Designing a Business Model for SMEs Global Expansion: The Case of WET in Hong Kong

LEUNG, Wai On

DProf (SME Internationalisation Models)

2020

Summary

Based on findings from Waste and Environmental Technologies Ltd. (WET) where I worked as director, this report demonstrates how WET as a Hong Kong-based small-medium enterprise (SME) succeeded to expand globally and build its international presence by establishing satellite operations, wherever the opportunity arises. It addresses internationalisation of expertise and technology by looking into the development of a patented invention, namely the WetSep system, to meet the needs of customers worldwide, supported by case studies of its success and failures in entering new markets.

The major focus of the whole report can be categorised into four phases, namely review of existing business model and marketing strategy; case studies in Hong Kong, Australia and selected other countries from WET's twenty years of operation; analysis of the case studies; and development of a future internationalisation strategy. I provided a detailed analysis of the business model and marketing strategy adopted for the long-term internationalisation for WET. My findings are that the 4 Is – Innovation (uniqueness and creative product of the business), Incubation, Intellectual Property and Integration (of technology) – are crucial in promoting the success of SMEs in internationalisation and business operation. Once a new idea is raised, the company should provide facilities and a good system to incubate and create solid ground for the development of the new idea. Moreover, key resources, key activities, key partners and market characteristics are important attributes for internationalisation. WET had been benefited from International Soft Landing Programme in Sydney Australia where WET's 4 Is principle was well acknowledged for entering the programme.

To conclude, I recommend that other SMEs follow the 4 Is principle when planning to expand their business internationally and always be open to changes. This Research Project Report hopes to prompt other SMEs to adopt a similar business approach based on WET's 4 Is principle and internationalisation strategy.

Table of Contents

List of Figures

List of Tables

List of Appendices

1. Introduction

"Wastewater is a global problem. Today, around 80% of all wastewater is discharged untreated into the world's waterways where it creates health, environmental and climate-related hazards. Urbanization further exacerbates this challenge with increasing wastewater generation, while at the same time using more of Earth's dwindling resources" (The International Water Association, 2018).

In this chapter, I will introduce my research, which is focused on reporting on a comprehensive structured marketing and business development strategy for a local business to become global, and how Waste and Environmental Technologies Limited (WET) builds its international presence by establishing satellite operations wherever the opportunity arises.

In particular, I will demonstrate the feasibility for WET as an environmental technologies 'Small and Medium-sized Enterprise' (SME), and the method to grow my business by building a roadmap that emphasises the use of 4 Is, namely innovation (uniqueness and creative product of the business), incubation, intellectual property and integration.

In 2016 and 2017, Hong Kong ranked first out of sixty-three economies based on four indicators: economic performance, government efficiency, business efficiency and infrastructure (South China Morning Post, 2017). In the same article, the financial secretary, Paul Chan Mo-Po said that the report was a "clear recognition" of Hong Kong's "favourable business environment and robust financial system." It is evident from this article that Hong Kong is a good city to establish a business in due to the support from the government and financial institutions. Although, this study pertains to recent data, Hong Kong has maintained a competitive position in the past as well. It has maintained a position among the top three of this index since 2003.

Chinese University academic Terence Chong Tai-Leung has commented that if the rankings placed more weight on business costs and political climate, then Hong Kong might not be as competitive as indicated in its ranking suggests (South China Morning Post, 2017). Thus, taking these aspects into account, it is evident that Hong Kong experiences a lot of competition challenges.

A Hong Kong citizen myself, setting up a business in Hong Kong was a relatively easier alternative from the business and personal perspective. However, given the high level of competition, sustaining the business has been difficult. Admitting water shortage is a global issue, this motivated me to develop a robust, competitive solution to the wastewater problems of the local market. The logic behind is that a product which can successfully compete in the local Hong Kong market, would have the ability to compete all around the world.

1.1 WET

Coming primarily from the technical and engineering field, establishing WET as a global pioneer for environmental technologies was a challenge at first. However, besides other factors, my curiosity and enthusiasm for knowledge and a good challenge have helped me overcome various obstacles.

This research is focused in reporting on the development of a comprehensive structured marketing and business development strategy for establishing an international business model through satellite operations approach for WET, an environmental technologies SME.[1] Not only does it leverage on the role of technology, the example of WET demonstrates the feasibility for an SME to formulate and execute a global business strategy for its internationalisation based on its technological innovations. This process reveals a series of challenges faced with primary focus on the importance to protect intellectual copyright via obtaining a patent, in order to ensure its sustainability. All companies going global need to safeguard their ownership advantages, such as through technology (Dunning & Lundan, 2008). However, for the SMEs, this is an even more important condition, since technological advances require financial resources not only for developing new technologies but also for securing them (i.e. to cover the costs for patent applications) such are not always disposable to SMEs compared to large, multinational enterprises (MNES) (Czamitzki & Delanote, 2015; Signore, 2020). In 1982, I established my own company called Leung's Engineering. The transformation from Leung's Engineering to Waste and Environmental Technologies Limited. To briefly describe the opportunity, there was

[1] Small – medium sized enterprises (SMEs) in Hong Kong refers to manufacturing enterprises with fewer than 100 employees and for non-manufacturing enterprises with fewer than 50 employees (Support and Consultation Centre for SMEs- Trade and Industry Department, 2017).

a problem and I received an order from a client to solve it. My initial proposal to solve the problem failed, as a result I had to develop something new to meet the requirements of the client within a short span of time to maintain my professional reputation. That was when I came up with the WetSep system, a water filtration system.

