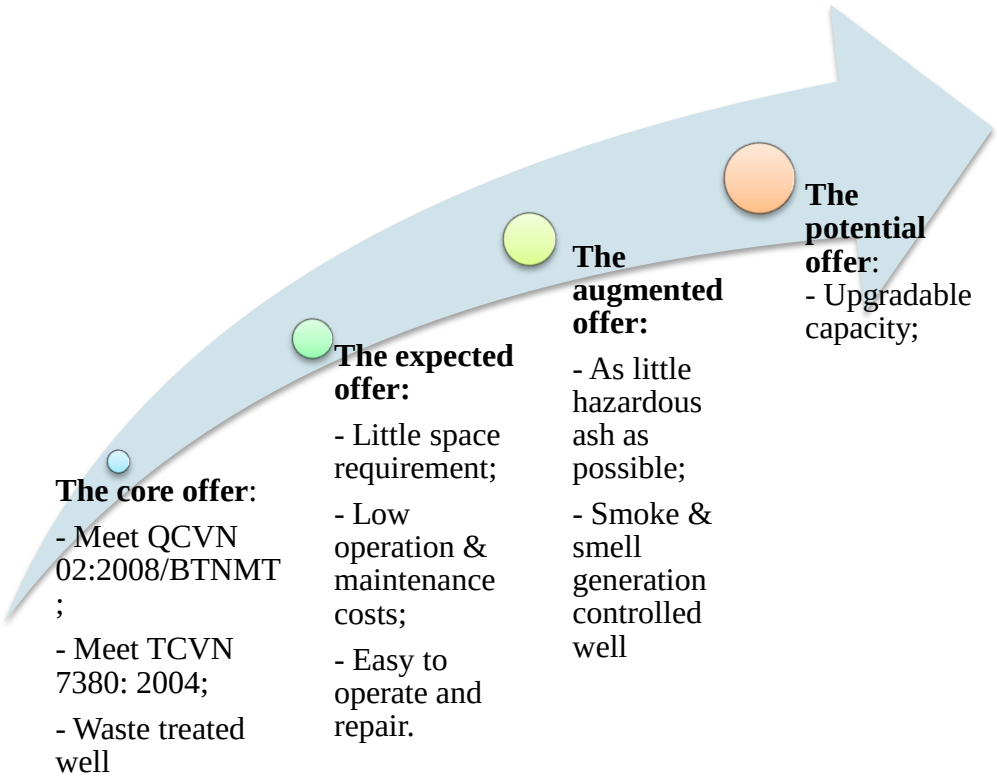

FIGURE 43. Key desired benefits of the medical solid waste treatment products

- The core offer has to:

  - Meet QCVN 02:2008/BTNMT - National Technical Regulation on the Emission of Health Care Solid Waste Incinerators. This document is provided at Appendix 5 in the end of the research.
  - Meet TCVN 7380:2004 – Health Care Solid Waste incinerators - Technical requirements if the product is an incinerator. This document is provided at Appendix 6 in the end of the research.
  - Treat such waste well. It means that hazardous features of the waste have to be eliminated completely, safely and sustainably; the volume of the waste has to be minimized as possible. To be able to meet those requirements, the manufacturer should pay very close attention to characteristics of the medical solid waste generated by healthcare facilities in Vietnam provided in tables below:

TABLE 23. Percentage components of medical solid waste stream

No.	**Components of medical solid waste**	**%**
1	Needles and syringes	14,6
2	Line service	17,54
3	Cotton, bandages, gauze	33,87
4	Body parts, organs, placenta, tissues	5,53
5	Other	28,46
	Total	100

Source: Vietnam Environmental Status Report 2002

TABLE 24. Chemical and physical features of medical solid waste stream

No.	**Characters**	**Average**
1	Specific mass (ton/m^3)	0,13
2	Average humidity (%)	50
3	Hazardous ash from medical waste (%)	10,3
4	Specific heat (kcal/kg)	2,153

Source: Institute of Labour Medical & Environmental Hygine

TABLE 25. Mass percentage of chemical ingredients inside the medical solid waste stream

Component	Chemical ingredients (% mass)					
	Carbon	Hydrogen	Oxygen	Nitrogen	Sulphur	Ash
Body parts	50.8	9.35	39.85	-	-	-
Paper	43.5	6.0	44.0	0.3	0.2	6.0
Carton	44.0	5.9	44.6	0.3	0.2	5.0

Plastic	60.0	7.2	22.8	-	-	10.0
Fiber	55.0	6.6	31.2	4.6	0.15	-
Rubber	78.0	10.0	-	2.0	-	10.0

Source: Survey and Assessing the efficiency of medical waste incinerators in the south of Vietnam, Prof. Dao Van Luong & cooperators

TABLE 26. Mass percentage of medical solid waste components in some hospitals

Mass percentage	Plastic, needles & syringe, rubber	Chemicals, pharma-ceuticals, body parts	Other
Binh Duong General Hospital	65	15	20
Ben Cau District Medical Center Service	18	5	77
Army Hospital 175	13.3	9.4	73.3
Tien Giang Province Turber-culosis & Cancer hospital	50	15	35
Le Loi hospital – Vung Tau city	15	15	70

Source: Survey and Assessing the efficiency of medical waste incinerators in the south of Vietnam, Prof. Dao Van Luong & cooperators

- The expected offer should meet the following expectations:
  - Little space requirement for installation and operation. That is because the free space in most of hospitals, particularly ones located in the centers of cities or new urban centers of provinces is very limited.

- Low operation & maintenance costs. All interviewees in hospitals, espcially hospitals which have been equipped incinerators complain that their hospitals‘ monthly payments for treating such waste are too high in relation to their annual operation costs. Figure 44 and Figure 45 below show monthly payments for treating medical solid waste by city/provincial level hospitals and district level hospitals respectively. Below charts result from analyzing data the author has collected through face-to-face with people in charge of these hospitals.

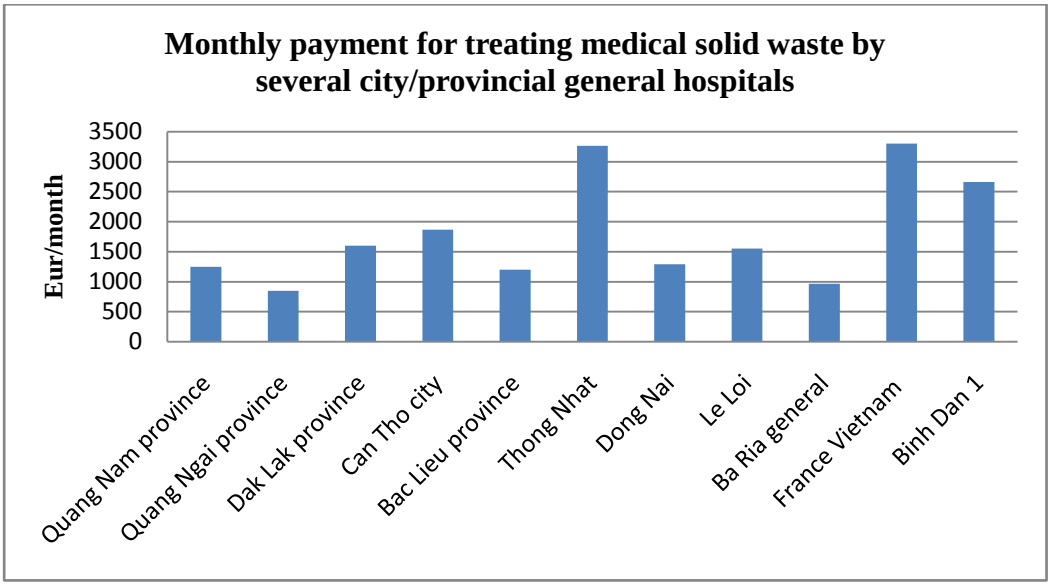

FIGURE 44. Monthly payments for treating medical solid waste by several city/provincial general hospitals

Note: at the time of interviewing and calculating these facts, the exchange rate is €1= VND 30,000.00 , and the unit price of diesel is €0.7/lit.

Where, Quang Nam province general hospital, Quang Ngai province general hospital, Bac Lieu province general hospital, Le Loi general hospital, Ba Ria general hospital are ones treating such waste by their own incinerators. Dak Lak province hospital has been treating by the steam sterilization systems and then delivers the sterilized waste to the local urban environment firm for landfill. The others contract with local urban environment companies to treat.

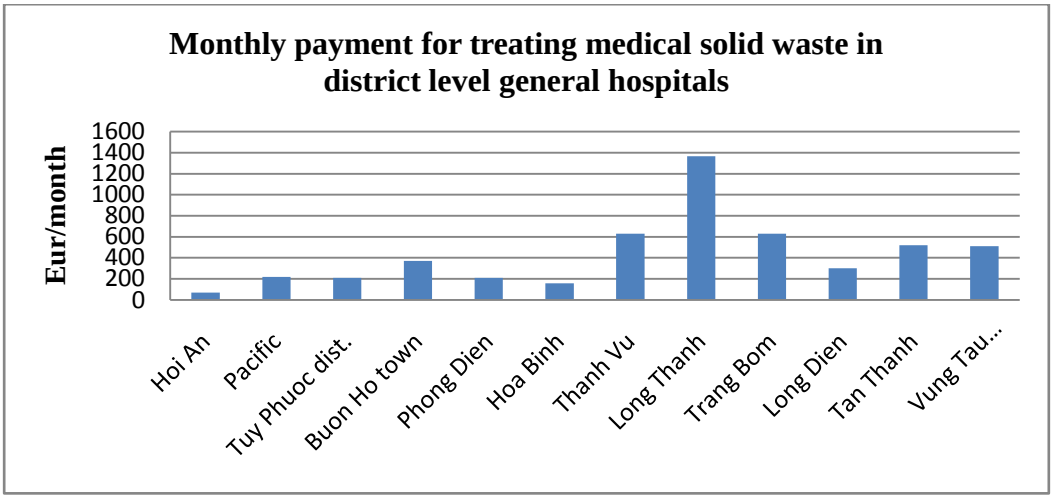

FIGURE 45. Monthly payment for treating medical solid waste in district level general hospitals

Note: at the time of interviewing and calculating these facts, the exchange rate is €1= VND30,000.00, and the unit price of diesel is €0.7/lit.

All these district level general hospitals are placed in different provinces, including the central coast region, the central highland area, Mekong Delta area and the southeast excluded HCMC. Among them, only Hoi An hospital, Pacific hospital and Vung Tau Medical Services center are in contracts with local urban environment firms for treating their medical solid waste. The others have been treating such waste by their own incinerators at their own spaces.

If the new entrant demonstrates that the operation and maintenance costs for its products are more competitive than rivals', it is likely successful.

Now having a look at below Figure 46 which presents monthly costs for treating medical solid waste in district level healthcare establishments located inside HCMC only. All of them enter contracts with CITENCO for treating such waste.

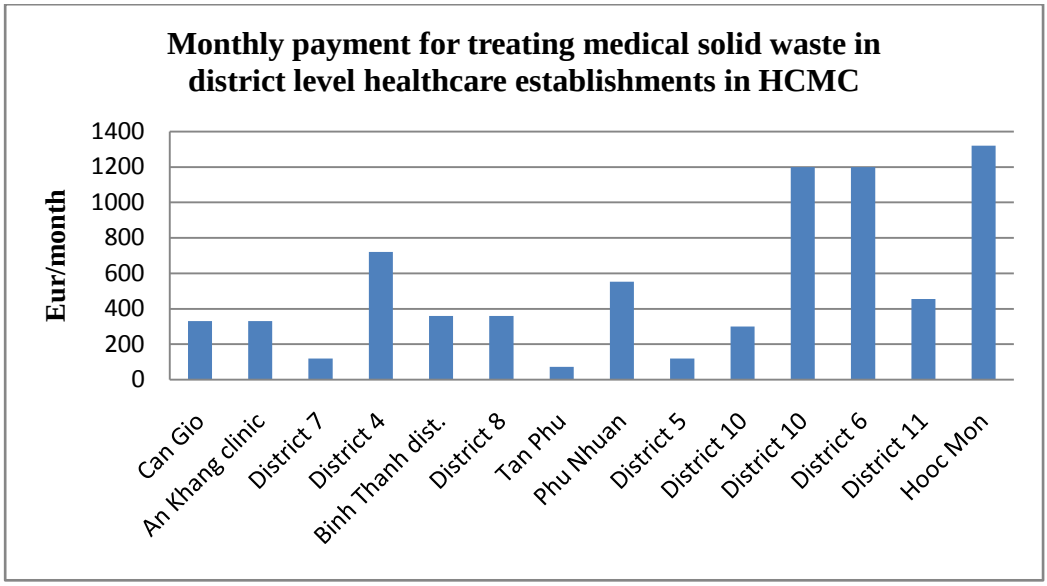

FIGURE 46. Monthly payment for treating medical solid waste in district level health establishments in HCMC

Note: at the time of interviewing and calculating these facts, the exchange rate is €1= VND 30,000.00 , and the unit price for treating medical solid waste is €0.4/kg according to Mr. Nguyen Thanh Da –Sales Executive, CITENCO.

  - Easy to operate and repair is expected because hospitals usually prefer to employ their nurses who are not technicians to operate the incinerators.
- The augmented offer should deliver a product that can produce as little hazardous ash after treating as possible. In fact, except being burnt by Hoval incinerators, the amount of hazardous ash always remains considerable as the author has seen in hospitals. This expectiation results from the fact that at present, the remaining ash after burning process is either land-filled within the hospital's space or delivered to the urban environment firm to be treated more. Hence, the less hazardous ash remains, the less effort, energy and money the hospital has to spend. Another serious problem that interivewees complain about all the time is the production of smoke and smell during operating incinerators, even Hoval incinerators. Therefore, if resolving this problem, the product can create its own competitive advantage against the competitor's ones.

- The potential offer is the ability to upgrade the product's treatment capacity. That is because hospitals is often expanded in term of size, they wish the product could meet new greater treatment demand in that case.

Hospital wastewater treatment product strategy

The wastewater treatment product strategy for healthcare organizations is also based on the end-users' demand with two dimensions: treatment capacity and key desired benefits.

Hospital wastewater treatment product's capacity

Usually, each hospital utilizes its own wastewater treatment system, so the treatment capacity of the product should be calculated on the base of the amount of wastewater it produces at present as well as estimated production in the future. Figure 47 and Figure 48 below show the amount of wastewater produced by and the existing treatment capacity in several city/provincial level hospitals.

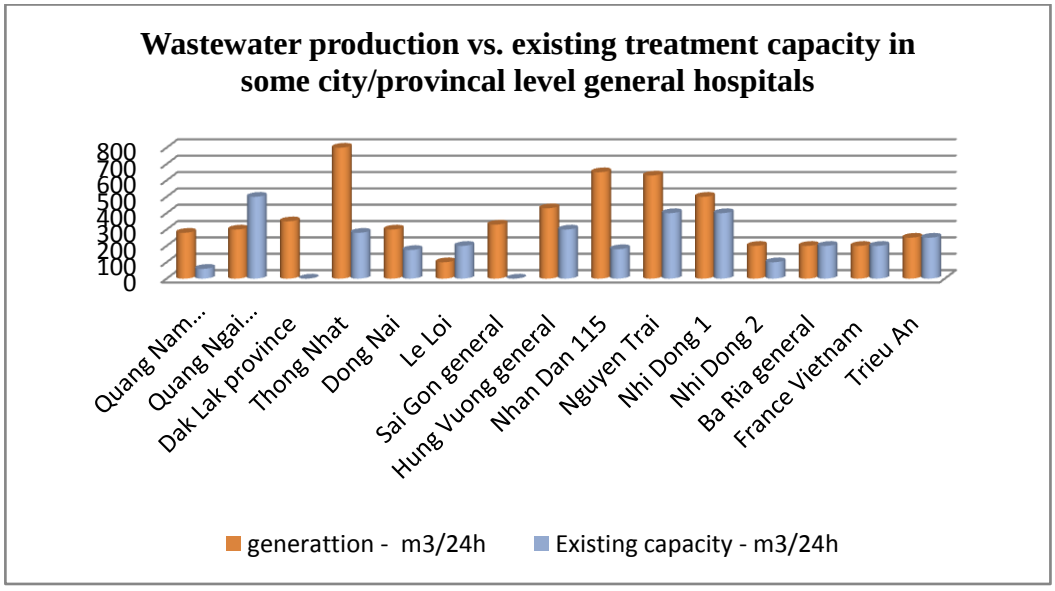

FIGURE 47. Amount of wastewater produced vs. existing treatment capacity in several city/provincial level general hospitals

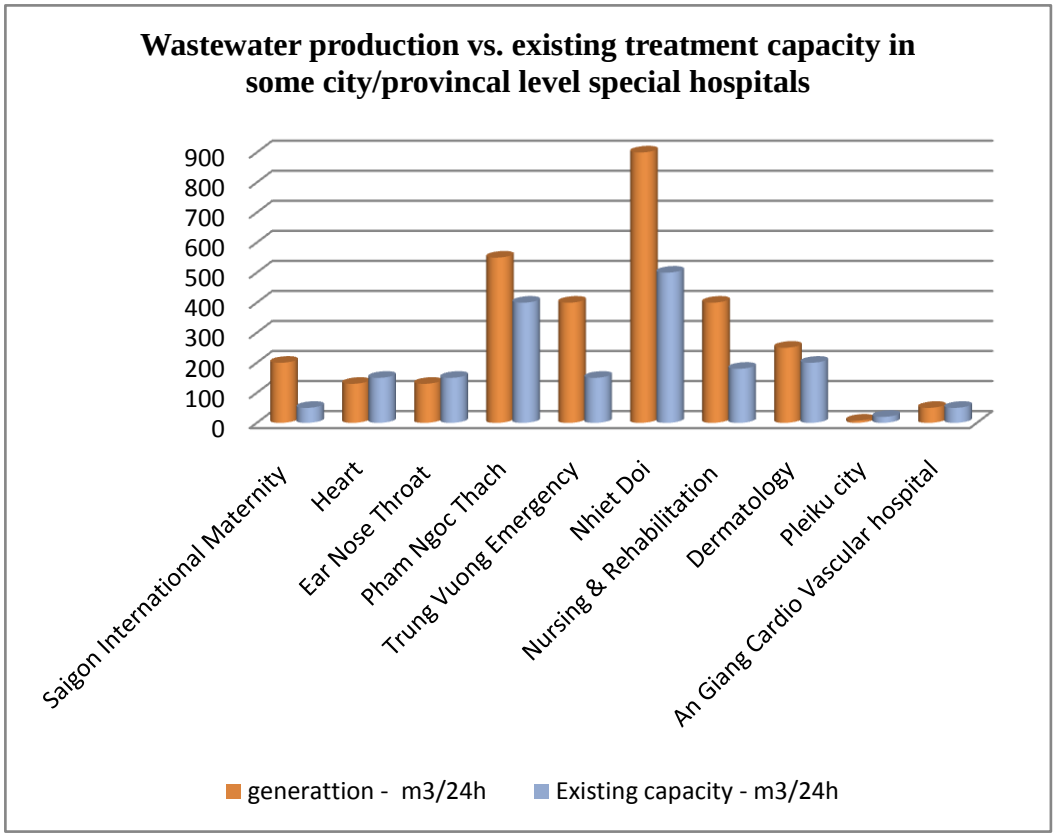

FIGURE 48. Amount of wastewater produced vs. existing treatment capacity in city/provincial level special hospitals

According to that, these hospitals produce a range of 100 - 900 cubic meters per day. Another noteworthy point here is that the majority of the existing systems fail to meet demand for the treatment capacity and quality standards of wastewater output. Few hospitals have not installed them yet. Therefore, there may be three need scenarios here: 1. constructing a new wastewater treatment system with treatment capacity equal to or over total amount of wastewater produced; 2. Or installing an additional system to fill the gap between the current capacity and desired one; or improving the existing system to adapt to new demand. Figure 49 below, which illustrates the existing treatment capacity vs. desired capacity in city level hospitals in HCMC, will provide additional information to support above arguments.