WetSep provides technology-based solutions to a wide range of environmental problems, such as purification of water from construction and factories or more specifically decommissioning of fuel lines at airports. Besides the WetSep, we dealt in anaerobic water treatment systems, renewable energies, green rooftop and other environmental technologies.

1.2 Internationalisation

The purpose behind transitioning from Leung's Engineering to WET in 1998 was because I realised the importance of specialised proprietary characteristics, namely innovation and an attractive brand name, as well as role of culture and language, as a requirement for internationalisation.

The growth focus of WET is to develop an international presence by establishing satellite operations wherever the opportunity arises. Some of the targeted markets include Canada, Singapore and Thailand but are not limited to these countries. These countries are very different in economic, political, institutional and labour factors. Hence, it will be important to consider this in the case selection process. As such, a structured global business model that includes operational requirements and marketing strategy is required to advance operations overseas.

Although WET has completed multiple one-off projects in international markets due to the great demand for WetSep's innovative and appropriate technology, I hope to take the company one step further and establish long-term operations. Having been recognised for my previous projects, clients from around the world continue to call and enlist my services. This acts as an upward spiral where, as the number of projects we work on increases, the recognition and demand for WetSep increases. As a result, it is only natural to take WET to the next level and setup more customised international operations to better and more promptly satisfy the needs of our customers worldwide.

To safeguard my innovation from competition, I targeted the short-term patent in Hong Kong and eventually applied for the patent grant offered by the Government of Hong Kong. With the grant, through an implementation agent, I patented the WetSep as a "Wastewater Treatment Chamber" in Hong Kong in 1999. Besides excluding competition, the patent acted as a recognition of the claimed technology, hence I patented it as a "Vortex Sewage Disposal Apparatus" in Australia, Japan, United Stated of America, Canada, Taiwan, France, Germany, Sweden and United Kingdom. This enabled me to sell abroad as and when an opportunity arose. My strategy to obtain patents for the innovation of WetSep across the globe demonstrates my business approach for WET, which is to transform it into a 'born-global' firm.[2]

My entrepreneurial capabilities increased as the company grew. At times, I made mistakes and the company suffered but was often rescued by my technical expertise. A major learning through the years has been to constantly evaluate my business decisions and continue to recalibrate the business model (see Section 1.4 Approach to Knowledge).

1.3 Global Business Strategy and Stakeholder Relations

As with any growth strategy, both the business model and marketing strategy are important components for the expansion and sustainable operation of a business. There are many differences between setting up the initial head office in Hong Kong and starting operations overseas. For example, local laws and regulations, customs and marketplace first need to be evaluated on a structured basis to evaluate the feasibility of a viable business in the overseas location. To mitigate the risks involved, detailed evaluation criteria will be developed to identify the most important parameters that would have the greatest impact and/or effect on the success of both the overseas operation and the overall business.

The primary stakeholders for this research project are myself and the company-WET. The research outcomes will be used by WET for expansion to international markets through rental and sale of the newly-patented WetSep system. The completed business model and marketing strategy will be implemented company-wide once

[2] A born-global firm is defined as "a business organisation that, from inception, seeks to derive significant competitive advantage from the use of resources and the sale of outputs in multiple countries." (AMD Law Group, 2012)

reviewed and approved by senior management with input from staff at lead positions in the international operations. Once the plan and strategy have been approved, proper training and implementation planning will be started to best determine which company resources will be acquired and implemented.

It is important that the final plan is comprehensive and refined, making it easy to understand and to implement for the staff involved. The objective of this report is to analyse past experiences, looking into the reasons for failures and successes and accordingly evaluate future opportunities that have or might arise to internationalise WET. Such a study would help me as the managing director/CEO to better focus my limited resources, namely time and money, towards the more probable opportunities that arise.

Other stakeholders involved in this research will be professionals[3] that I plan to garner insights from for the development of a plan and strategy, specifically through the lens of an SME. Their insight is essential to provide professional opinions and I hope to gather some practical knowledge as to what has been successful in their experiences. Furthermore, I will be able to guide the development of WET's own plan and strategy.

Finally, the other major group of stakeholders will be the final end-user (clients) of the WetSep system. To produce a sound business plan and marketing strategy, the needs and requirements of WET's customers are essential to a profitable and successful expansion. Through the course of this research, I have been conducting interviews with current and previous overseas clients to see what services and products they would like to see in an overseas office.

Additionally, inputs in the form of current code of designs and safety from industry associations and government departments in other countries will give some insight to what is required to meet the marketplace's needs. The feedback gained from this exercise will benefit not only on the development of the marketing strategy but also may provide technical insight to improve the WetSep System.

[3] Professionals here refers to Professor Powpaka Samart from the Chinese University of Hong Kong who provided insight into garnering feedback from current customers to understand current problems, my friends Mr. Aloysius Lee and Mr. Phillip Miu.

For each geographical location, a methodology to analyse the current marketplace will need to be developed and completed. From this analysis, the general global marketing strategy can be refined to meet the local requirements for a successful marketing plan. The resulting business model and marketing strategy will be used to expand WET's operations internationally.

1.4 Approach to Knowledge

To gain some insight into the decisions made through the years, this section will elaborate on my values as well as my approach to knowledge with respect to innovation and business supported with real life practices.

One of the key philosophies is that one should not only be taking opportunities but also giving opportunities to others. The two must be in balance as they are interlinked. If one does not give opportunities, then one will not get any opportunities. For example, at WET, I give opportunities by hiring young engineering graduates on a regular basis. By giving this opportunity, I take the opportunity of obtaining the latest academic findings, connections to universities and cheaper labour. On the other hand, if one does not take opportunities then one cannot give any. I was given the opportunity to serve in the crew of the Fri schooner in 1976. Despite being warned by family and friends of the perils of such a journey, I wanted to grasp the opportunity and make the best of it. Back then, little did I know that the connections I made in the Pacific Islands of Papua New Guinea, Fiji and Australia, would give WET more opportunities to sell our products in 2017. This is my main ideology in terms of hiring processes at WET.

Applying 3P's and 3R's to Leverage on Technology

Being in the competitive environmental technologies industry and in an era where research is crucial for sustenance, innovation has become a necessity for survival. At WET, besides hiring new staff to share ideas with, I believe in staying up-to-date with upcoming technologies. In the environmental engineering field, the 3R's - Reduce, Reuse and Recycle is a popular approach (Periathamby, Hamid, & Khidzir 2009; Tam & Tam, 2006). However, at WET, the 3P's are of greater importance when considering new technologies. 3P's stands for Pollutant into Products and Profits (Letmathe & Balakrishnan, 2005). Hence, a technology is of interest only if it treats some pollutants to obtain a usable or reusable product which can generate profits. For

example, electrocoagulation is the technology where electricity is passed through creating ions, destabilising suspended solids, enhancing the coagulation process and finally polishing the wastewater. By utilising this technology, the WetSep can treat more pollutants without using high concentrations of chemicals. When heavy amount of chemical is used, by-products such as fertiliser from treated animal waste cannot be used due to risk of pollution and further contamination. By promoting electrocoagulation, the end-product can be sold as a fertiliser, a product that generates profits.

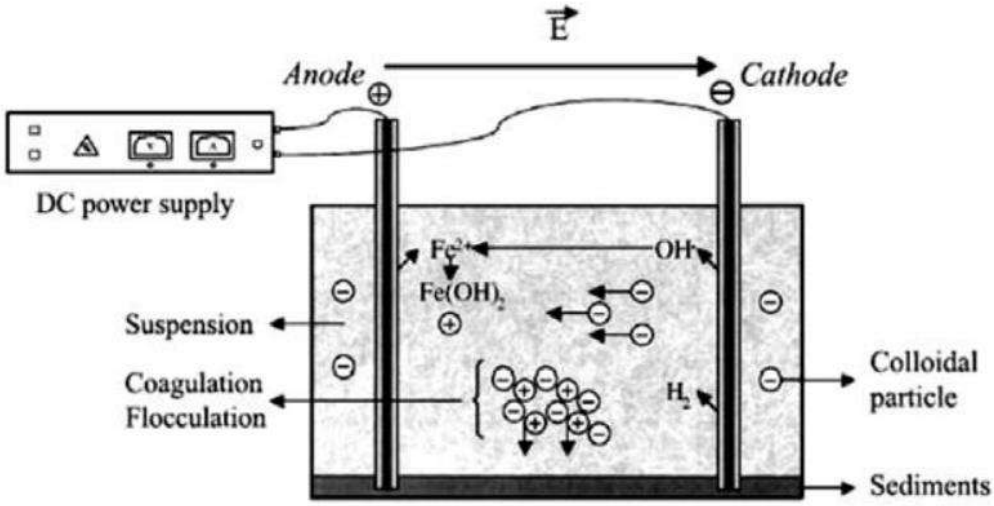


Figure 1 Principle of Electrocoagulation Process
(Source: Ultrapure Water 2008)

The 3P approach has been a successful approach in my perspective as it is driven by an underlying profit motive. In the real world where businesses are driven by profit, it is important to provide profit incentive by either reducing cost or increasing profits. In the Middle East, fracking is used to obtain oil. This process used to be known as a dangerous process as it involved injecting chemicals in the soil to increase the pressure underground to push the oil out. The chemicals had potential to seep through cracks and pollute the underground water sources. Over the years, new chemical wastewater treatments have been developed by other environmental engineering companies. These companies encouraged the oil companies to transmit the water for treatment and later the processed water was used for irrigation purposes, turning oil fields into bushes. The negative image of oil companies was restored to a more positive image through this venture.

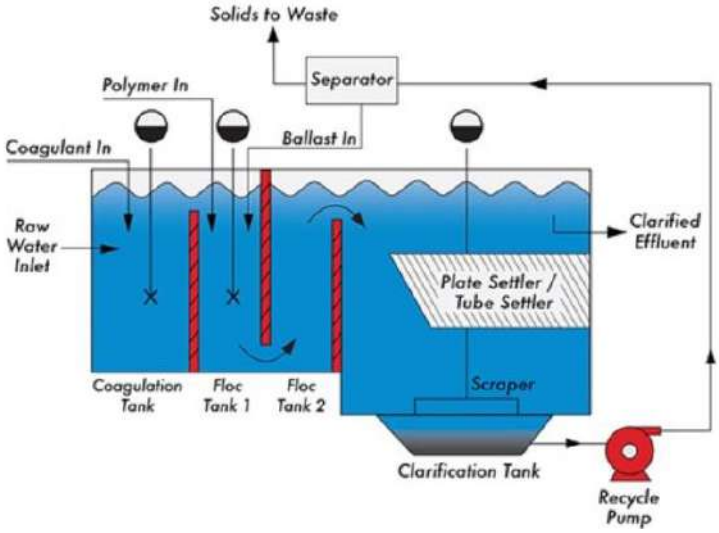


Figure 2 Frac Water Reuse Treatment System
(Source: Anguil Environmental 2020)

Another important lesson has been that an idea need not always originate from new knowledge, it could simply be through integration of innovation and that requires some level of imagination and experience. Most say, think outside the box, but from my experience, thinking inside the box works better at times. Thinking inside the box does not mean limiting yourself, it simply means to focus on your own creation and finding ways to improve what you already have instead of starting from scratch on a new technology. I find the Japanese temple knot to be representative of this concept. The knot is extremely precise and must be worked on continuously without adding anything new, to make it better.