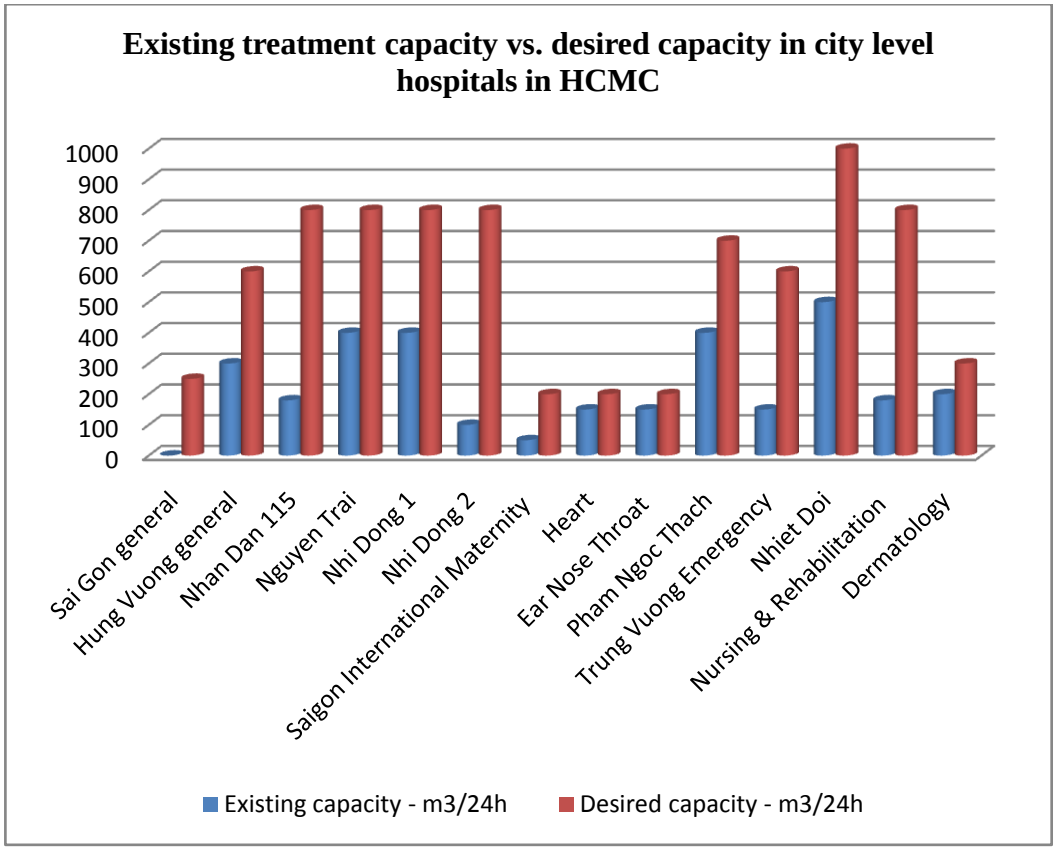

FIGURE 49. Existing treatment capacity vs. desired capacity in city level hospitals in HCMC

Conversely, most of district level hospitals in provinces either have not been equipped with wastewater treatment systems yet or are operating systems constructed many years ago. They desire a treatment capacity range of 5 - 60 cubic meters per day as depicted in Figure 50 below.

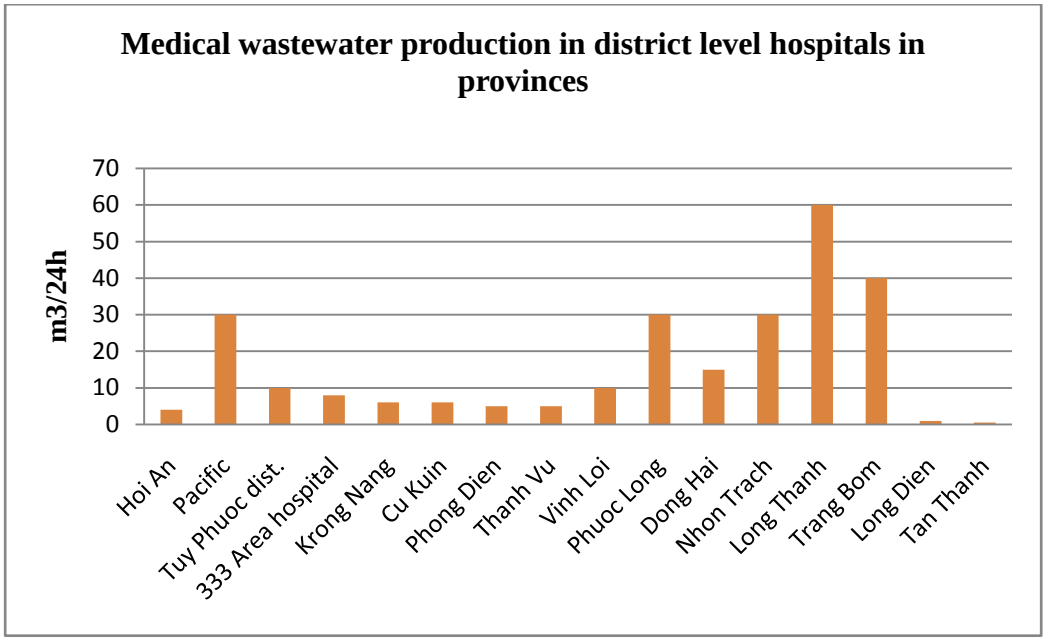

FIGURE 50. Amount of wastewater produced in district level hospitals in provinces

Meanwhile, the amount of wastewater generated by some district level hospitals in HCMC is even more than city/provincial level hospitals. In particular, Cu Chi district general hospital and Hooc Mon district general hospitals are designed to be two key healthcare facilities for new urban areas in the northwest of HCMC. That is why their wastewater production and desired treatment capacity remains so high in relation to other district level hospitals. Their desired treating system capacity spreads through a range of a few dozen to hundreds cubic meters per 24 hours. The column chart in Figure 51 below represents the existing wastewater treatment capacity and desired one in district level hospitals in HCMC.

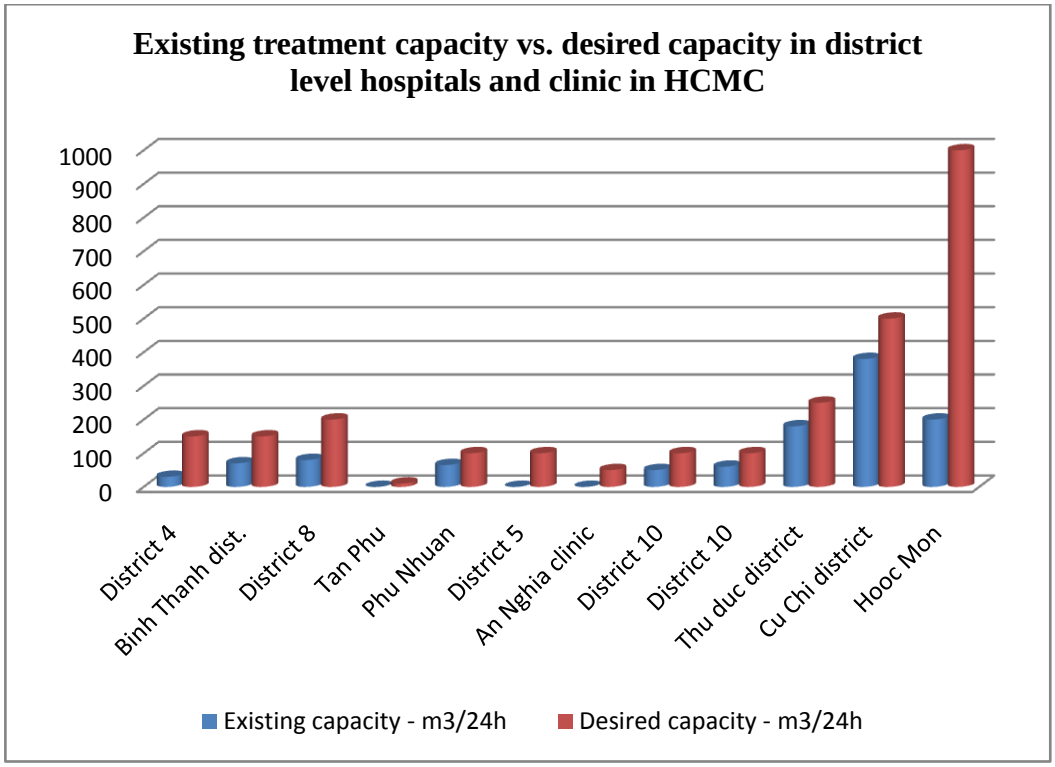

FIGURE 51. Existing treatment capacity vs. desired capacity in district level hospitals and clinic in HCMC

In short, the appropriate range of treatment capacity for hospital wastewater product lines summarized in Table 27 below.

TABLE 27. The range of wastewater treatment product's capacity

	Desired treating capacity (m3/24h)	Target end-users
Very small-scale	5 ~ 10	- Ward/commune level medical services centers.
Small-scale	10 ~ 100	- District level hospitals.
Medium-scale	100 ~ 800	- Some district level hospitals in HCMC; - City/province level hospitals
Large-scale	> 800	Some large-scale hospitals in HCMC

=> As analyzed above, desired capacities of hospital wastewater treatment products spread through a long range. In addition, the requirement of installation space, as well as demand for upgrading capacity of the system is always the leading concerns of healthcare facilities. So if the product's capacity is constructed in forms of separate modules and they can be connected to expand the treatment capacity easily and conveniently, it likely overcomes these obstacles.

Hospital wastewater treatment product's key desired benefits

Key desired benefits of a hospital wastewater treatment product are presented in forms of four offer levels as Figure 52 below.

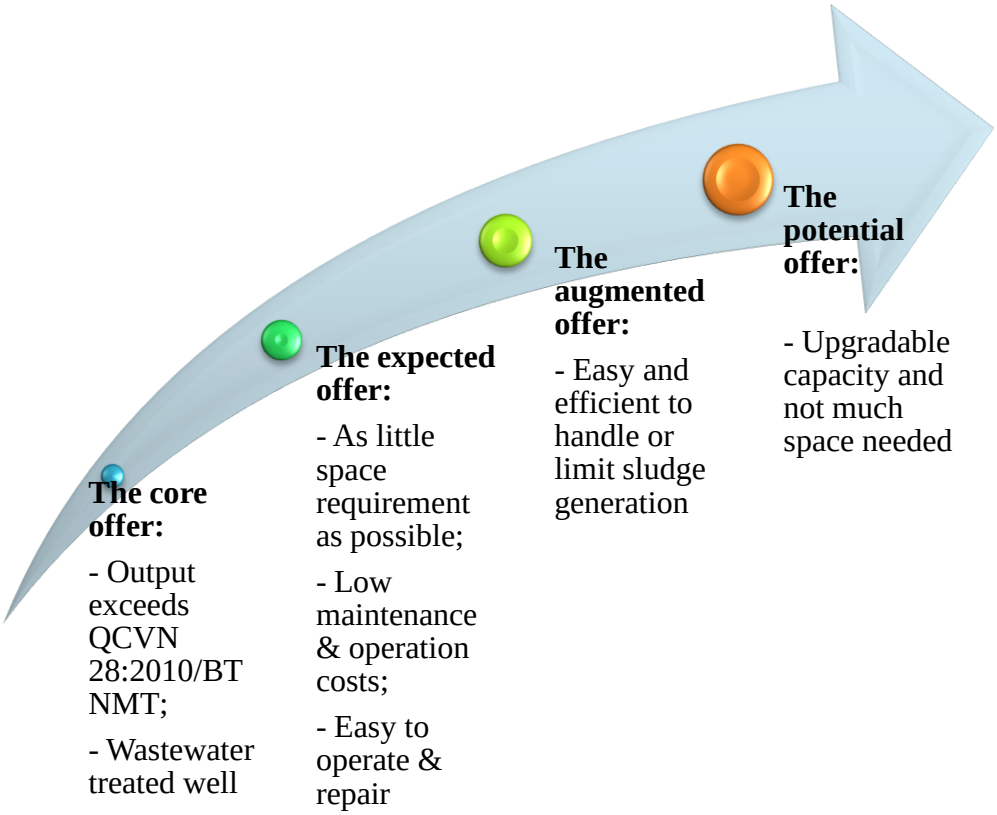

FIGURE 52. Key desired benefits of hospital wastewater treatment product

- The core offer of the product should:
  - Exceed QCVN 28:2010/BTNMT – National Technical Regulation on HealthCare Wastewater. This document is provided at Appendix 7 in the end of this research.
  - Treat wastewater well. Radioactive substances, heavy metals in the wastewater stream from producing X ray photographs and testing samples of infected bloods are serious problems that cause hospitals trouble because current wastewater treatment systems can not deal with them, according to Mr. Hai in Thong Nhat hospital, Ms. Liet in Hoa Binh district hospital and Mr. Khan in Tan Thanh district hospital. If the new entrant's technologies resolve these problems, they certainly gain competitive advantages against other competitors.

- The expected offer comprises:
  - Little space requirement for installation and operation. Unlike the incinerator, the wastewater treatment system usually needs more space while the available free ground in most hospitals, particularly ones located in urban areas is very limited. Another matter is that the majority of present wastewater treatment systems in hospitals are underground while demand for upgrading their treatment capacity is urgent. Therefore, solving installation space and treatment capacity trade-off is the key to success in this game.
  - Low operation and maintenance costs. There is the fact that a variety of hospitals, which have already installed wastewater treatment systems, either do select not putting their such systems in operation and then pay fines to the Environmental Police Department because value of the fines is much lower than systems operation costs or only operate the systems a few hours before inspectors of DoH or DoNRE or Environment Police departments visit their facilities, according to Mr. Liem, HCMC DoH.
  - Easy to operate and repair. That is because the operating staffs in hospitals are frequently nurses or even drivers.

- The augmented offer of the product is easy and efficient to handle and limit sludge generation as little as possible. Presently, hospitals usually have to pay local URENCOs for removing the sludge from the system once or twice a year. The sludge is also hazardous infected waste and needs to be treated carefully. However, it is becoming another threat of the public health because the current treating technology of URENCOs is mainly landfill.
- The potential offer is about the ability to upgrade the treatment capacity of the system but not much space required for this. Expanding the present facility and increasing the quantity of beds happens very frequently in Vietnam hospitals.

5.3.3 Price strategy

This is the most challenging duty in developing the marketing mix. The first challenge is from collecting information about the competitor's price level. This is extremely hard because the medical waste treatment equipment purchase process takes place under the form of sealed bidding proposals all the time. Thus, rivals hardly reveal their product prices to the general public. Even when the researcher, in the role of an investor, made phone calls to AIC and Vinaseco, they refused to reveal product prices unless there was documentation of the project sent to them. The second difficulty is that the investor's budget for purchasing medical waste treatment products is totally different from the public to the private sector, even among public investors as well as private buyers. The third obstacle for setting price here results from the fact that this research aims to serve any sustainable medical waste treatment solution suppliers/manufacturers rather than only specific one. Therefore, there are no detailed cost evidences from a manufacturer as a baseline. Finally, the treatment capacity of medical waste treatment equipment spreads through a very long range, depending on the specific amount of medical waste generated by each healthcare facility.

In order to overcome disadvantages, the author recommends a reference price range for each range of treatment capacity of products with respect to two fundamental considerations – investor's budget and competitor's price level. According

to that, the investor's budget will be determined by analyzing medical waste treatment system investment capital estimations in Bac Lieu and Ninh Thuan provinces prepared by Bac Lieu province DoH and Ninh Thuan People's Committee respectively. It is believed that inputs of these cost estimations should have been provided or consulted by healthcare waste treatment solution suppliers as illustrated in the buying process earlier, as well as in accordance with personal working experiences of the researcher. The latter – competitor's price level – is regarded on the basis of related writings on local newspapers.

From the author's personal working experience in project bidding in Vietnam, bidders usually set their selling price following the formula (1) below:

$$Product\ buying\ price\ \times (1.2{\sim}1.4) = Selling\ price \quad (1)$$

Where:

- Product buying price is the total expenses that the bidder has to pay to get a product available to sell to his customer.
- $(1.2{\sim}1.4)$ is the common range of mark-up. It aims to make sure that the bidder can earn profits from the business transaction. The specific value of mark-up is different from one project to another, and usually depends on some elements such as the amount of commission is asked by key participants in the buying process and the ability to win the game that the bidder can estimate on the basis of analyzing competitors and useful information leaked by the investor or buyer.
- Selling price is the price quoted in a quotation by the seller or offered in the bidding proposal by the bidder. When preparing investment budget estimations, the preparer likely refers to the quotation to get figures of total selling price. Then, an additional markup around 10% (1.1) will be added to produce the public investor's estimated budget. So:

$$Total\ estimated\ budget = Seller's\ offering\ price\ \times 1.1 \quad (2)$$

From (1) and (2), the relation between the seller's product buying price and the investor's total estimated budget is described as follows:

$$Total\ estimated\ budget = Seller's\ buying\ price \times (1.2{\sim}1.4) \times 1.1 \quad (3)$$

It is obvious that the seller's buying price, in this case, is almost equal to the product price that the foreign manufacturer charges the buyer. Now the formula (3) can be used as a baseline so that the foreign medical waste treatment equipment manufacturer sets their product prices to its agent(s) in Vietnamese markets.

Price strategy for medical solid waste treatment product

First, let's take a look at the investment capital estimations for collected hospitals in Bac Lieu and Ninh Thuan provinces in Table 28 below.

TABLE 28. Medical waste treatment system investment capital estimations in some hospitals

Hospitals	Scale	Invested items	Total capital estimation
Bac Ai district Medical Center	District level	Medical solid waste and wastewater treatment equipment	VND 6,442,564,000.00 equivalent to **€214,752.13**
Phan Rang Area Clinic	District level	Medical wastewater treatment system	VND 1,159,374,000.00 equivalent to **€38,645.8**
Dong Hai district hospital	District level, 60~100 beds	70-kilo per day medical solid waste equipment, and 20 m3/ 24h-wastewater treatment equipment	VND 5 billion Equivalent to **€166,666.67**
Vinh Loi district hospital	District level, 50~100 beds	20 m3/ 24h-wastewater treatment equipment	VND 4 billion equivalent to **€133,333.33**

Source: Plan for Treating Medical Waste in Bac Lieu Privince Period 2010 – 2020, Huynh Vu Phong – Chief Officer, Bac Lieu province DoH, 2010; Dispatch No. 2074/UBND-XDCB on Suggestion for Supporting Investment Capital from the Central Government's Budget to Invest Healthcare Waste Treatment Systems in Ninh Thuan province, Vo Dai - Vice Chairman of Ninh Thuan People's Commitee, 2011.