Figure 3 Japanese Temple Knot
(Source: Krause, 2020)

Another disciple of ‘thinking inside the box’ and former CEO of Walmart, Sam Walton, once said: "The key to success is to get out into the store and listen to what the associates have to say. It's terribly important for everyone to get involved. Our best ideas come from clerks and stock boys." (Rohlander, 2014:163). He too knew that it is better to observe the problems within the stores and improve on those before implementing new ideas from outside. I have often accepted challenging projects as it requires creativity and research into improving what we already have. For example, we are currently working on a project in Mexico where the input was not construction wastewater but dye water. The client also had different specifications for the treated wastewater. Hence, we modified our model, to fit those requirements and have learnt the added advantages of using this design. It has also opened up a different industry to leverage the system over.

From the business perspective, most small-medium enterprise owners are well experienced tradesmen, engineers and professionals but not necessarily good at being chief executive officers. It can be explained in terms of the chain of command on a ship. While there are many engineers and officers on board, only one of them has the ability and skills to be the coxswain. With my engineering background, I faced the same problem. In the 1980's, I met an Italian businessman who told me that a successful business is one that can sell by tomorrow. To sell by tomorrow, the company must keep goodwill with shareholders and customers, maintain clear books and be willing to handover always. The company must also keep the business interesting to ensure repeatable sales. Traditionally, managerial skills have always been a challenge for expansion of SMEs. This increases the importance of continual innovation and improvements for environmental SMEs like WET.

1.4.1 Professional Context

As mentioned earlier, most of my professional work and experience lies in the technical and engineering fields. Over the course of my career, I have worked on many projects that have required primarily technical solutions to complete the project. This technical expertise acquired during the course of my career has allowed my growth as a professional engineer. During my career, I have had the chance to do something that very few people have done; that is, design a product, apply and receive a patent for my design and finally bring the product to be successfully sold into the marketplace.

Learning from my mistakes and success in design and operation of the WetSep as well as running WET and marketing for the first generation of the WetSep system has respectively helped me advance my technical skills and business skills.

As I reflect on my own professional practice, I feel that the area that requires further development is my business skills. As an entrepreneur and Managing Director for WET, I have been able to develop practical business-related skills related to day-to-day operations such as but not limited to: business development, finances, human resources, marketing and overall management. I have had little or no formal training in the study of business, therefore, I have been able to develop my own business model that have worked reasonably well for WET. As I undertake the development and product delivery to the marketplace for the second Generation WetSep system, the project goal is to develop a more structured business model to be used in the international business that applies not only to my company and for WET's expansion to many overseas markets, but also share my knowledge to help other similar small to medium enterprises (SMEs) businesses to flourish.

WET is an SME with less than twenty (20) employees. There is a need to develop a strategy that can be used with minimal staff and minimal use of resources to maximise the business. I would like to understand what business models and strategies are available that are being used by other SME's, specifically in the engineering and environmental fields. This research project report is a conclusion to my learnings and findings through the years which I am sharing to benefit others who might be in a similar position as myself.

As the Managing Director of WET, I am the primary contact for many of the projects that WET has done recently and in the past for the WetSep system since 1998. In my experience, it has been a challenge to local and international market. It is intended that the outcome is to arrive at an easy and systematic approach to delegate more operational responsibilities to local staff working in the overseas market, such as set-up will offer a useful blueprint for other SMEs to maintain viable overseas operations.

1.4.2 Organisational Context

WET is an environmental company in Hong Kong that provides solutions for environmental issues with innovation in mind. WET can integrate different kinds of technologies to provide a comprehensive solution for the treatment of wastewater and other environmental issues. For example, the WetSep system and aerobic wastewater treatment system (AWTS) have been successfully used for the treatment of construction wastewater and sewage wastewater respectively. Both systems can also be integrated with renewable energy such as solar and/or wind energy to provide an "off the grid" treatment system for clients.

Table 1 Characteristics of WET

History	Started in 1998
Main Products	WetSep (10, 20, 60, 80), Anaerobic Wastewater Treatment Systems (AWTS).
Countries	17
Employees	20 employees
Application	Landfill Leachate, Municipal Wastewater, Bentonite and Sludge Slurry, Deep Cement Mixing Wastewater, Wash Bay Collection Sump, Tunnelling and Excavation Works Wastewater and Construction Wastewater.

(Source: Author, 2018)

Figure 4 Diverse Offerings Worldwide
(Source: Author, 2018)

With only 20 employees in total **(See Appendix I Organisational Structure)**, WET is a small company that has limited financial and human resources. Out of this team, three of them are stationed in China managing manufacturing operations. Besides this small team, I often seek help from my old connections—Mr. Michael Lee and Mr. Phillip Liu—to follow up on potential opportunities in Canada and Australia respectively. They are close friends of mine who work as separate entities in helping WET.

In 2017 alone, WET manufactured and exported 20 WetSep units to some of our targeted marketplaces Australia, Canada, Thailand and some through cold calls like United States and Malaysia.

This number can be compared to our local sales of 40 units and local rental of 40 units. Thus, a total of 100 units were manufactured and brought to market in 2017 alone.

Overall, the number of WetSep units demanded per month can range from 10 to 20 and annually a minimum of 100 units are demanded. It is worth mentioning that we have only three manufacturers who help produce the units. We have kept this number low as we do not want our design to be shown to many factories as that could lead to duplication. Unfortunately, as a result, the supply often varies; hence I started

a rental system and stored some WetSep units to contract against good deals that arise. By storing and lending my units for short term rentals, I am not only allowing for WetSep to be used on smaller projects, hence catering different customers; but also ensuring to have stock available at hand for my clients in case of emergencies.

Table 2 Different Models of WetSep

	WetSep 10	WetSep 20	WetSep 60	WetSep 80
Length	2290 mm	2991 mm	6058 mm	7058 mm
Width	1910 mm	2438 mm	2438 mm	2438 mm
Height	2230 mm	2591 mm	2591 mm	2891 mm
Net Weight	1500 kg	1750 kg	6000 kg	7000 kg
Capacity	10 m3/h	20 m3/h	60 m3/h	80 m3/h

This lending model has been successful in Hong Kong. I had also tried it in Australia but faced some issues with copyright infringement as explained in later section. By learning from experiences like that, I hope to be able to come up with a better and more robust internationalisation strategy.

This research is an opportunity for WET to develop a comprehensive business plan that is suited for an SME of a similar size. The resulting research will allow the limited resources available for overseas operations to be used to its fullest potential to get the financial return. It will also allow for the expansion of resources and labour in time.

Additionally, due to WET's diversification of products and services currently offered to the local market, a large portion of the available resources are required to maintain the local business leaving few resources available for the overseas market.

Table 3 Background of Clients in 2017

Market	Geography	Business Activity	Client Type
Hong Kong	Metropolitan	• Selling and lending individual models • Selling packaged water treatment solutions.	• Government Departments • Private Construction Companies • Public Construction Companies
Australia - Sydney - Melbourne	Metropolitan	• Selling individual models • Selling packaged water treatment solutions.	• Private Construction Companies
Thailand	Remote	• Selling individual unit and partnered through Memorandum of Understanding (MoU)	• Research Institute
United States	Metropolitan	• Lending individual units	• Remediation Company
Malaysia	Remote	• Selling Individual Units	• Public Construction Company
Canada	Metropolitan	• Selling Individual Units	• Private Environmental Company

(Source: Author, 2018)

Expansion of the WetSep business overseas will also provide other benefits to the company. The staff at WET will be able to interact more with international client's and learn more about international requirements and standards that can be used to improve the WetSep system. Initially, the majority of the staff has little or no

international experience. Moreover, the skillset of the staff is mostly technical (i.e. skilled workers, technicians and engineers) with minimal business training and experience.

The resulting strategy and plan will be used to help grow the WetSep system business in other countries where we have existing clients and a presence for the second generation systems. WetSep system has been identified as best-suited for the overseas market.

Classified as an "Effluent Treatment Plant" under the category of manufacture. The WetSep is indexed as 29240 by the United Kingdom Standard Industrial Classification of Economic Activities 2007 (UK SIC 2007). The Aerated Wastewater treatment system can be classified as "Sewage Treatment Plant "under the same category and index.

1.5 Project Aims and Objectives

The overall project aim of this research is for me, as the CEO of WET, to develop a global business model and strategy to market the new WetSep Modular systems and set up operations in countries with conducive environments for WET. The successful implementation of WET's business model could help other innovating SMEs aiming to go global and face similar challenges, using WET as a blueprint for their expansion. The outcome of the research will require the business model to be structured and detailed to ensure: the ease of entry into the new market by adopting standardised steps in evaluating the needs of the new market, and as a result establish the sustainable development of WET as the best wastewater treatment system in the industry. However, the strategy will have to remain flexible to accommodate local factors such as culture, financial aspects and regulatory requirements to position themselves comfortably in the new environment. Since SMEs such as WET have limited resources, the business model will need to be simple and focused while generating the maximum business return (i.e. sales and profit). At the same time, for this research project in particular, it will be to discuss a new structure of business model that can be applied by other SMEs.[4]

[4] Description of the innovation and its development can be found on page 117.

In shaping a business approach for WET, I adopt a roadmap that emphasises the use of 4 Is, namely innovation (uniqueness and creative product of the business), incubation (where support for new technologies is provided), intellectual property (a necessary condition to safeguard technologies developed) and integration (of new developed technologies in the operations of the company). With the 4Is, internationalisation (the 5th I) becomes feasible, faster and sustainable.

For an in-depth exploration, there are 4 types of innovation, namely the incremental innovation (introducing new features by adding it into existing products using existing technologies), disruptive innovation (bringing new technologies to the company's existing market), architectural innovation (taking the original lessons, skills and technologies to a new market), and radical innovation (giving birth to revolutionary technologies by taking over the existing one). These innovative measures illustrate the various ways the company can innovate (Lopez, 2015). There should be more ways to innovate other than these four approaches, but these factors are what that suit my company's growth and development.

Intellectual property refers to the creation of the mind, such as innovation, literary and artistic works, and symbols, names and images used in commerce (World Intellectual Property Organization, 2003). I have worked with four main types of intellectual property protection for my business:

- Patents: Granting the property rights on an invention, allowing my company to exclude others from making, selling or using the invention.