Bac Lieu and Ninh Thuan provinces are at the same level of social economic development. So some district level healthcare facilities in both provinces may be similar in terms of scale and medical waste generation. As illustrated in Table 28, the value difference between the estimated investment capital for Bac Ai district medical center and Phan Rang Area clinic is almost the budget for the medical solid waste treatment equipment in Bac Ai district medical center. In the event of having the capacity difference between two medical wastewater treatment systems in both facilities, to be more exact, the estimated exact budget for the medical solid waste treatment equipment should be equal to 80% of the above value difference. It means that this budget is around €140,885.06 ((€214,752.13 - €38,645.8)*0.8). In this case, in accordance with the formula (3), the foreign manufacturer can negotiate with CITENCO and DNURENCO at the reference price range of €91,483.00 – €106,731.00. However, these figures seem to be abnormally high.

Similarly, the value difference between the estimated investment capital for Dong Hai district hospital and Vinh Loi district hospital is the planned budget for a 70-kilo-per-day medical solid waste equipment because both wastewater treatment systems have the same capacity. In this case, this budget is around €33,333.34 (€166,666.67 - €133,333.33). According to the formula (3), the foreign manufacturer can suggest to CITENCO and DNURENCO to price a 70-kilo-per-day medical solid waste treatment equipment at the reference price range of €21,645.00 – €25,252.00. These figures are more reasonable when they are compared with the competitor's price level provided below.

The second element is the competitor's price level. AIC offers the incinerator model F-1S which is suitable for district level hospital at the price of €28,000.00

(VND 700 million calculated at the time of early 2010) (Dat Viet Newspaper, 2010). Capacity of this model is between 25 and 30 kilos per hour. Another writing posted on Baomoi newspaper reveals that AIC won the tender package of supplying one medical waste incinerator and one medical wastewater treatment system to Bao Yen district general hospital in Lao Cai province at the bidding price of VND 6 billion (equivalent to €240,000.00 at the time of early 2010), where the price of the incinerator is around VND 2 billion (around €80,000.00). Meanwhile, representatives of domestic incinerator manufacturers complain that their incinerators have the same quality as AIC's product and the price is 3 times lower than AIC's price, but they never win any project when they compete with AIC. This abnormality happens not only in one project in Lao Cai province, but in various projects in different provinces and cities as well, particularly in the north of Vietnam (Phong, 2010). According to Mr. Dung – Head of Infection Control faculty, Nhon Trach district general hospital, the price of the Chuwastar incinerator that he has planned to submit to Dong Nai province DoH is approximately VND 1 billion (equivalent to €33,333.33 at the time of July 2011).

In short, the reference price range of medical solid waste treatment product lines that the new entrant can negotiate with DNURENCO and CITENCO is summarized in Table 29 below.

TABLE 29. Reference prices for medical solid waste treatment product lines

Product lines	Desired treatment capacity (kg/day)	Reference price range
Small-scale	20 ~ 100	€22,000.00 – €25,000.00
Medium-scale	500 ~ 1000	€80,000.00 – €115,000.00

Now, the new entrant can refer to these prices, and then negotiate with DNURENCO and CITENCO to offer the best price for each product.

Price strategy for medical wastewater treatment product

Similarly, we consider cost estimations for investing medical wastewater treatment systems in some hospitals in Bac Lieu and Ninh Thuan provinces summarized in Table 30 below.

TABLE 30. Estimated budget for equipping medical wastewater system

Hospital	Scale	Desired treatment capacity (m3/24h)	Total estimated budget	Reference range of selling price
Bac Lieu province	Public provincial level, 600 beds	100	VND 5 billion equivalent to **€166,666.67**	€64,935.00 - €88,383.00
Gia Rai district	Public district level, 250 beds	50	VND 4 billion equivalent to **€133,333.33**	€51,948.00 - €70,707.00
Nhon Hai Area clinic	Public district level	N/A	VND 1.16 billion equivalent to **€38,676.00**	€15,068.00 – €20,510.00
Center for Caring Reproductive Health	Public district level	N/A	VND 1.159 billion equivalent to **€38,676.00**	€15,068.00 – €20,510.00
Pacific	Private district level, 90 beds	30	**€18.300** is the total expenses to finish the entire system (since 2009)	

It should be noted that the estimated budget for investing in a medical wastewater treatment system above includes the price paid for the equipment, design, drawings, construction, testing and commissioning, etc. Generally, this figure is for a

finished system. From the standpoint of the author's working experience in project management, the equipment price is often equal to 60-70% of total value of the entire project. Due to assuming that the new entrant only offers equipment, pricing the medical wastewater treatment equipment should be calculated with respect to 60-70% of the total estimated budged for each system.
Similarly, the price of the medical wastewater treatment product to CITENCO and DNURENCO can be calculated as the following formula:

$$Total\ estimated\ budget \times (0.6{\sim}0.7) = Product\ price \times (1.2{\sim}1.4) \times 1.1 \quad (4)$$

Here, product price is the price of the medical wastewater treatment equipment that the foreign manufacturer suggests DNURENCO and CITENCO. According to the formula (4), we can calculate the reference price for some specific cases in Table 30 above.

From the side of the competitor's price level, let's examine AIC's price. As shown above, this company won the tender package of supplying and installing the entire hospital wastewater treatment system for Bao Yen district hospital at the price of €160,000.00 in 2010. If assuming that the equipment price is equal to 60-70% of the total value of the project, the equipment price of AIC is about €96,000.00 – €112,000.00. These figures are far higher than the reference product price calculated on the base of total estimated budget by Bac Lieu DoH, and Ninh Thuan People's Committee.

From findings illustrated above, the reference price range of medical wastewater treatment product lines is suggested in Table 31 below.

TABLE 31. Reference price for medical wastewater treatment product lines

Product line	Desired treatment capacity (m3/24h)	Reference range of price
Very small-scale	5 ~ 10	€7,000.00 ~ €15,000.00

Small-scale	10 ~ 90	€15,000.00 – €65,000.00
Medium-scale	100 ~ 800	€80,000.00 – €300,000.00
Large-scale	900 ~ 1000	€350,000.00 ~ €400,000.00

In order to assure that the products are offered at the most competitive price, the new entrant should double-check these numbers with his own related costs, and negotiate with CITENCO and DNURENCO more carefully.

5.3.4 Distribution strategy

Why should DNURENCO & CITENCO be the target agents?

Recommendation of both DNURENCO placed in Da Nang city & CITENCO in HCMC as the target agents in Vietnamese markets is based on the facts below:

- The first one is the *scope of impact*. Indeed, cultural differences and the existence of the regionalism among regions within Vietnam still remain pretty clear. Da Nang city has similarities in terms of the natural conditions and culture to the other provinces in the central coastal region. Also, it is considered the pioneer, the leader of this region and the example of development so that the other provinces in this region can learn from and imitate successful models of this city. Plus, Da Nang is also assessed the best city of Vietnam in terms of the efficiency of the public administrative system and sustainable development. Meanwhile, HCMC, the biggest and busiest economic center of the country, has considerable influence on other provinces in the south of Vietnam, even the central highland region. It is the pioneer in applying the centralized medical solid waste treatment model of the country.
  Beside, Da Nang city and HCMC are usually chosen to hold national level conferences, training programs to improve the productivity and performance of the whole central region and the south of Vietnam respectively. Therefore, if the foreign manufacturer is able to cooperate with DNURENCO and

CITENCO, and once a medical waste treatment model is applied successfully by these firms, the door to other markets is almost opened.

- The second fact is the efficiency of covering and serving target markets. That is because traffic among regions within Vietnam is heavily affected by the geographical element. It would be faster, more economical in terms of time and money to drive to central coastal provinces and some central highland provinces from Da Nang city rather than from HCMC. Meanwhile, it is more convenient to come to provinces in the south if departure is from HCMC.

Table 32 below shows most striking features of DNURENCO and CITENCO which reveal the reasons why these companies are recommended as the target agents in Vietnamese markets.

TABLE 32. Striking features of DNURENCO & CITENCO

	DNURENCO	**CITENCO**
Location	In Da Nang city – the heart of the central of Vietnam.	In HCMC – the center of the south of Vietnam
	Da Nang city has Da Nang International Airport and Da Nang port. Similarly, HCMC has Tan Son Nhat International Airport and Sai Gon port. All are the best and busiest airports and ports in Vietnam presently. Hence, travel and shipment of goods by airfreight and sea freight from outside Vietnam to these cities are very convenient. In addition, they are the local public firms, so they know well how to deal with local customs effectively.	
Core business operations	- Collecting, transporting and treating hazardous waste, medical solid waste, municipal waste, etc for the whole city; - Agent and supplier of special device serving sorting and storing waste ; - Consulting, designing and constructing projects relevant to the environment.	
Desire and expectation	Both Ms. Nu in DNURENCO and Mr. Da in CITENCO share that they have strong desires to cooperate with advanced clean-	

	tech suppliers in the West in the hope that medical waste can be treated in a more sustainable manner in relation to utilization of existing temporary solutions. Both of them are operating ineffective incinerators. Even so, DNURENCO's incinerators were made by a domestic manufacturer.	
Ownership	Being state-owned companies under direct management of Da Nang city and HCMC governments. Plus, the influence of both cities on their neighbor provinces is considerable. This is an advantage for DNURENCO and CITENCO to reach key participants in the medical waste treatment equipment purchase process more easily in both their cities and other provinces.	
Scope of impact and ability to cover markets	The central coastal provinces and a part of the central highland region.	A part of the central highland region and the south of Vietnam including the southeast region and Mekong Delta.
=> Factors of ownership and ability to impact and cover markets are two most critical competitive advantages in this game at this moment in order to balance strengths and influence against AIC – a public the dominant in this business placed in the north of Vietnam.		
Address	www.moitruongdothidanang.com.vn 471 Nui Thanh street, Da Nang city, Vietnam. Tel: +84 5113644266 Fax: +84 5113642423	www.citenco.com.vn 42-44 Vo Thi Sau street, District 1, HCMC, Vietnam. Tel: +84 838208666 Fax: +84 838202769

In summary, DNURENCO and CITENCO are targeted because: 1. they possess features to overcome present obstacles of this business, as well as competitive advantages to compete against the dominant AIC placed in the north of Vietnam; 2. They resolve traffic and transport challenges to assure that all target markets are reached, customer services are delivered in time, and travelling costs are optimized; 3. They help to overcome barriers of cultural differences and the regional-

ism among regions within Vietnam so that it is easier to understand and meet customer needs and expectation.

Working with DNURENCO & CITENCO

The action plan to enter the host market officially may require the foreign manufacturer to carry out two business trips to Vietnam at the beginning. The first trip aims to get to know the target agents, preliminarily examine and assess their reactions, and then negotiate the business cooperation contents, after reaching them by email or phone. Officially recognizing DNURENCO and CITENCO as the agents of the new entrant in Vietnam is very necessary because this will help them overcome price-sensitive buyers' worries about price difference between purchasing from the manufacturer and others. Right after all conditions and contents of the cooperating agreement or memorandum are reached by the parties, the second trip should be begun. The main purpose is to serve the marketing communication strategy. Detailed information about these operations will be provided in the integrated marketing communication strategy later on.

It would be a great advantage for three parties in this game if CITENCO and/or DNURENCO become the first end-user(s) of the centralized hazardous medical solid waste treatment equipment provided by the new entrant. That is because if this system operates smoothly, demonstrates its effectiveness and efficiency, and overcomes the typical problems of existing incinerators, it will heavily impact on other provinces as argued earlier. Indeed, the budget for equipping CITENCO and/or DNURENCO with new medical solid waste equipment is very feasible because they are located in two of richest and most developed cities of Vietnam. Simultaneously, they are under direct management of the city governments that directly decide on budget for treating medical waste in these cities.

DNURENCO and CITENCO will be in the role of independent Vietnamese bidders when they join any projects in Vietnamese markets. It should be the task of the manufacturer to provide these agents with the most competitive price for each product, information about delivery and guarantee period, and product catalogs.

Based on that, the agents will consider all remaining matters, and then make the final decision on the price of products quoted in the bidding proposals.

CITENCO and DNURENCO should set product prices in the form of the total cost of ownership (or product life cycle costing) when bidding proposals. The total cost of ownership consists of the price paid for the product, delivery costs, installation costs, and operation and maintenance costs, etc. This price will help the new product overcome the price competition from existing product lines, in particular cheap products, manufactured or distributed by domestic players if the new product proves that it requires lower operation and maintenance costs on the basis of applying more advanced and sustainable technologies than competitors' those. Once benefits and advantages of the new product demonstrated, the influence of customer's switching costs barrier may be reduced considerably, even no longer works. As a result, the most price-sensitive buyers like the private healthcare sector are also persuaded by the marketer. Beside, the product price is not the leading concern of the public investors.

In the case a medical waste treatment equipment sales contract is reached, the manufacturer's task should be only shipment of goods to a destination port in Vietnam. The remaining duties should be undertaken by CITENCO or DNURENCO. That is because this will help the manufacturer avoid bureaucracies and corruption issues from local customs when the goods arrive at Da Nang port or Sai Gon port. In addition, both DNURENCO and CITENCO are the public firms under direct management of the city governments, so they would have dealt with the local customs easily and effectively.

At the beginning of the cooperation, the manufacturer should spend time on heavily training the distributors' staffs in products' specifications, installation, operation, trouble shooting and fixing, and maintenance work. Besides that, holding workshops or seminars with focus on analyzing the role of the key participants in the medical waste treatment equipment buying process, and techniques to reach them is very essential to accelerate the efficiency of business activities in this game. Additionally, the manufacturer should also point out the advantages that DNURENCO and CITENCO have had to compete against competitors. Eventual-

ly, the manufacturer should mention the role and influence of key stakeholders in this business so that the agents know what actions of the stakeholders should be taken into consideration.

Once those issues have been done, maintaining the loyalty to the agents becomes very simple and easy. An email to ask about work and health status, or a phone call every week or month, even more frequently from the manufacturer is also enough to warm up the relationships with the agents. Furthermore, enjoyment of coffee morning, lunch or dinner after work with a little bit humor together will enhance the friendship considerably. As a result, the foreign manufacturer can better understand its agents, as well as be more involved in this market.

In order to motivate the agents and boost their commitment in this game, the new entrant needs to bargain for the commission issue on the sales with them. A commission range of 5 – 10% of the total contract value on each order can be taken into consideration, depending on specific agreements and obligations between the manufacturer and the agents.

Eventually, in order to avoid the competition and possible conflict between the agents, as well as to increase the target markets coverage, the author recommends the market division as follows:

- DNURENCO serves the central coast provinces such as Phu Yen, Binh Dinh, Quang Ngai, Quang Nam, Da Nang city, Thua Thien Hue, Quang Binh, Quang Tri and Ha Tinh, and the central highland province like Kon Tum, Gia Lai and Dak Lak.
- CITENCO is responsible for whole of the south of Vietnam and other provinces like Lam Dong, Dak Nong, Ninh Thuan and Khanh Hoa.
- For the remaining areas in Vietnam, any agent can join if it thinks that it can win projects in those places.

The market division between the two agents is represented in Figure 53 below.

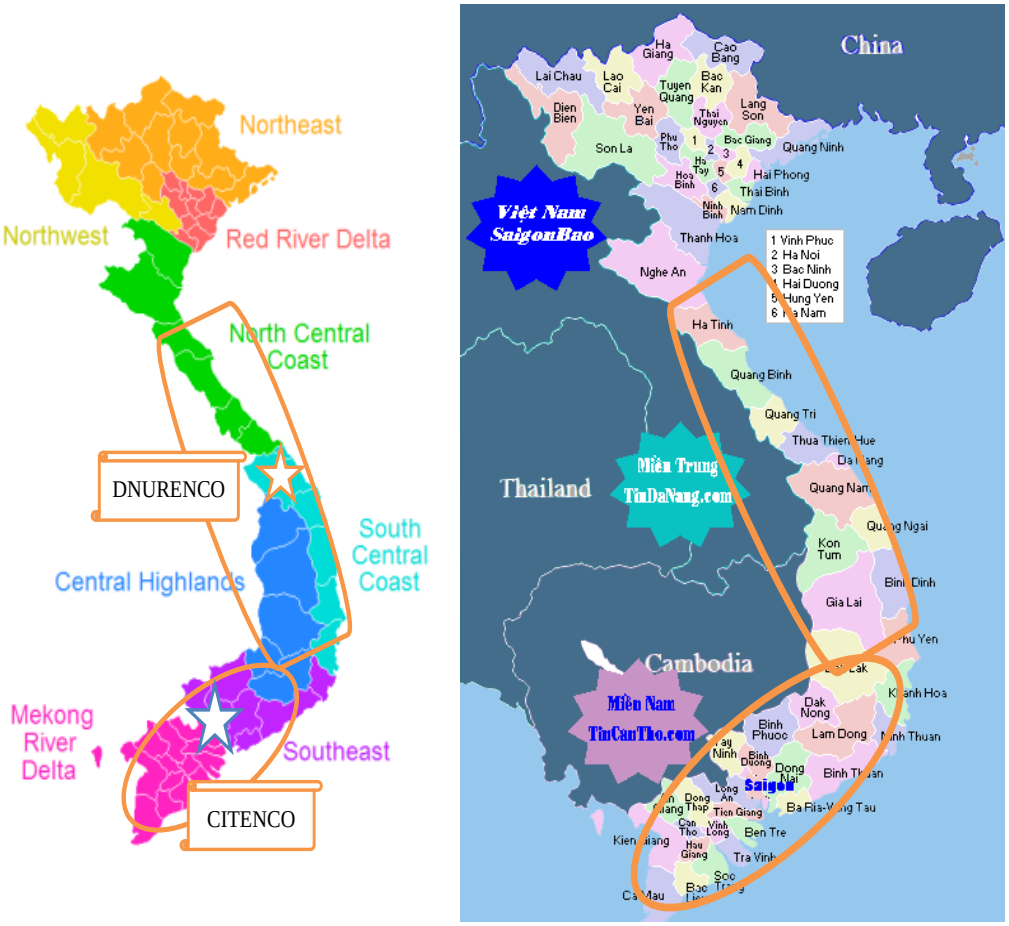

FIGURE 53. Preliminary markets division between DNURENCO & CITENCO

5.3.5 Integrated marketing communication (IMC) strategy

Findings from analyzing the medical waste treatment equipment buying process in the public sector, as well as stakeholder management show that the new entrant, in the role of the market challenger, should carry out the IMC strategy so that it can compete against the market leader – AIC, increase its image awareness and influence in the markets, and reduce threats and barriers that it may encounter.