- Trademarks: A distinctive sign that identifies certain goods or services provided by my company.

- Trade Secret: Rights on confidential information, commercially valuable information that may be sold or licensed by my company.

- Copyright: Granting the exclusive right to use or authorize others to use the work on agreed terms of my company literary and artistic creations.

Incubations expanded in the 80's and spread to the UK and Europe through various related forms and came late to Hong Kong by early 2000. It would not be easy for an SME to survive at a start-up and early stage even with innovation and intellectual properties, especially technology-oriented companies like WET.

Incubation activity has raising interest for financial support from organizations such as UNIDO and the World Bank. My company could be the first batch of companies that got invited to join the programme in Hong Kong Science Park back in 2000. The four main benefits that incubation offer include support to plan, launch, manage and grow my business.

Integration is the merging of the three key factors (Innovation, Intellectual Property and Incubation) with external resources and opportunities. Many successful business cases in the Western world are different from that in Asia. Recruitment of talented people with critical thinking from good education, such as those from abroad, and recruitment of trustworthy people who are well-connected ('Guanxi'[5]) account for the competitive edge.

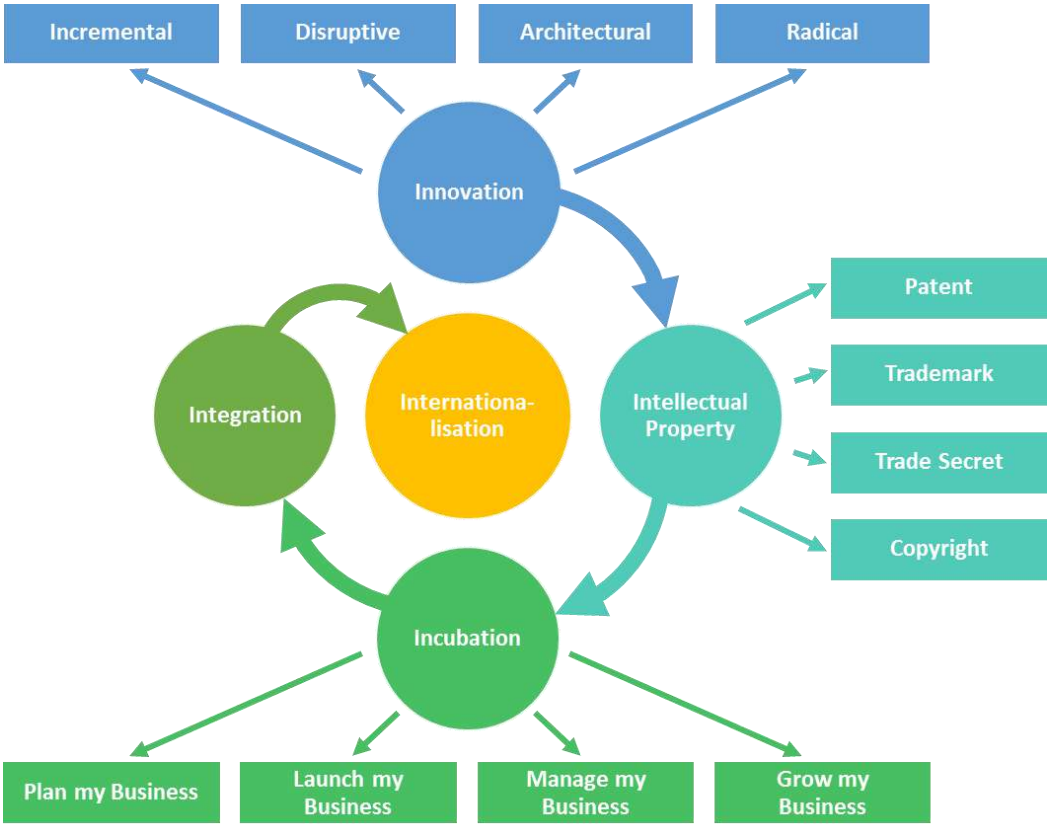


Figure 5 Roadmap Derived from 4 Is

To meet the project aims, various research tasks will be delivered. The overall objectives of this research are as follows:

[5] Guanxi (pronounced gwon-she) is a Chinese term meaning "networks" or "connections" that open doors for new business and facilitate deals. A person who has a lot of guanxi will be in a better position to generate business than someone who lacks it. Generally an acknowledged fact, it is particularly true in China that the wheels of business are lubricated with guanxi.

a) Review the literature for existing business models for SME's;

b) Review existing SME practices and methods for marketing strategies from present literature;

c) Establishing case studies as the methodology for this report and explanation of case selection procedure;

d) The classification of case studies[6] is as follows:

   I. Review designing of the WetSep technology as an innovation with an outlook on market need;

   II. Review WET's current business model and capabilities; and international business development approaches;

   III. Review existing WET local and international marketing strategy;

   IV. Case studies on past international ventures;

e) Based on the literature and case studies analysed, develop and discuss an interim structured business model and global marketing strategy that is applicable to WET for the WetSep system in the international market.

f) Conclusion of this report.

1.6 Project Outcomes

The purpose of the research is to evaluate the current business model and strategy for WET's international market and to develop a more robust and suitable business model for marketing of the improved WetSep product, given that the company does not have the same level of human capital as an MNE. By sharing my knowledge and experiences, I hope that other SMEs can find relevance from this business model. Given the complexity and inconclusiveness on research that has been conducted on internationalisation- performance link of SMEs, I hope that this report will contribute to our knowledge in that area (Zhou, et al., 2007). As noted by Lianxi

[6] The case studies give a factual presentation of the events and decisions made and also reviews the outcomes of those decisions and what could have been done better.