Although the market entry mode of agent is recommended, the foreign manufacturer should realize that helping their agents improve their productivity is the best way to increase business efficiency, as well as to build the loyalty. It becomes more essential because CITENCO and DNURENCO likely lack professional marketing skills. Thus, the IMC strategy designed below should be performed by both the new entrant and the agents, depending on each detailed task.

First of all, the new entrant should discuss with CITENCO and DNURENCO about communicating his appearance in Vietnamese markets as a sustainable and advanced medical waste treatment solution supplier from the West, and the cooperation among them to the general public. The primary purpose of this action is to send the MoH and healthcare facilities a message that from now on, they have one more option to take into consideration when making a decision on the treating hospital waste method. Additionally, the new solution is even more reliable and environmentally friendly than the existing ones because it comes from and certified by the western cleantech cluster, and now distributed by two big urban environment firms under direct management of the two best cities in Vietnam.

To get this purpose done, a press conference open to the public should be held in a famous hotel in District 1, HCMC with key invitees including a representative of the MoH, leaders of HCMC and Da Nang city People's Committees, news reporters in the Daily News boards of Vietnam Television (VTV) and HCMC Television (HTV) channels, director or top manager of the manufacturer, and directors of CITENCO and DNURENCO. In fact, District 1 is the downtown area of HCMC. An event taking place here is easy to spread throughout the country by media, especially the press. The presence of the representative of the MoH and leaders of HCMC and Da Nang city People's Committees, on the one hand, increases the attention of the other stakeholders and the awareness of new products. On the other hand, it is the chance to have certain influence over their medical waste treatment strategy in terms of technology by introducing key striking benefits of the new products briefly and precisely at the conference. Once the conference is televised on Daily News on VTV and HTV channels, it is very effective to reach the other stakeholders in the whole country at the level of announcing the product's arrival. That is because this television program is very common and watched by the majority of households, as well as televised over the country. All these matters can be conducted easily because both CITENCO and DNURENCO are the public companies under direct management of HCMC and Da Nang city governments.

Next, posting a comprehensive article on the new products with focus on striking advantages in terms of the technology and efficiency in relation to the existing

medical waste treatment solutions in Tuoi Tre newspaper becomes critical because this newspaper is very common and reputational, and seems to be the must-read daily newspaper for the majority of Vietnamese people. Certainly, it can reach all key stakeholders involved in this business in the whole country. Surely, it is much cheaper than advertising on such television channels. Contents of the article should be prepared carefully by staffs of CITENCO or DNURENCO, who are good at both technical and linguistic skills, and under assistance of the manufacturer to make sure that the writing becomes highly persuasive. It would be better if CITENCO performs this task because it is more experienced than DNURENCO. In addition, both CITENCO and the Tuoi Tre newspaper's office are located in HCMC.

Third, the websites of both CITENCO and DNURENCO are also the effective advertising channels. Business customers will be more confident and satisfied if they can easily find out entire useful information about the product such as specifications, operation manual, and key striking benefits against other products, quality certificates, etc. at the webpage of the suppliers. Therefore, the foreign manufacturer needs to provide the agents with all related product catalogs, both in print form and electronic file. Then CITENCO and DNURENCO have to arrange their websites so that visitors are pleased when they search for the product they desire.

Whereas the mass media above are primarily to establish the product awareness and the product image, as well as partly limit the influence of AIC on key stakeholders. It must be said that personal communications, particularly personal marketing and selling, heavily affect the buying decision and the success of this business. This task can be performed by salespeople of CITENCO and DNURENCO only. As pointed out earlier, the greatest advantage of CITENCO & DNURENCO in this game is under direct management of HCMC and Da Nang governments respectively. Thus, the salesperson needs to exploit the influence of this organization and relationships between members in this organization with those in other provinces to get contact information of key people in charge of the provincial DoH and/or the provincial People's Committee. Next, the salesperson should follow steps described in Table 33 below to make sure that the salesperson's effort will gain the highest effectiveness.

TABLE 33. Personal selling steps to city/province DoH

Step 1	**Pre-approach**
- Contact them by email or phone to get to know first; - Briefly introduce the salesperson's interest in cooperating to treat medical waste; - Evaluate the degree of interest in salesperson's solutions.	
Step 2	**Approach**
- Build and develop the relationships with key influencers involved in the purchase process, including the person who is responsible for the technical issue of the project, the person who approves the financial matter of the project, and the person who makes the final decision on selecting the supplier/contractor through greeting emails, chatting on phone or having coffee morning or dinners together as visiting them. - Ask about the action plan for treating such waste in that province; including what are the current problems and demand? When is the plan taken place? How much is the budget? Which technology is intended to apply? Do they need a partner to conduct a survey and prepare for the project documentation? - Categorize customers according to the attractiveness and performing schedule; - Try to ask for an appointment to discuss more clearly.	
Step 3	**Presentation and Demonstration**
- Carefully prepare for the meeting, including: power point - slide presentation, product catalogs, business card, clothes; - Present main product features and stress advantages in terms of the efficiency, reliability and environmental sustainability of the product compared with alternatives to the person who decides the technical issues of the project; - Provide product catalogs and show the eagerness to be involved in assisting technicians to prepare for the technical statement of the project; - Persuade the person who is responsible for the project finance by demonstrating the efficiency of the investment through a low level of operation costs, maintenance costs, and no payment for recovering environmental damages; - Keep as close to the person who decides on the selection of the final supplier/contractor as possible. Try to convince him/her by giving him/her assurance relevant to customer services after sales, assisting hospitals to improve their	

medical waste management capability by sharing successful examples from the West.	
Step 4	**Bidding proposal**
- Make sure that the bidding proposal definitely fits all requirements of the tender invitation file issued by the investor; - Product price quoted in the bidding proposal should be in the form of the product life cycling costing to highlight the product competitive advantages in terms of the investment efficiency, as well as to overcome the price comparison with low price products; - Maintain the close relationship with three most critical influencers mentioned above before, during and after the bidding proposal evaluation process; - Negotiate the final price for the project if selected.	
Step 5	**Closing the sales process**
- Excellently perform the assurance mentioned in the bidding proposal if winning the tender package; - Maintain the good relationship with key members of the purchase process.	

5.4 Recommendation summary

As illustrated earlier, cooperating with both CITENCO and DNURENCO as the agents of the western medical solid waste and wastewater treatment equipment manufacturer in Vietnam totally fits what is happening in this market. In addition, the Canvas business model has obviously represented how the new entrant can create, deliver and earn profits from this business. Furthermore, the recommended competitive marketing strategy has also drawn the way to create competitive advantages to compete against the strongest rival – AIC, the appropriate treatment capacity range and key desired benefits of both the hazardous medical solid waste and wastewater treatment product lines, the reference price ranges of both kinds of equipment, how to design the effective distribution system to cover and serve all target customers best, and finally the IMC strategy to win this game in Vietnamese markets.

6 CONCLUSIONS

There is really substantial market demand for hospital waste treatment products in Vietnam. At present, the total amount of hazardous medical solid waste generated by healthcare establishments is either burnt by inefficient incinerators or unsafely land-filled inside the establishment's space. The majority of these incinerators are placed in city/province level and district level hospitals. Few medium and large-scale ones are being utilized by the local urban environment companies. All these incinerators have problems with smoke and smell control while operating, as well as high operation and maintenance costs. Most of these incinerators fail to meet the Vietnam national technical standards on air emission for healthcare incinerators. Another notable point is that there is a tendency to gather and treat medical solid waste at a centralized treatment unit of a local urban environment firm, particularly in modern and large urban areas. The only buying situation of hazardous medical solid waste treatment equipment is the buying of new equipment.

Market demand for medical wastewater treatment equipment is even more urgent. That is because most of the existing medical wastewater systems fail to meet the requirements in terms of both desired treatment capacity and the quality of the output wastewater. Even so, plenty of healthcare establishments have not installed the treatment system yet, especially district level hospitals. Thus, the purchase situation of the medical wastewater treatment products is either the buying of new one or upgrading the treatment capacity and efficiency of the existing system. The present medical wastewater treatment systems are mainly applying the biological technology and using chemicals to disinfect the output wastewater. Indeed, many healthcare facilities do choose to pay fines to environmental police rather than install a new system or operating the existing system. That results from the fact that the value of the fine is far lower than the current system operation costs or investing a new one.

The hospital waste treatment equipment purchase process is definitely determined by the ownership element. The private healthcare organizations finance and organize the buying process itself. Depending on the size of the order, these facilities buy directly or invite to bid in accordance with the Vietnamese Bidding law.

The buying process quite simple and it is decided and influenced by the management board of that private medical facility.
Meanwhile, the medical waste treatment equipment purchase process for state-owned hospitals is much more complicated, time-consuming and involved in many stakeholders. The city/province DoH is the investor, the city/province People's Committee decides and approves the budget for the purchase, and state-owned hospitals are the end-users. Usually, the Medical Project Management Board belonging to the city/province DoH will be responsible for all stages of the purchase process. The hospital waste treatment equipment is put into operation only if it gets the approval from the city/province DoNRE in terms of the environmental engineering.

The number of hazardous medical solid waste treatment product suppliers remains low. They are either small-scale domestic producers or distributors/representatives of some foreign incinerator manufacturers from Japan, Korea, and UK. Most of them are the same in power, scale and technology, except AIC – the market leader placed in Hanoi, Vietnam. Conversely, there are more than 100 players in the hospital wastewater treatment equipment business. Due to the same in capability, and no differentiation in terms of the product technology, no player really dominates this market. However, once the purchase of medical solid waste and wastewater treatment products takes place at the same time within one project, AIC becomes the strongest competitor in this game once again. It may be concluded that the nature of competition in the medical waste treatment industry is how strong and close the relationship between the supplier and the public investor is, and how much the supplier is willing to pay to key influencers of the Medical Project Management Board under the form of commission.

There are a variety of key stakeholders involved in this business in Vietnam. First, CITENCO and DNURENCO may be potential business partners of the foreign new entrant because they possess most essential characteristics to be able to produce certain competitive advantages to succeed in this business. Second, private healthcare establishments are hospital wastewater treatment product buyers and end-users. Third, city/province departments of health are the main and most critical investors or buyers in this business. The most important participants in the

medical waste treatment equipment buying process stay in these organizations. Fourth, public URENCOs are potential medical solid waste treatment product buyers. Once regulations on applying the centralized medical solid waste treatment model come into effect, these firms will be big customers. Fifth, medical waste treatment products can be put into operation only after they get the approval from inspectors of city/province DoNRE. Sixth, City/province People's Committees decide on the model of medical solid waste treatment, make decisions on budget for investing into health projects in that city/province. Plus, they directly manage the majority of public URENCOs. Seventh, the MoH orients kinds of medical waste treatment solutions and technologies. Eighth, the MoNRE imposes national technical standards or regulations which may produce technical barriers on medical waste treatment products. Finally, AIC is the strongest competitor in this business.

At the time of conducting the empirical research in Vietnam, HCMC and some different provinces such as Bac Lieu, Ninh Thuan, Gia Lai and Dak Lak have prepared plans for equipping public healthcare establishments located in the city/province with treating hazardous medical solid waste and wastewater equipment to submit to the MoH because World Bank just granted this ministry a loan of 150 million US dollar in July 2011 to support the hospital waste management and treatment performance improvement project for the whole health system. This project is planned to be carried out between 2011 and 2017 according to the agreements between the lender and the borrower. For that reason, the western hospital waste treatment product manufacturers must have been expecting to see a" business map" with clear guidelines so that they can sell their products to customers in Vietnam markets successfully.

The market entry mode of agent is recommended by the researcher with respect to four dimensions - fitting the current market context, the ability of monitoring and controlling markets, overcoming operation costs and business efficiency trade-off, and minimizing risks for the western entrant. DNURENCO and CITENCO are targeted because of the following reasons: 1. they possess the essential features to overcome present obstacles of this business, as well as competitive advantages to compete against the market leader AIC placed in the north of Vietnam; 2. They

resolve traffic and transport challenges to assure that all target markets are reached, customer services are delivered in time, and travelling costs are optimized; 3. They help to overcome barriers of cultural differences and the regionalism among regions within Vietnam so that it is easier to understand and meet customer needs and expectation.

In addition, the author describes the rationale of how the western hospital waste treatment equipment manufacturer creates, delivers and captures value from this business opportunity in Vietnam markets in the form of the Canvas business model. This recommended model provides core suggestions associated with the customer segment, value propositions, channels, customer relationships, revenue stream, key resources, key activities, key partnerships and cost structure.

Eventually, the writer does design the competitive marketing strategy through a new marketing mix. First of all, the competitive advantages are developed on the basis of analyzing the nature of competition in this business in Vietnam, and lessons learnt from the success of AIC. Second, the product strategy is built in respect to the problems of existing hospital waste treatment products and end-users expectation found out during the empirical research to assure that the value propositions are created to meet market demand. Third, the price strategy designed on the basis of estimating the possible budget of the public investor and considering AIC's price level in some medical projects it has done represents the reference price range for each product line. Fourth, the distribution strategy is associated with the ability to reach and serve all target customers best, and overcoming disadvantages of traffic and transportation, cultural differences and the regionalism. Finally, the IMC strategy with focus on personal selling results from understanding the local culture, the nature of competition and the buying process.

So far, all the research questions have been answered fully, and the research objectives have been gained. Although the research has been conducted in only the southern half of Vietnam including the South Central Coast region, the Central Highland region, the Southeast region and the Mekong Delta; however, the results of analyzing market and the recommendations are likely applicable for the rest of the Vietnam marketplace. That is because the research samples spread through

most developed central cities and provinces, both city/provincial level and district level hospitals, and both public and private healthcare sectors.

Although this research is undertaken in the Vietnam marketplace only, it can completely be applied for any markets in which the hospital waste treatment product purchase process, the nature of competition, and the industry structure are similar to those analyzed in this research, in particular other emerging markets in the world.

REFERENCES

Published references

Blythe, Jim and Zimmerman, Alan. 2005. *Business to Business Marketing Management - A Global Perspective.* s.l. : Thomson, 2005. ISBN 1-84480-001-6.

Burca, Sean De, Fletcher, Richard and Brown, Linden. 2004. *International Marketing - An SME Perspective.* s.l. : Pearson Education Ltd., 2004. ISBN 0 273 67323 8.

Douglas West, John Ford, Essam Ibrahim. 2010. *Strategic Marketing - Creating Competitve Advantage.* New York : Oxford University Press Inc., 2010.

Hooley, Graham, Piercy, Nigel F. and Nicoulaud, Brigitte. 2008. *Marketing Strategy and Competitive Positioning.* s.l. : Pearson Education Limited, 2008. 978-0-273-70697-7.

Kotler, Philip, et al. 2009. *Marketing Management - An Asian Perspective.* Singapore : Pearson Education, 2009.

Mohr, Jakki, Sencupta, Sanjit and Slater, Stanley. 2005. *Marketing of High-Technology Products and Innovations.* s.l. : Pearson Prentice Hall, 2005. ISBN 0-13-123023-9.

Porter, Michael M. 2008. *On Competition - Updated and Expanded Edition.* s.l. : Harvard Business Press, 2008.

Electronic references

CIA - The World Factbook. January 19, 2011. https://www.cia.gov/library/publications/the-world-factbook/geos/vm.html (accessed March 9, 2011).

General Statistics Office. Mar 2011. http://www.gso.gov.vn/default.aspx?tabid=395&idmid=3&ItemID=10033 (accessed Mar 10, 2011).

12manage. 2011. 12manage. *SWOT Analysis.* [Online] April 2011. [Cited: April 30, 2011.] http://www.12manage.com/methods_swot_analysis.html; http://www.quickmba.com/strategy/swot/.

—. 2011. 12manage. *SWOT Analysis.* [Online] April 2011. [Cited: April 30, 2011.] http://www.12manage.com/methods_swot_analysis.html.

Dat Viet Newspaper. 2010. Clean medical waste in accordance with Japanese technology. *Khoahoc.com.vn.* [Online] March 2010. [Cited: Oct 16, 2011.] http://www.khoahoc.com.vn/doisong/moi-truong/giai-phap/27181_Lam-sach-rac-y-te-theo-cong-nghe-Nhat-Ban.aspx.

General Statistics Office. 2011. Education, Health, Culture & Lives. *General Statistics Office.* [Online] 2011. [Cited: Sep 6, 2011.] http://www.gso.gov.vn/default.aspx?tabid=395&idmid=3&ItemID=10033.

—. 2010. Education, Health, Culture & Lives. *General Statistics Office.* [Online] 2010. [Cited: Sep 6, 2011.] http://www.gso.gov.vn/default.aspx?tabid=395&idmid=3&ItemID=10033.

Harvard Business School. 2005. Harvard Business Review. *SWOT Analysis II: Looking inside for Strengths and Weaknesses* . [Online] Harvard Business School Pulishing, Jun 2005. [Cited: April 30, 2011.] http://hbr.org/product/swot-analysis-i-looking-outside-for-threats-and-op/an/5528BC-PDF-ENG?Ntt=swot%2520analysis. ISBN-10: 1-4421-0553-9.

—. 2005. Harvard Business Review. *SWOT Analysis I: Looking inside for Threats and Opportunities.* [Online] June 2005. [Cited: April 30, 2011.]

http://hbr.org/product/swot-analysis-i-looking-outside-for-threats-and-op/an/5528BC-PDF-ENG?Ntt=swot%2520analysis. ISBN-10: 1-4221-0552-0.

KN. 2010. Bring Chuwastar medical waste incinerator in use: Consideration of its suitability. *DaiDoanKet.* [Online] April 2010. [Cited: Oct 6, 2011.] http://www.daidoanket.vn/PrintPreview.aspx?ID=11401.

Minh, Duy. 2010. Anninhthudo. *Xahoi.* [Online] August 22, 2010. [Cited: March 27, 2011.] http://www.anninhthudo.vn/Tianyon/Index.aspx?ArticleID=80782&ChannelID=5.

Ministry of Health. 2011. Home. *Ministry of Health.* [Online] Ministry of Health, 2011. [Cited: Sep 6, 2011.] http://www.moh.gov.vn/wps/portal/moh/home/!ut/p/c5/04_SB8K8xLLM9MSSzPy8xBz9CP0os3hnd0cPE3MfAwP3IC9nA89QD18_Dws_Y08PQ6B8JG55QwMCusNB9iGpsHBxszAwcjI18ww0cDEw8DSFyBvgAI4GaPox7ffzyM9N1S_IjTDIDEhX-BABBDR8N/dl3/d3/L2dJQSEvUUt3QS9ZQnZ3LzZfQ0dBSDQ3TDAwR1JKQzBJVUhN.

Phong, Dong. 2010. Abnormalities in bidding medical waste incinerator. *Baomoi.* [Online] EPI Technologies, 2010. [Cited: Oct 6, 2011.] http://www.baomoi.com/Bat-thuong-dau-thau-lo-dot-rac-thai-y-te/45/4273602.epi.

QuickMBA. 2010. QuickMBA. *SWOT Analysis.* [Online] 2010. http://www.quickmba.com/strategy/swot/.

STEPRO Co., Ltd. 2011. Company Introduction. *stepro.* [Online] 2011. [Cited: Oct 17, 2011.] http://www.stepro.com.vn/trang-chu.html.

West, Douglas, Ford, John and Ibrahim, Essam. 2010. *Strategic marketing - Creating Competitive Advantage.* New York : Oxford University Press Inc., 2010.

2006. WHO. *Health care waste management.* [Online] 2006. [Cited: March 27, 2011.] http://www.healthcarewaste.org/en/620_tech_national.html.
2007. WHO. *Waste from health care activities.* [Online] November 2007. [Cited: April 4, 2011.] http://www.who.int/mediacentre/factsheets/fs253/en/.

Yahoo Vietnam. 2009. STEPRO Co. Ltd Capability Profile. *Yahoo Vietnam! 360Plus.* [Online] Jul 2009. [Cited: Oct 16, 2011.] http://vn.360plus.yahoo.com/obana-vietnam/article?mid=50&fid=-1.

APPENDICES

This part provides related supporting information to help the reader understand contents of the research more clearly and easier. It consists of 9 appendices as follows:

- Appendix 1 – Interview questionnair for hospital's staff
- Appendix 2 – Interview questionnair for URENCO
- Appendix 3 - Interview questions for DoH and DoRNE
- Appendix 4 – Current hospital waste mangement state in healthcare facilities surveyed
- Appendix 5 – QCVN 02:2008/BTNMT – National technical regulation on the emission of healthcare waste incinerator
- Appendix 6 – TCVN 7380:2004 – Technical requirements on healthcare solid waste incinerator
- Appendix 7 – QCVN 28:2010/BTNMT – National technical regulation on healthcare wastewater
- Appendix 8 – List of contact persons

Appendix 1 - Interview questionnaire for hospital's staff

Interview Questionnaire for Hospital Personnel

Hospital Name: _____

Interviewee: _____

Title:_____

Location: _____

Date/Time: _____

Contact address: _____

1.	What is the sector of your hospital? ☐ Private ☐ Public/State-owned ☐ Joint venture ☐ Other
2.	How many beds are there in your hospital?
3.	How many kilos of medical solid waste and cubic meters of wastewater are generated per day (or per month) by your hospital?
4.	What kind of medical waste treatment technology/method is been applying by your hospital?
5.	Why is this treatment technology/method used?
6.	Who did make the final decision on choosing this technology/method?
7.	What extent are your staffs that are responsible for handling medical waste satisfied with the current technology/method? ☐ Strongly convenient

	☐ Good ☐ Satisfied ☐ Poor Other comments: _____
8.	What are favorable and unfavorable to the current medical waste treatment solution in your hospital? Favourable: Unfavourble:
9.	How much does your hospital pay for treating medical waste per month or per year?
10.	Who finances your organization for paying medical waste treating fee or purchasing medical waste treatment equipment?
11.	Who is responsible for purchasing new medical waste treatment equipment when your organization demands?
12.	How is the buying process taken place when your organization needs to buy a new medical waste treatment solution?
13.	What are fundamental criteria that a medical waste treatment solution supplier must meet so that it can be accepted by your organization?
14.	How do you assess the quality of services (after sales) by the current medical waste treatment solution supplier?

15.	What expectations do you expect from a medical waste treatment solution supplier in order to improve the present circumstance?

Additional comments and suggestions:

Appendix 2 – Interview questionnaire for URENCO

Interview Questionnaire for URENCO

Company Name: _____

Interviewee: _____

Location: _____

Title: _____

Date/Time: _____

Contact add.: _____

1.	What is the sector of your organization? ☐ Private ☐ Public/State-owed ☐ Joint venture Other:
2	What kinds of services is your company offering to hospitals?
3.	Where is your company operating and serving which hospitals?
4.	What are benefits that hospitals can get if they choose your offerings rather than treating HCW by themselves?
5.	What kind of HCW treatment technology are you using? When installed? Origin? How about its current capacity in relation to current demand? What about maintenance for it?
6.	How is the buying process taken place when your organization needs to buy a new medical waste treatment solution? Especially legal procedures relevant to authorities
7.	Do you need to some partner in order to do the current job better? What are

	fundamental criteria that a partner must meet so that it can be accepted by your organization?
8.	How much does a hospital pay for treating 1 kilo HCW by your company?
9.	How do you assess your firm's position in this market segment?

Additional discussion:

Appendix 3 – Interview questions for DoH and DoNRE

1. What is the role of DoH/DoNRE in hospital waste management in your province/city?
2. What is the relationship between DoH/DoNRE and healthcare facilities in the province/city?
3. What do you think if some foreign partner wants to cooperate to solve problems caused by hospital waste?
4. What do you need from a foreign partner who comes to help improve the current situation?

Appendix 4 – Current hospital waste management state in healthcare facilities surveyed

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
A	The Central Coastal region: Da Nang city, Quang Nam province, Quang Ngai province and Binh Dinh provine									
1	Da Nang General Hospital	State-owned & city-level	Da Nang city	N/A	N/A	N/A	Contract with DNURENCO for transporta-tion and treat-ment	N/A	N/A	Major biologi-cal tech. Chlo-ramine B to disinfect wastewater out-put.

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	According to Ms. Trung, Chief of Infection Control Faculty, hospital presently enters a contract with Da Nang Urban Environment Company (DNURENCO) - a state-owned firm for solid waste transportation and treatment following policies of the city government. Hospital's wastewater treatment system was installed and in operation since 2003, sponsored by the East Meets West organization. Output parameters of wastewater meet QCVN-28:2010/BTNMT. Sludge is treated once a year by DNURENCO. Hospital has been trying to be removed from the "black list" of the MoH because it has caused serious environment pollution recently. Unfortunately, it no longer works well from April 2011 due to damage, she says. She shares that the hospital is expecting an investment to improve the existing wastewater treatment system.									
	The author interviewed only one hospital in Da Nang city because all healthcare facilities mandatorily enter contracts with DNURENCO for medical solid waste transportation and treatment following policies of the city government. Mr. Hoang, Environ-mental Engineering Assistant Manager in Da Nang city DoNRE, explains that appointing DNURENCO as the only firm which is responsible for treating solid medical waste aims to: 1. decrease risks of medical waste pollution because most of existing hospitals are placed in urban areas, their incinerators do not work well while DNURENCO's waste treatment center is in a suburb; 2. Be easier for the city authorities to monitor and control issues of medical solid waste; 3. The centralized medical waste treatment model is more									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	economical and suitable because this city is not too large. In a face-to-face interview with Ms. Phan Thi Nu, Chief of Environment Technology Department in DNURENCO, she says that 78 hospitals and other healthcare facilities in the city are her firm's customers so far. The total hazardous medical solid waste collected is around 500 kilos per day. Such waste is transported by special refrigerated vans. The company is utilizing 2 electricity-powered incinerators made in Vietnam to treat such waste. Their capacities are 200 kg/h and 100 kg/h. Both incinerators consume average 0.5 liter of diesel to burn 1 kilo of such waste. Diesel price unit at the interviewing time is about 0.7 euro/lit (VND 21.000/lit). So, to treat 1 ton of such waste, the firm has to pay at least €700 for buying diesel only, excluded other costs. Meanwhile, the price for transporting and treating 1 ton of such waste set by the city People's Committee is about €314 (VND 9.4 million), she adds. She is not really satisfied with the existing incinerators in terms of technology and efficiency because ash after burning process still remains much and need to be land-filled. This leads to reducing the efficiency of landfill. According to Ms. Nu, another difficulty which decreases the efficiency of waste treatment is that hospitals' staffs are not honest and serious at sorting wastes properly as reg-ulations. She concludes that her company is really interested in advanced technologies to improve the current situation. She appre-ciates the cooperation with foreign partners from the West.									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
2	Quang Nam Prov-ince Gen-eral Hos-pital	State-owned & pro-vincial level	Quang Nam province	600 beds	400 kg/day	Diesel: €1.250; Mainten-ance: €220; Operator's s alary: €170	Hoval incinerator made in Austria.	60 m3/24h	N/A	N/A
	According to Mr. Nguyen Anh Tuan, administration staff, the existing incinerator was equipped in the form of the ODA project by Quang Nam province health department. However, it is old and no longer works efficiently at present. From August 2011, the pro-vincial government requests the hospital to enter a contract with Quang Nam Urban Environment company for driving medical solid waste to Hoi An Centralized Waste Treatment factory launched in July 2011. Payments for treating waste and wastewater are from hospital's annual operational budget. Before the Hoi An Centralized Waste Treatment factory built, medical solid waste in surround-ing health care facilities are taken to the hospital and burnt by this incinerator.									
3	Hoi An	State-	Quang	130 beds	3	€70/month	Contract with	4	N/A	A wastewater

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	hospital	owned, district-level	Nam province		kg/day		Quang Nam Urban Environmental firm	m3/24h		treatment sys-tem is under construction.
	According to Mr. Pham Van Tai, Administration & Organization Assistant Manager, the hospital enters a contract with Quang Nam Urban Environmental firm for transportation and treatment following policies of Hoi An city government. At the time of the inter-view, a wastewater treatment system is under construction. Before that, wastewater is discharged into the common underground pipe-line. He also adds that the hospital is lack of special equipment to transport medical waste within the hospital and special bins for hazardous medical waste at this moment.									
4	Pacific hospital	Private district-level	Quang Nam province	90 beds	13 kg/day	€220/ month	Contract with Quang Nam Urban Environmental firm	30	€450~ €500/ month	Micro organ-ism, chemical and physical technology
	According to Mr. Do The Dan, Chief of Administration Department, the hospital enters a contract with Quang Nam Urban Environ-									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	mental firm for transportation and treatment following policies of Hoi An town government. A wastewater treatment system was in-stalled and in operation since 2009. Output parameters of wastewater meet QCVN-28:2010/BTNMT according to the assessment of the local DoNRE. Initial investment capital is about €18.300. Being a private hospital, all hospital's operations are financed by itself, from daily activities to investment operations. Mr. Dan says that if the hospital wants to install a waste or wastewater treatment equipment or system, it can prepare the entire project itself and then submit it the Quang Nam province DoNRE for approval in terms of environmental specifications. In summary, Quang Nam province government assigns Quang Nam URENCO to be responsible for collection, transportation of solid medical waste in hospitals located in Hoi An town, Tam Ky town and other districts in the province to treat at Hoi An Centralized Waste Treatment factory.									
5	Quang Ngai Gen-eral Hos-pital	State-owned, provin-cial lev-	Quang Ngai province	600 beds	120 ~150 kg/day	Average €850/ month	Hoval incinerator made in Austria.	N/A	N/A	Biological tech-nology and chloramine B to disinfect the

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
		el								output
	According to Mr. Bao who is responsible for operating medical solid waste and wastewater systems, the hospital has been operating a 200-kg Hoval incinerator made in Austria. This incinerator is placed in the old facility, about 1 km from the current place. Mr. Bao says that this incinerator needs average 0.3 liter of diesel (€0.7/lit in Vietnam market) to burn 1 kg of solid medical waste. It means that the hospital has to pay average €850 per month for buying diesel to solve the amount of medical solid waste it generates, ex-cluded other costs. Medical solid waste produced by other health care establishments located in Quang Ngai urban center are also treated in this hospital following directions of the provincial government. Then the hospital charges those facilities diesel purchase costs on the basis of how many kilos of waste need to be treated. Mr. Bao shares that burning ash, especially glass bottles still re-mains a lot. At the time of the survey, there are two new incinerators which are already installed and waiting for testing and commis-sioning procedures inside the hospital's space. However, information relevant to both new incinerators is not revealed. About the wastewater treatment system, Mr. Bao informs that it was in operation since 2010, design capacity of 500m3/24h, use of major biological technology and chloramines to disinfect the output. He adds that this system and both new incinerators are invested by the provincial health department. The wastewater treatment system is built by a domestic firm in HCMC. Output parameters of									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	wastewater reach standard B of national standards on healthcare wastewater. But sometimes, several parameters are under standards due to use of bad quality of chloramines bought from market. The researcher have also contacted with persons in charge of Mo Duc district hospital and Duc Pho district hospital for interviews. But eventually, they do cancel them. However, according to Mr. Bao, most of district hospitals are equipped 15~25-kg-per-day inci-nerators. In general, Quang Ngai province general hospital can be regarded as a centralized medical solid waste treatment unit of this province. The local urban environment firm just plays the role of waste transporter.									
6	Binh Dinh Turbercu-losis & Cancer Hospital	State-owned, provin-cial one	Binh Dinh province	180 beds	10 kg/day	€101/diese l/month	Hoval MZ4 incine-rator made in Aus-tria.	N/A	N/A	Biological tech-nology and chemistry to disinfect the output
7	Binh Dinh	State-	Binh	130 beds	1	€11/diesel	Cooperate with	N/A	N/A	Biological tech-

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	Psychiatric Hospital	owned, provin-cial one	Dinh province		kg/day	/month	Binh Dinh Turber-culosis & Cancer hospital			nology and chemistry to disinfect the output
	Binh Dinh Turberculosis & Cancer hospital and Binh Dinh Psychiatric hospital are neighbors. They share the common border line, use the same medical waste incinerator, as well as wastewater treatment system. Mr. Nguyen Sy Dung, Chief of Infection Control faculty, Binh Dinh Turberculosis & Cancer hospital, shares that his hospital is de-signed as the centralized medical solid waste treatment unit for all healthcare establishments located in Quy Nhon town belonging to Binh Dinh province. The hospital is using a 400-kg/day- Hoval MZ4 incinerator made in Austria. This machine consumes about 0.5 liter of diesel/kg of waste burnt. It was equipped by Binh Dinh province health department in 2002. Mr. Dung says that the total amount of such waste treated by this incinerator is between 7 and 8 tons per month. His hospital charges others healthcare units about €0.4/kg of waste (VND 12.000/kg) correspondingly the price of 0.5 liter of diesel in Vietnam market at that time. At present, the hos-									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	pital lacks of special medical waste bins and device to pick up waste due to the limitation of its operational budget. About wastewater treatment, a 150-m3/24h-wastewater treatment system was constructed by Vietnam Russia Tropical Center from 2001 and presently under management and operation of Binh Dinh Psychiatric hospital. Total operational costs of this system are around €400/month. Due to being equipped ten years ago and on the basis of National Technical Regulation on Health Care Waste at that time, output parameters of wastewater do not meet current standards mentioned in QCV 28:2010/BTNMT, says Mr. Tran Nguyen Vu, Chief of Infection Control faculty, Binh Dinh Psychiatric hospital. In April 2010, he reports this status to the provincial health department to ask for improving the system. However, Binh Dinh Turberculosis & Cancer hospital is still in the ”black list” of the MoH because of its serious wastewater pollution so far, according to Mr. Vu. In terms of technology, this wastewater treatment system is similar to the system in Quang Ngai Provine General hospital.									
8	Tuy Phuoc District General	State-owned, district	Binh Dinh province	180 beds	8 kg/day	€210 /diesel/ month	Incinerator made in Vietnam	10 m3/24h	N/A	Biological and chemical tech-nology

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	hospital	level								
	The hospital is located in Tuy Phuoc district, Binh Dinh province. According to Mr. Truong Van Ky, Deputy Director of Tuy Phuoc District General hospital, the hospital's incinerator and wastewater treatment system were equipped by Binh Dinh province health department for 2 years. The capacity of the existing incinerator is 30 kg/shift. It is manufactured by Binh Dinh Pharmaceutical and Medical Equipment company – a local state-owned firm. Mr. Ky says that the incinerator is operated once every two days because the quantity of medical solid waste produced are just about 8 kg/day. For each burning shift, it consumes around 20 liters of diesel. He adds the incinerator is usually run in nighttime. The wastewater treatment system has been in operation but its quality is not good, he evaluates. Wastewater after treatment is dis-charged into a stream near the hospital.									
	In conclusion, there is a tendency of treating medical solid waste at a centralized treatment unit in the central coastal provinces, either in a facility of the local urban environment firm or in a provincial-level hospital. It aims to find more benefits in terms of economy and environmental protection. Allocation of incinerators based on the amount of such waste generated and the geographical element seems to meet demand in these central coast provinces in the current circumstance. However, the efficiency of the existing incinera-									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	tors is in doubt, particularly in terms of emission and smell control as well as fuel costs to burn waste. For medical wastewater, most of public hospitals' wastewater treatment systems are old and failed to meet QCVN 28:2010/BTNMT. The existing processing technology is mainly the combination of biological and chemical technologies. Urban Environment firms and public hospitals are end-users while the city/provincial health departments play the role of investors.									
B	The Central Highland region: Gia Lai province & Dak Lak province									
9	Pleiku city General hospital	State-owned, city lev-el	Gia Lai province	70 beds	30 kg/day	N/A	Chuwastar F-1S made in Japan	7.3 m3/24h	N/A	AAO technolo-gy of Japan
	According to Mr. Nguyen Ba Ly – Chief of Administration Office, Pleiku city general hospital, both the medical solid waste incine-rator and wastewater treatment system have just been in operation for 5-6 months. The incinerator consumes about 14-15lit/hour. Even though it is still in the guarantee period, it has problems with operation continuously, particularly its fuel injector. Smoke and smell generation is serious thought the supplier assures that that would not happen. He prefers to enter a contract with a local urban									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	environment firm for treating such waste because the hospital does not have any technician to deal with it. At present, the incinerator is operated by nurses. The entire project of equipping such hospital waste systems in hospital is performed by the provincial medical project management board. Hospital is the end-user. Because the hospital's space is limited and located in downtown area, it would be better if medical solid waste is delivered to the local urban environment firm. The hospital also prefers to buy something from the manufacturer rather than from intermediaries because he thinks that it would be cheaper. He expects the supplier to supply the right goods according to the MoH's regulations.									
10	Gia Lai Traditional Medicine hospital	Public provin-cial lev-el	Gia Lai province	N/A	3 kg/day	20 lit of diesel/ month equivalent €14/month	Incinerator made in Vietnam by HCMC university of tech-nology	No statis-tics	No statis-tics	Biological tank + chloramines B
	According to Mr. Truong – Chief of Administration office, the hospital's incinerator was installed in 2007. Glass bottles are not burnt completely. Smoke and smell generation is quite serious while operating the incinerator. To deal with this problem, the solution is to									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	increase the height of the chimney. The hospital's wastewater treatment system was also in operation from 2007. Because the suppli-er is in HCMC, and travelling between HCMC and Gia Lai province is very time-consuming, after sales services are not good when the incinerator and wastewater treatment system are in trouble. The hospital lacks special device for collecting and picking up such waste.									
11	An Khe General hospital	Public district level	Gia Lai province	N/A	N/A	N/A	Not equipped yet, unsafe landfill	N/A	N/A	Not installed yet
12	Ayun Pa general hospital	Public district level	Gia Lai province	N/A	N/A	N/A	Not equipped yet, unsafe landfill	N/A	N/A	Not equipped yet
13	Mang Yang Gen-eral hos-	Public district level	Gia Lai province	N/A	N/A	N/A	Not equipped yet, unsafe landfill	N/A	N/A	Not equipped yet

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	pital									
14	Dak Po General hospital	Public district level	Gia Lai province	N/A	N/A	N/A	Not equipped yet, unsafe landfill	N/A	N/A	Not equipped yet
15	Center for disease treatment, Education, Labour and Society	Public district level	Gia Lai province	N/A	N/A	N/A	Not equipped yet, unsafe landfill	N/A	N/A	Not equipped yet
16	Center for Malaria Prevention	Public district level	Gia Lai province	N/A	N/A	N/A	N/A	N/A	N/A	Not equipped

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
17	Center for Social Dis-eases Pre-vention	Public district level	Gia Lai province	N/A	N/A	N/A	N/A	N/A	N/A	Not equipped
	Due to limitation of time fund, the author came to see Ms. Huong, Deputy Director of Gia Lai province DoNRE in her office to get information about medical waste management in other heath care facilities. She says that majority of hospitals and medical service units located in the province are not equipped medical solid waste and wastewater treatment systems yet. As a result, they have made the environment polluted seriously and negative impacts on health of local people. She also suggests solutions and the implementa-tion progress for 8 healthcare establishments which is now in the "black list" of the province DoNRE. Schedule suggested is 2011-2012.									
18	Dak Lak General Hospital	Public provin-cial lev-	Dak Lak province	750 beds	400~ 450 kg/day	€1.600/ month	High temperature water steam steri-lizing technology,	350 m3/24h	N/A	Not installed yet.