Zhou, this task is a challenging one as one can only evaluate the internationalisation strategy as a whole (Zhou, 2007).

Undertaking a doctorate with this work project as the key area of research gives me the opportunity to draw on a wide range of literature not only in science but on the use of practice knowledge and fieldwork. The literature I have selected falls into the following categories:

a) Role of SMEs in an Economy;

b) Internationalisation of SME's;

c) Business Models for Small Enterprise;

d) Competitive strategies for small enterprise: Social Capital, New Product Development, Incubation Program;

e) Comparison of Marketing Strategy Approach in Hong Kong and Western Countries;

f) Conventional Water Treatment System;

g) Social and Environmental Impact;

h) Worldwide growth of Tunnel Industry; and

i) Influence of institutions on internationalisation

An illustrative flow chart of the project outcomes is shown in Figure 6 below.

Figure 6 Flow Chart of Project Outcomes

An analysis of the existing literature related to business strategies and marketing of SMEs in the environmental sector; there is little information on developing a marketing strategy for SME's in the environmental sector. Followed by a review to understand the initial establishment of WET in Hong Kong in order to review the company's structure and current practices. The environmental sector — includes the government, the developers, and even pressure groups—is unique in the sense that there are many stakeholders with vested interests in the outcome of any water and wastewater infrastructure project.

WET's past in internationalisation has been analysed to better account for the decision-making strategies and highlight the difficulties that WET or an SME may encounter in the process of internationalisation. The goal is to adopt the best approaches found and to see if a unique 'global marketing strategy' can be created for WET. The final strategy would have to be simple that optimises both staff and financial resources to have the greatest impact on sales. The strategy should also be flexible to adapt to various requirements for each unique project and incorporate social, economic and environmental concerns.

In conclusion, using the case study of WET's initial expansion to overseas market with other smaller-scale case studies, I aim to map out the success and failures of the internationalisation strategy, which are greatly dependent on the economic and political structure of the markets that I wanted to enter.

2. Literature Review

As mentioned in Chapter 1 (Introduction), there is insufficient information on developing a marketing strategy for SMEs, be they SMEs in the environmental sector or SMEs in other sectors in Hong Kong. In my project, I have taken into consideration the specific nature of the environmental technology fields and the sector as I further investigate and summarise information from other previous research studies that are relevant to WET and other SMEs, before formulating my argument on the comprehensive global marketing strategy for SMEs.

The following literature review also helps to build some foundational knowledge, for example, some common marketing model and the current trend of the industry, for the research design. In detail, the literature review is broadly comprised of two parts: The first part starts with addressing the distinctiveness of SMEs. Then it provides a background on internationalisation, institutional and social capital theories. This part is concluded with addressing modes of internationalisation. In the second part, we provide a technical theoretical background, exemplified by WET's WetSep technology, introduced by a section on new product development. In the last section, I make connections between a unique and in a multidisciplinary approach in engineering, and various international business and management literatures and insights, in order to deliver an innovative business and marketing strategy for technology-intensive SMEs, as reflected in my research design.

2.1 Small and Medium Enterprises (SMEs)

In Hong Kong, an SME is any manufacturing enterprise with fewer than 100 employees or any non-manufacturing enterprise with fewer than 50 employees (Support and Consultation Centre for SMEs, 2017). The technical definition varies from country to country but is usually based on employment, assets, or a combination of the two (The Hong Kong Chinese Importers' & Exporters' Association, Hong Kong Baptist University- School of Business, Institute for Enterprise Development, 2011).

Table 4 The Share of SMEs among all Enterprises and Total Employment in Asia

Countries	Share of All Enterprises (%)	Share of Total Employment (%)	Year
Hong Kong	98.0	45.0 (TE)	2017
Thailand	99.7	80.3 (EE)	2014
Philippines	99.6	63.7 (EE)	2013
Japan	99.7	69.7 (EE)	2012
Malaysia	97.3	65.0 (TE)	2014
Singapore	99.4	68 .0(TE)	2012
PRC	97.3	64.7 (IE)	2011

(Source: Vandenberg, et al., 2016 & Support and Consultation Centre for SMEs, 2017)

They play a critical role in the development of the country, contributing a large proportion of the country's GDP and economic activity. Reports showed most of the South Eastern Asian countries have found the importance of SME's towards the national productivity (The Hong Kong Chinese Importers' & Exporters' Association, Hong Kong Baptist University- School of Business, Institute for Enterprise Development, 2011). Particularly in Asia, the Asian Development Bank (ADB) and Asian Development Bank Institute (ADBI) stated in their report in 2015 that SMEs had "the potential to boost productivity and increase employment at the national, regional, and global levels" (Asian Development Bank Institute, 2015).

SMEs are seen as engines of economic growth worldwide. One of the important roles of SMEs in this context includes poverty alleviation through job creation, in both developed as well as developing countries. The entire globe is taking extreme benefits from SMEs which are capable of accelerating the economy of any country.[7] It plays a huge responsibility in providing further employment and overall conversion of the economy. It is also implicitly stated that sectors conquered by SMEs are better able to develop dynamic economies of scale. The roles of SMEs in the creation of productive employment are concerned with its position in the centre of the range of sizes and resources intensities in a rising economy. Developing economies

[7] For this very reason, most of the countries are keeping a vigilant eye on the growth and development of these SMEs.

have started to focus on the crucial role that SMEs can play in their development (Harash, et al., 2014).