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
		el					then crushing and landfill. Spanish technology.			
	Doctor Nguyen Van Hung, Chief of General Planning Department, Dak Lak province general hospital shares that the current medical solid waste treatment system has been in operation since 2007 although it was sponsored by Denmark Clean Water organization in 2000. Due to high operation costs, the system was only put into operation 7 years later on. It was worth VND 5 billion at the year of 2000. He assesses that this system is simple and easy to operate. However, this technology does not treat sharp substances effectively. At present, the operation cost for it is from the annual operational budget of the hospital. Mr. Hung adds that the hospital enters a maintenance contract with a company in Da Nang city. Regularly, this company does maintenance work for this system. The contract is worth VND 15 million per year. After being sterilized, medical solid waste is delivered to a local urban environment firm for fur-ther treatment. The hospital has not installed the wastewater treatment system yet. However, a project for constructing a new wastewater treatment system inside the hospital’s space has been prepared by Dak Lak provincial department of health. The total investment budget for the									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	new system is around VND 22 billion. A business placed in Hanoi will perform this project, Mr. Hung reveals. He says that the hospital must ask Dak Lak provincial department of health for investing in the hospital waste systems because it does not have enough money to do that. However, this process is very time-consuming, even a few years, Mr. Hung shares. Because the hospital is placed in the downtown area of Dak Lak city, it does have much free space.									
19	Buon Ho Town General hospital	Public district level	Dak Lak	180 beds	15~ 20 kg/day	€370 / diesel/ month	Incinerator made in VN	No statis-tics	No statis-tics	NaOH + chlo-rine
	Mr. Y Luar Nie, Chief of Administration Organization Unit is not satisfied with the existing incinerator. In fact, it is a manual one, old, bad at air emission and smell. Plus, hazardous burning ash remains much. Wastewater treatment system was in operation from end of 2009. It was built by a firm in Nha Trang. It uses NaOH & Chlorine to treat wastewater. The output wastewater is discharged into an underground concrete storage tank and then permeates through the ground.									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	Like other state-owned hospitals, it cannot buy hospital waste treatment equipment itself because of limitation of its budget. It must ask the provincial DoH.									
20	333 Area General hospital	Public district level	Dak Lak province	150 beds	20 kg/day	N/A	Not treated (unsafe landfill)	8 m3/24h	N/A	Direct dis-charge without treatment
21	Krong Nang Gen-eral hospit-al	Public district level	Dak Lak province	100 beds	30 kg/day	N/A	Incinerator	6 m3/24h	N/A	Direct dis-charge without treatment
22	Cu Kuin General hospital	Public, district level	Dak Lak province	110 beds	15 kg/day	N/A	Incinerator	6 m3/24h	N/A	Direct dis-charge without treatment
	In in-depth interview with Mr. Nguyen Huu Huyen - Chief of Planning Department, Dak Lak province DoH, he says that his organi-									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	zation is responsible for managing healthcare facilities in the province and investing to build medical facilities, included hospital waste treatment equipment purchase. He adds that 100% of medical solid waste and wastewater generated by medical service centers in the province have not safely treated so far. According to the medical waste and wastewater management report in Dak Lak up to March 2011 provided by Mr. Huyen, 95% of hospitals in the province have small-scale-medical solid waste incinerators. However, they do not work well: waste not burnt completely, ash remains much and not safely land-filled; 80% of them have problems with control of air emission and dust. About the medical wastewater treatment issue, the report concludes that 79% of total 21 hospitals have been equipped medical wastewater treatment systems, but 40% of checked facilities fail to meet TCVN 7328:2004. He explains that hospital treatment methods are proposed by the MoH and DoH. According to him, treating medical solid waste by sterilizing or incinerators is backward now. To increase the efficiency of wastewater treatment systems, drainage systems in hospitals must be rebuilt, he suggests. Unfortunately, this is out of the DoH's budget, he concludes. About organizing the hospital waste treatment equipment buying process, he says that the DoH will consider both price and technol-ogy elements at the same time, and without concern about the internal or external issue. If some foreign organization comes to help improve hospital waste treatment performance, his organization is willing to cooperate.									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	In conclusion, demand for treating medical solid waste and wastewater in healthcare facilities in the central highland areas is large and urgent.									
C	The South Areas: An Giang province, Bac Lieu province, Can Tho city, Ba Ria-Vung Tau province, Dong Nai province, HCMC,									
23	An Giang Cardio Vascular hospital	Public provin-cial lev-el	An Giang province	153 beds	1.5 kg/day	€15/diesel /month	Contract with another hospital to help treatment	50 m3/24h	N/A	Microorganism processing
	Mr. Thai Duc Thuan Phong - Chief of nurse says that at the beginning, his hospital contracted with An Giang general hospital to treat medical solid waste by an incinerator in that hospital. But it is now overloaded, so his hospital enters a new contract with Tri Ton district general hospital to do that. It is about 30-40km between 2 hospitals. His hospital's wastewater treatment system has been in operation since 2009. It was invested by An Giang province DoH. The hos-pital is planning to expand its capacity up to 500-600 beds. Thus, it really demands for assistance to deal with both medical solid waste and wastewater in the future. However, it is really a challenge for his hospital because its space is limited now, Mr. Phong ex-									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	presses. He also reveals that all information relevant to hospital waste treatment is managed by the Administration Organization unit.									
24	Phong Di-en Genral hospital	Public district level	Can Tho city	50 beds	10 kg/day	€210/diese l/month	Incinerator	5 m3/24h	No statis-tics	Biological and chemical tec-chnology
	According to Mr. Phung Phuoc Nguyen, Chief of Planning Department, the hospital was just built by government bonds for Can Tho city. At present, hospital has 50 beds, but will grow up by 120 in near future. An incinerator branded "made in the US" is under test-ing and commissioning period. However smell and air emission generation is very serious. According to the incinerator operator, it consumes about 1 liter of diesel to burn 1 kg of medical solid waste. The amount of burning ash remains low. Similarly, the wastewa-ter treatment system is just invested by Can Tho city health department. He adds that some district general hospitals in Ninh Kieu, Cai Rang and O Mon districts are in the same situation with his organiza-tion because these district hospitals are invested at the same time under one project of the city health department.									
25	Can Tho city Gen-	Public city lev-	Can Tho city	500 beds	75 kg/day	€1867 / month	Contract with Sao Viet company for	No statis-	No statis-tics	Biological & chemical tech-

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	eral hos-pital	el					treatment	tics		nology
	Mr. Nguyen Hong Tam, chief of Infection control faculty, says that the hospital has contracted with Sao Viet company for treating medical solid waste for nearly one month. Before that, such waste was driven to TW Can Tho General hospital and treated by an incinerator there. This incinerator is designed to treat medical solid waste produced by city-level hospitals located in center of Can Tho city. Recently, this incinerator has been overloaded, so it stops burning such waste for other hospitals. At the time of the interview, medical solid waste in the hospital is not collected in time by Sao Viet company, while the hospital does not have a cold store to contain such waste as regulations. The researcher walks around the hospital and finds out the air and smell around the hospital's waste store are serious. The researcher and local newspapers are confused because the hospital signs a contract with Sao Viet company located in Vung Tau city!!!!!!!. That is because the distance between Can Tho and Vung Tau city is around 300 km, and it should have taken more than six hours to drive between these cities, and included risks of traffic accidents for the hazardous waste carrier on the way. The hospital has to pay €0.85/kg (VND 25.000/kg) of such waste for Sao Viet firm. This price is twice as high as the normal price in any cities and province in Vietnam.									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	The hospital's wastewater treatment system was constructed from 2004, uses biological and chemical technology. Even though the current capacity of the system is still greater than the quantity of wastewater produced, the hospital is preparing a plan to submit to the city health department for improving the existing one or building a new system. At present, the hospital uses chloramine B and NaOH to control wastewater output, Mr. Tam says. Payments for waste treatment are from the hospital's annual operation budget. Buying new waste treatment equipment or a wastewa-ter treatment system must be submitted to the city health department for approval and investment capital. When asked what the hos-pital is expecting to improve the present situation of medical waste management, Mr. Tam shares that if the hospital is equipped an incinerator, it will be more active in treatment. However, another challenge is that the hospital's area is limited while there are many households around the hospital, he worries. Meanwhile, there is no firm that operates in medical solid waste treatment business in Can Tho city so far, even the city urban environment company.									
26	Hoa Binh General hospital	Public distric level	Bac Lieu province	Exist-ing: 60 beds.	7~8 kg/day	Average €157/ month	Manual incinerator	No statis-tics	No statis-tics	Not installed yet

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
				Plan: 100						
	The hospital is located in Hoa Binh district, Bac Lieu province. The hospital is presently under construction to expand its facility. At this moment, it is using a very old manual incinerator without air emission and smell control built by the hospital. Before that, according to Ms. Tran Hong Liet, the hospital was sponsored an incinerator by The No Border Organization from United Kingdom. However, it was damaged and stopped working after years in use. Medical wastewater is discharged into the same pipelines of toilets because no wastewater treatment system is installed up to now. She adds that the provincial health department has planned to be equipped a new incinerator and a new wastewater treatment system when the construction is finished. Currently, the hospital intends to bring medical solid waste and wastewater to Bac Lieu Province General hospital for treatment.									
27	Bac Lieu Province General hospital	Public provin-cial lev-el	Bac Lieu province	650 beds	270 kg/day	N/A	Hoval MZ incine-rator made in Aus-tria	No statis-tics	N/A	Biological and chemical tech-nology

No.	Health establishment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Generation Kg/day	Treating payment - Eur/month	Current treatment solution	Generation M3/24h	Treating payment - Eur/month	Current treatment technology
	According to Mr. Bay, the incinerator operator of the hospital, the incinerator is in operation for about 5 years. It is operated once every two days. Each burning shift of the incinerator lasts about 16 hours to burn 700 medical solid waste kilos including waste generated by the hospital and other health care facilities in Bac Lieu city. The hospital charges these facilities €1.17/kg (VND 35.000/kg). She says it consumes between 60 and 70 liter of diesel per shift. The incinerator has two burning chambers, so smoke is controlled quite well and ash remains little. About the hospital's wastewater treatment system, results of analyzing wastewater output parameters by Bac Lieu province DoNRE in June 2011 show that 3 of total 6 parameters are far greater than national standards.									
28	Thanh Vu General hospital	Private provincial level	Bac Lieu province	200 beds	17 ~ 20 kg/day	Average €630/ month	Contract with Bac Lieu Province general hospital	5 m3/24h	N/A	Biological and chemical technology
	Thanh Vu General hospital is the private one, located in the center of Bac Lieu city and very close to Bac Lieu General hospital. Because the hospital management refuses to meet the researcher, information relevant to it is collected from other stakeholders. Howev-									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	er, the credibility of such information still remains very high. Presently, the hospital signs a contract for treating medical solid waste with Bac Lieu Province General hospital, according to Mr. Bay – the incinerator operator of Bac Lieu Province General hospital. Every day, he receives average from 17 to 20 kg of such waste from Thanh Vu General hospital. It is charged about €1.17/kg waste (VND 35.000/kg) by Bac Lieu hospital. It also invested a 5-m3/24h-medical wastewater treatment system which applies the biological and chemical technology. According to results of analyz-ing wastewater output parameters by Bac Lieu province DoNRE in May 2011, the system meets QCVN 28:2010/BTNMT. This treatment system is designed and constructed by Minh Thong Trading & Construction Co. Ltd. in HCMC.									
29	Vinh Loi District general hospital	Public district level	Bac Lieu province	50 beds	35 kg/day	N/A	KW-20 incinerator, new verison	10 m3/24h	N/A	Not installed yet
30	Gia Rai District	Public district	Bac Lieu	150 beds	110 kg/day	N/A	KW-20 incinerator, new verison	35 m3/24h	N/A	Not installed yet

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	general hospital	level	province							
31	Phuoc Long dis-trict gener-al hospital	Public district level	Bac Lieu province	120 beds	90 kg/day	N/A	KW-20 incinerator, new verison	30 m3/24h	N/A	Not installed yet
32	Dong Hai district general hospital	Public district level	Bac Lieu province	60 beds	45 kg/day	N/A	Not equipped yet	15 m3/24h	N/A	Not installed yet
33	Province-preventive medicine	Public district level	Bac Lieu province	0	10 kg/day	N/A	Not equipped yet	5 m3/24h	N/A	Not installed yet

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	center									
34	Social Dis-eases Pre-vention Center	Public district level	Bac Lieu province	0	10 kg/day	N/A	Not equipped yet	5 m3/24h	N/A	Not installed yet
35	HIV/AIDS Prevention Center	Public district level	Bac Lieu province	0	10 kg/day	N/A	Not equipped yet	5 m3/24h	N/A	Not installed yet
36	64 ward/commune-level- medical service centers		Bac Lieu province	0	80 kg/day	N/A	Not equipped yet	20 m3/24h	N/A	Not installed yet
	Above information is provided by Mr. Huynh Vu Phong, Head of Office, and Mr. Giao, Inspector of Bac Lieu province health de-partment. According to the document named “Plan for Treating Medical Waste in Bac Lieu Province – Period 2010 -2020” prepared									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	by Mr. Phong in 2010, Bac Lieu province health department plans to allocate investment capitals for healthcare facilities which are not equipped or installed medical solid waste equipment as well as wastewater treatment system as follows: - Year 2010: €666,667.00 (VND 20 billion) - Year 2011: €566,667.00 (VND 17 billion) - Year 2012: €1,966,000.00 (VND 59 billion) Mr. Phong says the structure of total investment capital includes loans from World Bank (about €2.88 billion = VND 86.4 billion) and Bac Lieu province budget (around €320,000.00 = VND 9.6 billion). However, at the time the researcher carries out surveys in Bac Lieu province (July 2011), it seems to be that no project is kicked off yet.									
37	Thong Nhat Gen-eral hos-pital	Public provin-cial lev-el	Dong Nai province	1200 beds	2330 kg/day	€3267/ Month	Contracts with URENCO Bien Hoa.	700 ~ 800 m3/24h	No statis-tics	Biological and chemical tech. Existing capaci-ty 280 m3/24h installed in

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
										2001.
	According to Mr. Nguyen Thanh Hai - Chief of Infection control faculty, Dong Nai province government forces provincial level hospitals located in Bien Hoa city have to contract with Dong Nai URENCO for treating medical solid waste at the facility of this firm. So is his hospital. This company charges VND 14,000 per kilo of such waste. The quality of service offered by this company is under satisfaction, Mr. Hai says. At present, hospital has not got special equipment to pick up and transport medical solid waste inside the hospital's space yet. The existing wastewater treatment system was constructed and in operation from 2001 by a domestic company. Total surface area of this system is around 50m2. However, the treatment capacity of the system is not upgraded although the need is really urgent over last years. Mr. Hai shares that another serious problem that one of two facilities belonging to his hospital has been facing is wastewater produced by X ray photograph production activities. The current solution to deal with this kind of wastewater is use of a mixture including Ca(OH)2 + cements + sand to solidify wastewater, and then landfill. In addition, the remaining blood from blood examination activities also is a challenge for his hospital to treat. Presently, this blood is discharged into the sewage drainage of hospital. Mr. Hai says that his colleagues in hospitals in HCMC have the same concern as his. He reveals that due to wastewater treatment system									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	operation costs is too high in relation to hospital's financial capability, the system is often stopped. Representatives of Dong Nai province DoH have made a survey for constructing a new wastewater treatment system inside the hospital's space, Mr. Hai adds. Budget for this project is provided by Dong Nai People's committee. Eventually, he concludes that he and his organization strongly expect a wastewater treatment system which requires little space for installation, meets desired capacity, and affordable. It will be much better if some organization sponsors or grants to build a new one because it takes so long time to get the investment from the provincial DoH.									
38	Dong Nai General hospital	Public provin-cial lev-el	Dong Nai province	720 beds	Aver-age 220 kg/day	Average €1290/ month	Contracts with URENCO Bien Hoa	300 m3/24h	About €175/ chemicals/ month	Biological and chemical tech-nology
	According to Ms. Mai Thi Tiet - Chief of Infection control faculty, her hospital's medical solid waste is collected and treated by Dong Nai URENCO according to the province's policies. She says this solution is safe and effective currently. Wastewater treatment system is old and no longer works well. The hospital asked for improving it from 2008 but no signal from the									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	Dong Nai province DoH so far. The Administration Organization unit and Medical Device and Materials unit are responsible for buying equipment in the hospital. However, investing in medical solid waste and wastewater treatment equipment is out of hospital's control and financial capability, so it has to ask the provincial DoH for help. The hospital needs to prepare related information to submit to the provincial DoH for consideration and approval. After that, the DoH will conduct a survey at the hospital. Criteria to select a supplier are experienced in that field, quality and environmental safety. The wastewater treatment system has to use advanced technology, requests little space and low operation costs. The hospital is willing to co-operate with foreign investment.									
39	Nhon Trach Dis-trict Gen-eral hos-pital	Public district level	Dong Nai province	110 beds	20 kg/day	No statis-tics	Manual incinerator	30 m3/24h	N/A	Biological and chemical tech-nology
	The existing incinerator was built by Dong Nai health department when the hospital founded. It is a very manual brick incinerator. At									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	the time of the author's visit, the incinerator looks very messy by remaining ash and medical solid waste bags. Mr. Dung shares that he is absolutely dissatisfied with the current incinerator. Once the incinerator operates, smoke and smell generation is terrible. Luck-ily, the hospital is away from households and there are a lot of trees surrounding the hospital's space. The hospital also reports this problem to the provincial management in the hope of being equipped a better solution, but the circumstance is still that. The capacity of the existing wastewater treatment system is 30 m3/24h. The hospital prepared and submitted a plan for improving the wastewater treatment system from 2008 but no signal from the provincial management so far. According to Mr. Dung, Chief of In-fection faculty, Dong Nai Health Project Management Board and AIC conducted a survey of medical waste management situation of the hospital in 2009. Expectations: 1 new modern incinerator, he recommends Chuwastar one made in Japan. A wastewater treatment system is wanted urgently.									
40	Long Thanh Dis-trict Gen-	Public district level	Dong Nai province	400 beds	60 ~ 70 kg/day	Average €1.365/die sel/month	BIC incinerator made in Belgium	50 ~ 60 m3/24h	N/A	Biological and chemical tech-nology. De-

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	eral hos-pital									signed capacity about 80 m3/24h.
	According to Ms. Ho Thi Minh Thao, staff in Infection Control faculty, the hospital is just expanded in terms of facility. The hospital has been using a two-chamber-incinerator made in Belgium for treating medical solid waste. This one was equipped about ten years ago by the province health department. She adds that the incinerator is old and often has problems while burning waste. It consumes about 1 liter of diesel per 1 kg of waste. Ash still remains much and unsafe. As a result, the hospital management signs a new contract for transporting and treating such waste with Dong Nai URENCO. This company charges the hospital €0.33/kg of waste (VND 14.000/kg). It seems to be more economical for the hospital but risks of spreading infected diseases to the public grows up because the medical waste carrier of Dong Nai URENCO is not qualified enough, Ms. Thao evaluates. Additionally, it is not made sure that whether such waste is driven to the processing unit of the company or sold to some private firm for illegal and unsafe recycling. Then she concludes that a good medical solid waste incinerator is still better than other solutions for the hospital at this stage. For the wastewater, she shares that the existing 80-m3/24h-wastewater treatment system becomes old and not really work effectively									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	in terms of operation costs and environmental protection. Sludge produced from the system is also another problem for the hospital. In addition, wastewater from X-ray film photographing activities is really challenging for not only the hospital but others as well. This kind of wastewater contains heavy metals and radiating substances that the biological and chemical technology cannot handle, she explains.									
41	Trang Bom District general hospital	Public district level	Dong Nai province	150 beds	30 kg/day	Average €630/diese l/ month	Incinerator and contracts with URENCO Bien Hoa	40 m3/24h	N/A	N/A
	According to Ms. Ve Thi Song An, chief of Infection Control faculty, the province health department has approved the project of expanding the hospital's facility and equipping a new incinerator. At present, the hospital's medical solid waste is treated by a manual brick incinerator built by the hospital. This is the temporary treatment solution before the new incinerator arrives. The existing one consumes average 1 liter of diesel per 1 kg of waste. Air emission and smell is definitely not controlled. Before that, the province health department had equipped the hospital an incinerator when it founded. However, it has become damaged and stopped									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	working so far. Ms. An says that her organization is considering to sign a contract for transporting and treating medical solid waste with Dong Nai URENCO because the temporary incinerator is not effective in terms of economy and environment.									
42	Long Dien General hospital	Public district level	Ba Ria – Vung Tau province	80 beds	25 ~ 40 kg/day	€210 ~ €420 /diesel/ month	Incinerator	1 m3/24h	N/A	N/A
	According to Ms. Tran Thi Ngoc Khanh, Staff in Infection Control faculty, her organization is treating medical solid waste by a manual incinerator built from 1999 when the hospital established. Due to serious smoke and smell generation of the existing incinerator, the province health department equips the hospital with a new one to replace the existing. Currently, the new one is under testing and commissioning. According to Mr. Thanh, Head of Administrative Organization Unit, at least 10, even up to 20 liters of diesel are needed to burn total amount of medical solid waste generated by the hospital. He evaluates this is very difficult in relation to the annual operation budget of the hospital. Meanwhile, a wastewater treatment system was constructed for years, but it has never run. That is because the design capacity of the									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	system does match the quantity of wastewater produced. Mr. Thanh says, the hospital generates around 1 m3/24h. According to Mr. Thanh, the province health department just delivered about 5 or 6 incinerators to other district hospitals such as Chau Duc hospital, Con Dao hospital, etc.									
43	Tan Thanh district general hospital	Public district hospital	Ba Ria – Vung Tau province	100 beds	30 ~ 50 kg/day	€420 ~ €630/ diesel/ month	Incinerator	0.5 m3/24h	N/A	Not installed yet
	According to Mr. Doan Anh Khan, Head of Administration and Organization Unit, the hospital was equipped a 2-chamber incinera-tor by the province health department in 2006. However, it no longer works well. The incinerator needs from 20 to 30 liters of diesel to burn the medical solid waste that the hospital produces every day. This fuel cost is too high for a public district hospital because its annual operation budget is limited. In addition, burning ash remains much and unsafely. It is dumped right inside the hospital's space, the researcher sees. Smoke and smell generation is out of control. Mr. Khan shares that the incinerator has often stopped working recent month due to damage. The maintenance services supplier does not co-operate when the hospital calls. As a result, hospital's									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	staffs have to repair by themselves. So far, the hospital has not got a wastewater treatment system yet. Wastewater is discharged into a large brick-built pit and then per-meates through the ground. He and the hospital warmly welcome any assistance or investment from the outside to help the hospital improve the current case.									
44	Vung Tau Medical Center	Public district level	Vung Tau city	N/A	15 kg/day	€510/ Month	Contract with a local environmen-tal hygiene firm	N/A	N/A	N/A
	The center is located in the center of Vung Tau city. It serves only medical examinations for outpatients. According to Ms. Tran Thi Nhan, staff in Administration and Organization unit, the center contracts with a local environmental hygiene firm for transporting and burning medical solid waste. She reveals that payments for treating waste are €1.530 per quarter. However, services of this company are rather poor: sometimes late for picking up waste, no special medical waste carrier. She concludes that if her center is equipped a good incinerator, it can treat such waste in a more effective manner.									
45	Le Loi	Public	Vung	350 beds	80 ~	Diesel: €1.050 ~	Hoval	100	N/A	Biological and

No.	Health establishment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Generation Kg/day	Treating payment - Eur/month	Current treatment solution	Generation M3/24h	Treating payment - Eur/month	Current treatment technology
	General hospital	city level	Tau city		150 kg/day	€2100/month; Maintenance fees: €110 ~ €167/ Month	incinerator	m3/24h		chemical technology
	This is the largest public hospital in Vung Tau city. According to Mr. Ho Duc Tuong, Head of Administration Organization department, although the quantity of beds for inpatients is 350 units, it serves additional between 2500 and 3000 outpatients every day. That is why the statistics of the amount of medical solid waste are in a wide range. The hospital was equipped a Hoval incinerator by Ba Ria-Vung Tau province health department in 2006. This incinerator can burn from 80 to 120 kilos of such waste per shift. It consumes 50 liters of diesel per shift. It usually works 1 or 2 shifts per day depending on the quantity of such waste generated. Beside, the hospital also helps other healthcare facilities treat medical solid waste and then charges them diesel fees for burning waste. The hospital also pays between €1330 and €2000 (VND 40 ~ 60 million/year) for maintenance annually. At the time of the interview, a new incinerator made in Korea was already installed and will be in operation soon, according to Mr. Tuong. For wastewater treatment, the current wastewater treatment system was constructed by Van Lang Environment company in 2005. Its									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	present capacity is enough to treat wastewater generated by only some special faculties of the hospital. Mr. Tuong says that the prov-ince health department has also approved a project of increasing the current system capacity by 200 m3/24h. It will be constructed in August 2011. About the buying process of medical solid waste and wastewater equipment, Mr. Tuong says that the hospital can recommend some technology or equipment in the plan submitted to the province health department. However, the final decision is made after appoint-ments among the provincial People's Committee, Science and Technology department and Health department.									
46	Ba Ria General hospital	Public provin-cial Level	Ba Ria – Vung Tau province	500 beds	200 kg/day	€966/diesel/ month	Hoval incinerator	200 m3/24h	N/A	Biological and chemical tech-nology
	Above information of the hospital is provided by Ms. Tran Thi Hon, Head of Nurse, Infection Control faculty. In fact, this is the hos-pital that conducts the medical solid and wastewater treatment best among healthcare establishments that the researcher visits.									
47	Can Gio	Public	HCMC	150 beds	30	€330/diesel/	Incinerator made	N/A	N/A	Not equipped

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	hospital	district level			kg/day	month	in Vietnam			yet
	Can Gio is an island district belonging to HCMC. The only means of transport to connect it with the remaining parts of HCMC is ferries so far. According to Mr. Le Long Binh, Administration staff, the hospital has been presently utilized a 2-stage-high pressure incinerator to treat medical solid waste. This incinerator was equipped by HCMC Health department. Unlike other hospitals' incine-rators, this one uses gas to burn waste. However, the incinerator consumes more gas than normal. In addition, its gas injector often has problems. Its inside structure is damaged by high temperature. Mr. Binh adds the hospital has submitted HCMC Health depart-ment a plan for installation of a new exposed wastewater treatment system, and waiting for feedback from the management.									
48	District 2 General hospital	Public district level	HCMC	70 ~ 80	10 kg/day	N/A	Contract with CITENCO for transport and treatment	15 m3/24h	N/A	Biological & chemical com-bination tech-nology
	Mr. Luong Tam Phuc, an administration staff, says that the hospital contracts with CITENCO for transport and treatment of medical									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	solid waste following the encouragement of HCMC People's Committee. The unit price for transporting and treating waste is set by CITENCO. The hospital is satisfied with services the company provides so far. Waste treatment payments are from the annual operational budget of it. For wastewater treatment, the hospital was equipped a 60-m3-per-day treatment system by HCMC Health department since 2006, though the current amount of wastewater is about 15 m3/24h. The biological and chemical combination technology is applied for the existing system. Because designed capacity is far greater than the current wastewater generation, the system is still in good operation.									
49	An Khang Clinic	Private district level	Dist. 1, HCMC	N/A	13 ~ 14 kg/day	€330 / month	Contract with CITENCO	N/A	N/A	N/A
	According to Mr. Do Dinh Trieu, Chief of Nurse, his organization offers mainly services of examination to outpatients only. The clinic chooses to enter a contract for transporting and treating medical waste with CITENCO because of the following reasons: following the encouragement of the city; the clinic does not have enough space to install an incinerator; and afraid of the quality and air emission control of existing incinerators in Vietnam markets. Monthly payments for treating medical waste is about €330 (3~4 mil-									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	lion VND). He feels satisfied with current services of CITENCO. Being a private unit, the clinic has to finance entire its activities. When the clinic needs to purchase some waste treatment equipment, it does by itself absolutely. The clinic must invite person in charge of HCMC DoNRE to test and commission a new waste treatment system before putting in operation. Due to the fact that the private healthcare facilities is under very tight supervision of Environmental Police and DoNRE, the quality of any new equipment is always in highest priority, Mr. Trieu says.									
50	France-Vietnam Hospital	Private city lev-el	Dist. 7, HCMC	200 beds	300 kg/day	€3300 / month	Contract with CITENCO	200 m3/24h	N/A	Biological tech-nology. But wastewater out-put is under standards, ac-cording to HCMC DoNRE and Health de-

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
										partment.
	FV hospital is a FDI establishment. This is one of the most modern and best-served hospitals in Vietnam at the moment. This is also the only one of interviewed medical organizations which is equipped best from the sorting stage to storing and treating medical solid waste. The author has had a very open face-to-face interview with two people in two different departments of the hospital. First, according to Ms. Nguyen Thi Huyen Chi, Head Nurse in Surgical Ward, the hospital presently contracts with CITENCO for transporting and treating medical solid waste. Monthly payment for dealing with medical solid waste is about €3300 (VND 100 million). However, if sorting waste at generating sources is carried out more properly, it is believed that this cost will be considerably decreased, she says. CITENCO is sometimes late for picking up waste from the hospital's store. This puts the hospital in certain difficulties, she assesses. Ms. Chi adds that before entering a contract with CITENCO, her organization co-operated with Holcim Vietnam Co. Ltd. to process medical solid waste. Holcim Vietnam is more professional than CITENCO, Ms. Chi evaluates. Nevertheless, it charges higher prices than CITENCO presently. Like other private medical facilities, this hospital also finances all its operations by itself. In her point of view, it seems to be better in terms of economy and environmental pollution control if the hospital equips a good waste treatment									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	system and treats such waste right in its space rather than deliver to another partner who is not responsible. Conversely, Ms. Sa, an environment expert of the hospital, shows prefers to sign a contract with an external partner for treating med-ical waste. She explains that 1. If the hospital treats such waste by itself, it seems to have to face bureaucracies and corruption from people of the DoNRE and Environment Police who are responsible for monitoring and inspecting the environmental issues, even when the hospital handles it well; 2. She worries about the space requirement for installation of an incinerator inside the hospital; 3. The quality of the incinerator in terms of air emission and smell control; 4. Services after sales of the supplier, especially when the incinerator has problems in operation; 5. Initial investment, operation and yearly maintenance costs are also other noteworthy issues. Finally, she makes a conclusion that her hospital will be persuaded unless a medical solid waste treatment solution supplier is able to help it solve the above worries. She shares that when the hospital wants to equip waste treatment equipment/system, it must prepare a complete project describing all matters relevant to the equipment/system, for instance specifications, origin, technology, etc. then submit the project to the city health department as well as DoNRE for approval in advance. After the project is approved, the hospital begins to invite tender proposals.									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	Before putting the new system in operation, it must be tested, commissioned and allowed by the DoNRE. About the purchase process of the hospital, she says that the technical department will be responsible for building up and recommending specifications of the equipment/system. Next, the purchase department will shop around to have an overview of prices. The financial department always cares about prices while the quality of product is taken into account by the management.									
51	Nhan Dan Gia Dinh hospital	Public city lev-el	HCMC	1400 ~ 1600 beds	Not re-vealed	Not revealed	Contract with CITENCO	400	Not re-vealed	The existing system has ca-pacity of 500 m3/24h, in op-eration from 1999.
	According to Ms. Huynh Ngo Cam Tu, staff in Administration department, she not allowed to reveal specific information about the amount of medical solid waste and wastewater generated by the hospital. However, when being asked her expectation to make the current medical waste management of the hospital better, she shares that the existing wastewater treatment system has problems with									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	high maintenance and operation costs, as well as sludge generation. In addition, the current capacity and technology of the system is under demand of the hospital, while the hospital does not have enough space for installing a new treatment system like the existing, she says.									
	In a open face-to-face with Mr. Phan Thanh Liem, staff in General Planning Unit, HCMC Health department, who is responsible for checking and monitoring the medical waste and wastewater management and treatment issues in healthcare establishments located in HCMC, he says that after a survey conducted by the combination between HCMC Health department and DoNRE, it is concluded that most of wastewater treatment system in hospitals in HCMC are in degradation and backward in terms of technology. There is the fact that these medical organizations try to use their existing wastewater treatment systems to deal with the authorities rather than to protect the environment. For that reason, HCMC Health department co-operates with Vietnam Academy of Science and Technology to conduct the project of "Medical Treatment for HCMC" during the period 2010-2011. The project aims to improve the quality of medical waste and wastewater treatment activities as part of the sustainable development policy of HCMC. This project is then sub-mitted to HCMC People's Committee for consideration and approval in terms of investment budget. Below information relevant to healthcare facilities under direct management of HCMC Health department is collected from the project provided by Mr. Liem.									

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	Notes: unit price/kg of solid waste is €0.4 (VND 12.000/kg) provided by Mr. Nguyen Thanh Da, Sales executive, CITENCO.									
52	HCMC Psychiatric hospital	Public city lev-el	HCMC	100 beds	5 kg/day	€60/ month	Contracts with CITENCO	N/A	N/A	A 120-m3/24h system under construction from the end of 2010
53	District 7 hospital	Public district level	HCMC	150 beds	10 kg/day	€120/ month	Contracts with CITENCO	N/A	N/A	The existing system is old and backward. A new 150-m3/24h system needed.
54	District 4	Public	HCMC	Existing:	60	€720/	Contracts with	N/A	N/A	Existing sys-

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	hospital	district level		100; Plan: 150	kg/day	month	CITENCO			tem: 30 m3/24h; Demand: 150 m3/24h
55	Binh Thanh dis-trict hos-pital	Public district level	HCMC	Existing: 100; Plan:150	30 kg/day	€360/ month	Contracts with CITENCO	N/A	N/A	Existing: 70 m3/24h; Demand: 150 m3/24h
56	District 8 hospital	Public district level	HCMC	Existing: 100; Plan: 200	30 kg/ day	€360/ month	Contracts with CITENCO	N/A	N/A	Existing: 80 m3/24h; Demand: 200 m3/24h
57	Tan Phu	Public	HCMC	8 beds	6	€72/	Contracts with	N/A	N/A	Not installed

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	district hospital	district level			kg/day	month	CITENCO			yet; Demand: a new 10 m3/24h one
58	Phu Nhuan district hospital	Public district level	HCMC	100 beds	46	€552/ month	Contracts with CITENCO	N/A	N/A	Existing sys-tem: 65 m3/24h; Demand: 100 m3/24h
59	District 5 hospital	Public district level	HCMC	100 beds	10 kg/day	€120/ month	Contracts with CITENCO	N/A	N/A	Not installed yet; Demand: a new 100 m3/24h one

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
60	An Nghia Clinic	Private district level	Can Gio dis-trict, HCMC	Existing: 20 beds; Plan: 50 beds	8 kg/day	N/A	Chuwastar incinera-tor supplied by AIC	N/A	N/A	Not installed yet; Demand: a new 50 m3/24h one
57	District 10 hospital	Public district level	HCMC	70 beds	25 kg/day	€300/ month	Contracts with CITENCO	N/A	N/A	The existing 50 m3/24h system is good in terms of quality of wastewater output; Demand: 100 m3/24h

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
58	District 1 hospital	Public district level	HCMC	92~100	100 kg/day	€1.200/ month	Contracts with CITENCO	N/A	N/A	Existing sys-tem: < 60 m3/24h and under stan-dards; Demand: 100 m3/24h
59	District 6 hospital	Public district level	HCMC	Now: 100; Plan: 200	100 kg/day	€1.200/ month	Contracts with CITENCO	N/A	N/A	A 200 m3/24h system in oper-ation from 2009.
60	District 11 hospital	Public district	HCMC	Now: 100; Plan: 200	38 kg/day	€456/ month	Contracts with CITENCO	N/A	N/A	N/A

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
		level								
61	Hooc Mon district hospital	Public district level	HCMC	Now: 550; Plan: 1000	110 kg/day	€1.320/ month	Contracts with CITENCO	N/A	N/A	The existing system: 200 m3/24h but old and not effec-tive; Demand: 1000 m3/24h
62	Tu Dzu Maternity hospital	Public city lev-el	HCMC	Now: 1200 beds; Plan: 1350 beds	120 kg/day	€1440/ month	Contracts with CITENCO	N/A	N/A	The existing system: 500 m3/24h since 1999; Demand: 1000

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
										m3/24h
63	Binh Dan 1 hospital	Public city lev-el	HCMC	450 beds	222 kg/day	€2664/ month	Contracts with CITENCO	N/A	N/A	The existing 500 m3/24h system operates well.
64	Nhiet Doi hospital	Public city lev-el	HCMC	550 beds	N/A	N/A	N/A	900 m3/24h	N/A	Existing sys-tem: biological tech., 500 m3/24h since 2003; Demand: 1000 m3/24h
65	Trung	Public	HCMC	600 beds	N/A	N/A	N/A	400	N/A	Existing sys-

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	Vuong Emergency hospital	city lev-el						m3/24h		tem: biological tech., 150 m3/24h since 1995; Demand: a new 600 m3/24h system
66	Thu Duc district general hospital	Public district level	HCMC	550 beds	N/A	N/A	N/A	200 m3/24h	N/A	Existing sys-tem: biological tech., 180 m3/24h since 2004; Demand: 250

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
										m3/24h
67	Sai Gon general hospital	Public city lev-el	HCMC	250 beds	N/A	N/A	N/A	330 m3/24h	N/A	Not installed yet. Demand: a new 250 m3/24h one
68	Cu Chi general hospital	Public district level	HCMC	1000 beds	N/A	N/A	N/A	300 m3/24h	N/A	Existing sys-tem: biological tech., 380 m3/24h since 1998; Demand: 500 m3/24h one

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
69	Dermatol-ogy hospital	Public city lev-el	HCMC	120 beds	N/A	N/A	N/A	250 m3/24h	N/A	Existing sys-tem: biological tech., 200 m3/24h since 1999; Demand: 300 m3/24h
70	Nursing & Rehabilita-tion hospit-al	Public city lev-el	HCMC	350 beds	N/A	N/A	N/A	400 m3/24h	N/A	Existing sys-tem: biological tech., 180 m3/24h; Demand: a new 800 m3/24h

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
										one
71	Hung Vuong hospital	Public city lev-el	HCMC	900 beds	N/A	N/A	N/A	430 m3/24h	N/A	Existing sys-tem: biological tech., 300 m3/24h since 1999; Demand: 600 m3/24h
72	Nhan Dan 115 hospit-al	Public city lev-el	HCMC	1000 beds	N/A	N/A	N/A	650 m3/24h	N/A	Existing sys-tem: biological tech., 180 m3/24h since 2003;

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
										Demand: 800 m3/24h
73	Nguyen Trai hos-pital	Public city lev-el	HCMC	800 beds	N/A	N/A	N/A	630 m3/24h	N/A	Existing sys-tem: biological tech., 400 m3/24h since 1998; Demand: 800 m3/24h
74	Nhi Dong 1 hospital	Public city lev-el	HCMC	1200 beds	N/A	N/A	N/A	500 m3/24h	N/A	Existing sys-tem: biological tech., 400 m3/24h since

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
										1995; Demand: 800 m3/24h
75	Nhi Dong 2 hospital	Public city lev-el	HCMC	1000 beds	N/A	N/A	N/A	200 m3/24h	N/A	Existing sys-tem: biological tech., 100 m3/24h since 1992; Demand: a new 800 m3/24h one
76	Pham Ngoc Thach hos-	Public city lev-	HCMC	750 beds	N/A	N/A	N/A	550 m3/24h	N/A	Existing sys-tem: biological

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	pital	el								tech., 400 m3/24h since 1998; Demand: 700 m3/24h
77	Ear Nose Throat hospital	Public city lev-el	HCMC	130 beds	N/A	N/A	N/A	130 m3/24h	N/A	Existing sys-tem: biological tech., 150 m3/24h since 2000; Demand: a new 200 m3/24h one

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
78	Heart hos-pital	Public city lev-el	HCMC	130 beds	N/A	N/A	N/A	130 m3/24h	N/A	Existing sys-tem: biological tech., 150 m3/24h since 2000; Demand: a new 200 m3/24h one
79	Hong Duc general hospital	Private district level	HCMC	30 beds	N/A	N/A	N/A	12 m3/24h	N/A	Not installed yet
80	Pho Quang general	Private district	HCMC	30 beds	N/A	N/A	N/A	35 m3/24h	N/A	Existing sys-tem: biological

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	hospital	level								tech., 35 m3/24h, but wastewater output under standards.
81	Van Hanh general hospital	Private district level	HCMC	150 beds	N/A	N/A	N/A	80 m3/24h	N/A	Existing sys-tem: biological tech., 80 m3/24h, but wastewater output under standards.
82	Gaya Viet-	Private	HCMC	35 beds	N/A	N/A	N/A	25	N/A	Existing sys-

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	nam- Ko-rea hospital	district level						m3/24h		tem: biological tech., 25 m3/24h, but wastewater output under standards.
83	Cao Thang Eyes hos-pital	Private district level	HCMC	21 beds	N/A	N/A	N/A	8 m3/24h	N/A	Existing sys-tem: biological tech., 5 m3/24h, and wastewater output under standards.
84	Vietnam –	Private	HCMC	21 beds	N/A	N/A	N/A	10	N/A	Existing sys-

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	Korea Eye hospital	district level						m3/24h		tem: biological tech., 5 m3/24h, and wastewater output under standards.
85	Hong Thai Maternity hospital	Private district level	HCMC	50 beds	N/A	N/A	N/A	30 m3/24h	N/A	Existing sys-tem: biological tech., 30 m3/24h, and wastewater output under standards.
86	Saigon	Private	HCMC	100	N/A	N/A	N/A	200	N/A	Existing sys-

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
	Interna-tional Ma-ternity hospital	city lev-el						m3/24h		tem: biological tech., 50 m3/24h, and wastewater output under standards.
87	ITO hos-pital 1	Private district level	HCMC	86	N/A	N/A	N/A	20 m3/24h	N/A	Existing sys-tem: biological tech., 20 m3/24h, and wastewater output under standards.

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
88	ITO hos-pital 2	Private district level	HCMC	10	N/A	N/A	N/A	10 m3/24h	N/A	Existing sys-tem: biological tech., 10 m3/24h, and wastewater output under standards.
89	Trieu An	Private city lev-el	HCMC	350 beds	N/A	N/A	N/A	250 m3/24h	N/A	Existing sys-tem: biological tech., 250 m3/24h, and wastewater output under

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
										standards.
	According to Mr. Duc, Head of Solid Waste Management unit, HCMC DoNRE, the issue of medical solid waste management in HCMC is quite good so far. The city government assigns CITENCO to collect and treat such waste. Before April 2011, CITENCO is under direct management of HCMC DoNRE. After that, however, it is managed by HCMC government. In order improve the capability of treatment process, as well as a backup plan for CITENCO, the city government invested a new 21-ton-centralized medical solid waste treatment unit in Dong Thanh area, Hooc Mon district. Budget for this project is from the ODA capital sponsored by Belgium. Regularly, CITENCO has to send HCMC DoNRE an environmental impact assessment report. In addition, healthcare facilities must also report their waste management status to HCMC DoNRE. Inspectors of DoNRE also come to check and evaluate the situation in these organizations. DoRNE is responsible for approving the design and technology of a healthcare facility when this one wants to install it.									
There are several common features found in all the state-owned healthcare facilities surveyed as follows: - All state-owned healthcare facilities cannot buy hospital waste treatment equipment themselves. This work must be done by city/provincial DoH;										

No.	Health establish-ment name	Sector & scale	Location	Quantity of beds (unit)	Medical solid waste			Medical wastewater		
					Genera-tion Kg/day	Treating payment - Eur/mont h	Current treat-ment solution	Genera-tion M3/24h	Treating payment - Eur/month	Current treat-ment technolo-gy
- All of them are end-users; - They expect and appreciate additional assistance outside because it takes so long time to receive investment of city/province DoH.										

Appendix 5 – QCNV 02:2008/BTNMT – National technical regulation on the emission of healthcare solid waste incinerator

Permissible limit for ingredients of the air emission from healthcare solid waste incinerator

Parameter	Chemistry formula	Unit	Permissible limit
Dirt		mg/Nm^3	115
Hydrofluoric acid	HF	mg/Nm^3	2
Hydrochloric acid	HCl	mg/Nm^3	100
Carbon monoxide	CO	mg/Nm^3	100
Nitrogen oxide	NOx	mg/Nm^3	250
Sulfur dioxide	SO_2	mg/Nm^3	300
Mercury	Hg	mg/Nm^3	0.55
Cadmium	Cd	mg/Nm^3	0.16
Lead	Pb	mg/Nm^3	1.2
Total dioxin or furan Dioxin Furan	 $C_{12}H_{8-n^*}Cl_{n^*}O_2$ $C_{12}H_{8-n^*}Cl_{n^*}O$	ng – TEG/Nm^3	2.3

Appendix 6 – TCVN 7380:2004 - Technical requirements on healthcare solid waste incinerator

No.	Item	Requirements description
1	Structure	- At least two burning chambers – primary and secondary ones. - The cover of the incinerator must be made of metal (or other equivalent material) which can work under the heating condition and the environmental condition. - The outside surface temperature of the cover is not over 50^{o}C. - The incinerator structure must be sealed to avoid leaking burning gases outside. - Working pressure inside the burning chamber must remain lower than the atmosphere pressure.
2	Working temperature	- Inside the primary chamber: >800^{o}C - Inside the secondary chamber: >1050^{o}C - Exhaust air at the end of the chimney: <250^{o}C
3	Noise	Lower than 85 dBA at a distance 1m from the noise source.
4	Burning ash	Mass percentage of flammable substances in burning ash must remain less than 0.5% of total burning ash mass.
5	Chimney	3m higher than the roof of the highest house at the distance of 40m from the incinerator; - In the case of having no such house, the height of the chimney must be at least 8m from the ground; - The velocity of exhaust air while working must be above 15 m/s.
6	Power supply	- Only the incinerator which is liquid fuel, or gas, or electricity-powered is allowed to use.
7	Operation control device	- Thermal control device for the primary and secondary chambers must work well during the operating period;

		- Thermal alarm device when the temperature of the primary chamber is lower than 1000^{o}C and over 1200^{o}C; - Device displays the safe condition to open the incinerator's door.
8	Ventilation	- Must be the kind of forced ventilation.

Appendix 7 – QCVN 28:2010/BTNMT – National technical regulation on healthcare wastewater

$$Cmax = C \times K$$

Where:

- C is the value of parameters and pollutants, provided in Table 1 below.
- K is the ratio that expresses scale and special functions of healthcare facility, provided in Table 2 below.
- For parameters such as pH, Total *coliforms, Salmonella, Shigella* and *Vibrio cholera* contained in medical wastewater, K = 1.

Table 1 – Permissible Value C for pollutants

No.	Parameter/Pollutants	Unit	Value of C	
			Level A	Level B
1	pH	-	6,5 – 8,5	6,5 – 8,5
2	BOD_5 (20^oC)	mg/l	30	50
3	COD	mg/l	50	100
4	TSS	mg/l	50	100
5	Sulfur (calculate in accordance with H_2S)	mg/l	1,0	4,0
6	Ammonia (calculate in accordance with Nitrogen)	mg/l	5	10
7	Nitrat (calculate in accordance with Nitrogen)	mg/l	30	50
8	Phosphat (calculate in accordance with Phospho)	mg/l	6	10
9	Gear or oil	mg/l	10	20
10	Total radiation level α	Bq/l	0,1	0,1
11	Total radiation level β	Bq/l	1,0	1,0
12	*Total coliforms*	MPN/	3000	5000

		100ml		
13	*Salmonella*	batteries/ 100 ml	Not found	Not found
14	*Shigella*	batteries/ 100 ml	Not found	Not found
15	*Vibrio cholera*	batteries/ 100 ml	Not found	Not found

Notes:

- Total radiation level α & β are only applied for healthcare facilities which use radiation sources.
- The value of C in column A is used to calculate the permissible value in the case the output wastewater is dischaged into water resources which are not used to sever domestic activities.
- The value of C in column B is used to calculate the permissible value in the case the output wastewater is dischaged into water resources severing domestic activities.
- The output wastewater is allowed to discharge into the common underground drainage system if the permissible value of pollutant is calculated following the value of C in column B.

Table 2 – Value of ratio K

Type	**Scale**	**K**
Hospitals	≥ 300 beds	1.0
	< 300 beds	1.2
Other		1.2

Appendix 8 – List of contact persons

No	Name	Contact address
1	Doctor Trung	Chief of Infection control faculty, Da Nang general hospital, Da Nang city. Tel: +84 905492189
2	Ms. Phan Thi Nu	Chief of Environment Technology Department, DNURENCO, Da Nang city. phanthinu@gmail.com Tel: +84 903555662
3	Mr. Hoang	Technology and Environment Assistant Manager, Da Nang city DoNRE, Da Nang city. Tel: +84 913401050
4	Mr. Van Tien Ha	Director of Hoi An Center, UNESCO Vietnam Center of Information, Quang Nam province. unescovnvanha@gmail.com Tel: +84 909398150
5	Mr. Do The Dan	Head of Administration Department, Pacific hospital, Hoi An town, Quang Nam province. Tel: +84 905061506
6	Mr. Pham Van Tai	Assistant Head of Administration Organization Unit, Hoi An hospital, Quang Nam province. Tel: +84 906 556 476
7	Mr. Nguyen Anh Tuan	Administration staff, Quang Nam province general hospital, Quang Nam province. Tel: +84 905001839
8	Mr. Thai	Medical Equipment and Materials unit, Quang Ngai province general hospital, Quang Ngai province. Tel: +84 974026196
9	Mr. Bao	Incinerator and wastewater treatment system operator, Quang Ngai province general hospital, Quang Ngai province.

10	Mr. Trang Nguyen Vu	Chief of Infection Control faculty, Binh Dinh Psychiatric hospital, Binh Dinh province. Tel: +84 986250599
11	Mr. Nguyen Sy Dung	Chief of Infection Control faculty, Binh Dinh Tuberculosis & Cancer hospital, Binh Dinh province. Nguyensydung1972@yahoo.com.vn
12	Mr. Truong Van Ky	Deputy Director, Tuy Phuoc district general hospital, Binh Dinh province. Tel: +84 905340992
13	Ms. Dieu	Sales Executive, Binh Dinh URENCO, Binh Dinh province. Tel: +84 905320238
14	Mr. Hau	Inspector, Gia Lai province DoST, Gia Lai province. Tel: +84 985026454
15	Ms. Huong	Deputy Director of Gia Lai province DoNRE, Gia Lai province. Tel: +84 905327567
16	Mr. Nguyen Ba Ly	Chief of Administration Office, Pleiku city general hospital, Gia Lai province.
17	Mr. Truong	Chief of Administration Office, Gia Lai Traditional Medicine hospital, Gia Lai province.
18	Ms. My	Nurse, Gia Lai Traditional Medicine hospital, Gia Lai province. Tel: +84 905990203
19	Mr. Y Luar Nie	Head of Administration Organization Office, Buon Ho town general hospital, Dak Lak province. Tel: +84 1663244288
20	Doctor Nguyen Van Hung	Chief of General Planning Department, Dak Lak province general hospital, Dak Lak province. Tel: +84 913493522
21	Mr. Nguyen Huu Huyen	Chief of Planning Department, Dak Lak province DoH, Dak Lak province. huyennguyenhuu@gmail.com

		Tel: +84 913454915
22	Dr. Pham Van Hau	Institute of Hygine and Epidemiology of Tay Nguyen, Dak Lak province. pvhau@vnn.vn
23	Mr. Thai Duc Thuan Phong	Chief of nurse, An Giang Cardio Vascular hospital, An Giang province. Tel: +84 918277357
24	Mr. Phung Phuoc Nguyen	Chief of Planning Department, Phong Dien Genral hospital, Can Tho city. Tel: +84 949957277
25	Mr. Nguyen Hong Tam	Chief of Infection control faculty, Can Tho city General hospital, Can Tho city. Tel: +84 1223499800
26	Ms. Tran Hong Liet	Nurse, Hoa Binh district general hospital, Bac Lieu province
27	Mr. Bay	Incinerator operator, Bac Lieu Province General hospital, Bac Lieu province.
28	Mr. Huynh Vu Phong	Head of Office, Bac Lieu province DoH, Bac Lieu province
29	Mr. Giao	Inspector, Bac Lieu province DoH
30	Mr. Khuu Le	Deputy Director, Bac Lieu province DoNRE
31	Mr. Hien	Legal specialist, Bac Lieu province People's committee
32	Doctor Nguyen Thanh Hai	Chief of Infection control faculty, Thong Nhat general hospital, Dong Nai province. Nguyenthanhhai119@yahoo.com.vn Tel: +84 913610602
33	Ms. Mai Thi Tiet	Chief of Infection control faculty, Dong Nai general hospital, Dong Nai province. Tel: +84 918805663
34	Mr. Truong Anh Dung	Chief of Infection control faculty, Nhon Trach district general hospital, Dong Nai province. Tel: +84 916896433

35	Ms. Ho Thi Minh Thao	staff in Infection Control faculty, Long Thanh district general hospital, Dong Nai province. cotranhtt@yahoo.com
36	Ms. Ve Thi Song An	Chief of Infection Control faculty, Trang Bom district general hospital, Dong Nai province. Vethisongan_69@yahoo.com
37	Ms. Tran Thi Ngoc Khanh	Staff in Infection Control faculty, Long Dien General hospital, Ba Ria-Vung Tau province. Tel: +84 906726732
38	Mr. Doan Anh Khan	Head of Administration and Organization Unit, Tan Thanh district general hospital, Ba Ria – Vung Tau province. Tel: +84 945339464
39	Ms. Tran Thi Hon	Chief of Nurse, Inflection Control faculty, Ba Ria general hospital, Ba Ria – Vung Tau province.
40	Mr. Ho Duc Tuong	Head of Administration Department, Le Loi general hospital, Ba Ria – Vung Tau province. hoductuongbvll@yahoo.com.vn Tel: +84 977739479
41	Ms. Tran Thi Nhan	Staff in Administration Organization unit, Vung Tau city medical services center, Ba Ria – Vung Tau province. Tel: +84 919935881
42	Ms. Huynh Ngo Cam Tu	Staff in Administration department, Nhan Dan Gia Dinh hospital, HCMC. Tiny_hlt@yahoo.com
43	Mr. Do Dinh Trieu	Chief of Nurse, An Khang clinic, HCMC. ddtrieu@akclinic.com.vn Tel: +84 902111115
44	Mr. Luong Tam Phuc	Administration staff, District 2 general hospital, HCMC.
45	Mr. Le Long Binh	Administration staff, Can Gio district general hospital, HCMC.

		Thuytien7464@yahoo.com.vn
46	Ms. Nguyen Thi Huyen Chi	Chief of Nurse, Surgical Ward, France-Vietnam hospital, HCMC. Chi.nguyen@fvhospital.com Tel: +84 958825808
47	Doctor Phan Thi Kim Cuc	Deputy Director, District 10 general hospital, HCMC Tel: +84 913666968
48	Mr. Phan Thanh Liem	Staff in General Planning department, HCMC DoH, HCMC liemphankts@gmail.com Tel: +84 908155422
49	Mr. Duc	Solid waste manager, HCMC DoNRE, HCMC Tel: +84 93684844
50	Mr. Nguyen Thanh Da	Sales executive, CITENCO, HCMC Thanhda-pkd@citenco.com.vn Tel: 84+ 985666671
51	Mr. Dang Van Huyen	Sales executive, VINASECO, Hanoi city vinaseco@gmail.com Tel: +84 973288277
52	Mr. Nguyen Dang Khoa	Sales Manager, Goldsun company, HCMC Tel: +84 918040230