Based on statistics prepared by the Small Business Administration (SBA) on business failures, it has been claimed that more than half of new businesses will disappear in the first five years (Mason, 2018). Their failures can be attributed to four aspects. First, SMEs face a lack of access to finance due to market failures and limited primary and secondary markets (Asian Development Bank Institute, 2015). Second, the development of SMEs is constrained by a lack of expertise and skill in organisation and management, which are the key factors for enterprises' efficiency, flexibility and competitiveness (Kimura, 2010). Thirdly, a shortage of sustainable entrepreneurial drive may come into the SMEs way to further development. Finally, there is a lack of networking, resources and knowledge. From a more recent perspective, with rapid technological advancement, the continued success of SMEs depends on the Four Aces - apply technology, agility, accelerated innovation and ability to attract and retain talent (Oxford Economics, 2017).

Despite the challenges that have risen with technological advancement and increased competition. SMEs have also been faced with great opportunities as a result of globalisation and ongoing regional economic integration. These opportunities include 1) the rise of niche markets, 2) the importance of customization, 3) reduced product life cycles that have made flexible production important and 4) subcontracting opportunities arising from the growth of the global production (Harvie, 2010).

2.2 Internationalisation of SMEs

Internationalisation is one of the most important paths for company growth. Entering a new market, customer bases will be broadened, which would help the growth of a company by increasing the production volume.

Traditionally, SMEs seldom involved in international market owing to financial and managerial constraints. But nowadays, internationalisation has become a major trend as more SMEs internationalise because of the profitable growth created by the open and integrated international markets (Chaney & Lin, 2007). Internationalisation is vital for small and medium enterprises in a global market (Iuliana, et al., 2008). Globalisation enables nearly every business to buy, sell and

cooperate on a global scale. Customers have the chance to compare prices globally in order to find the best offer. As mentioned earlier, companies get to leverage on the rise of niche markets and subcontracting opportunities arising from the growth of global production

SMEs obtain certain advantages as compared to some large multinational companies (MNCs). One main advantage would be the flexibility in operation and human resources due to their relatively small organisational size (Chaney & Lin, 2007).

Implementation of internationalisation involves a lot of challenges, such as liability of foreignness (Johanson & Vahlne, 2009), liability of newness (Stinchcombe, 2000) and liability of outersidership (Singh, 2012).

Liability of foreignness refers to the social and economic costs borne by a company when they operate in foreign markets as compared to domestic markets (Johanson & Vahlne, 2009). There are four types of disadvantages: cost in the initial acquisition of information; risk in foreign exchange currency fluctuation; discriminatory treatment and local restriction on the internationalisation by local government authorities (Hymer, 1976). Normally, domestic companies enjoy more advantages than foreign companies due to their familiarity with their native economic, social, legal and cultural conditions (Jensen & Szulanski, 2004).

The probability of an organisation dying is at maximum during its initial founding point and decreases as the organisation grows in age (Chinta, et al., 2015). This risk has been termed as the liability of newness. When companies internationalise, they face the liability of newness as they encounter new regulations, new cultures and different customer expectations (Singh, 2012). Their need for time to learn their roles as social actors, coordinate new roles for employees is often coupled with their inability to compete effectively with established organisations (Singh, et al., 1986) . On a more positive note, newness allows for enhanced endorsement for new ventures and the liability can be lowered with additional contacts and obtaining more knowledge on the new market (Makaela & Maula, 2005).[8]

[8] See chapter on 'social capital'.

Liability of the outsider will be faced by those companies attempting to leverage strategic alliances and partnership during internationalisation process. The extent of being an outsider decreases when there are multilateral network and network relationships as proven by 'guanxi' (Knight & Cavusgil, 2004).[9]

Liability of Newness	Liability of Foreigness	Liability of Outsidership
Related to the age, size and experience of the firm	Related to firms' foreign status and lack of local knowledge	Related to lack of connections in networks required for growth

Figure 7 Internationalisation Process Challenges

(Source: Singh, 2012)

To cope with these challenges, Hong Kong government has provided a series of support to SMEs as elaborated in the next section.

2.3 Role of Regulatory Institutions

As SMEs play a critical role in the economic development of a country, and government attempt to take different measures to assist SMEs. For instance, to reduce the tension in capital, many countries such as the UK set lower tax rates for SMEs (The Hong Kong Chinese Importers' & Exporters' Association, Hong Kong Baptist University- School of Business, Institute for Enterprise Development, 2011). In South Korea, Doh and Kim (2014) found a positive relationship between governmental financial aids and regional SME innovations. By measuring technological innovations, such as patents, utility models, trademarks, etc, those researchers found that a positive relationship exists among development assistance by the Korean government and patent acquisitions as well as new design registration of SMEs. Assistance from the government is important to the need to build a robust environment for SMEs, thereby a social relationship in todays' networked economy.

In the context of Hong Kong, SMEs occupy 98% of all enterprises and 60% of the total employee population, contributing a very important role in Hong Kong's

[9] An informal network of doing business in China.

economic development (Li- Min Hsueh, 2006). Similar to the SMEs over the world, they are facing the following difficulties:

- Lack of funds for marketing their products and sufficient information on the market;
- Inability to explore overseas markets, making sales expansion difficult;
- Low levels of labour skills and knowledge which lower operating efficiency,. and
- Inadequate funds for investment and know-how to apply technology in operations.

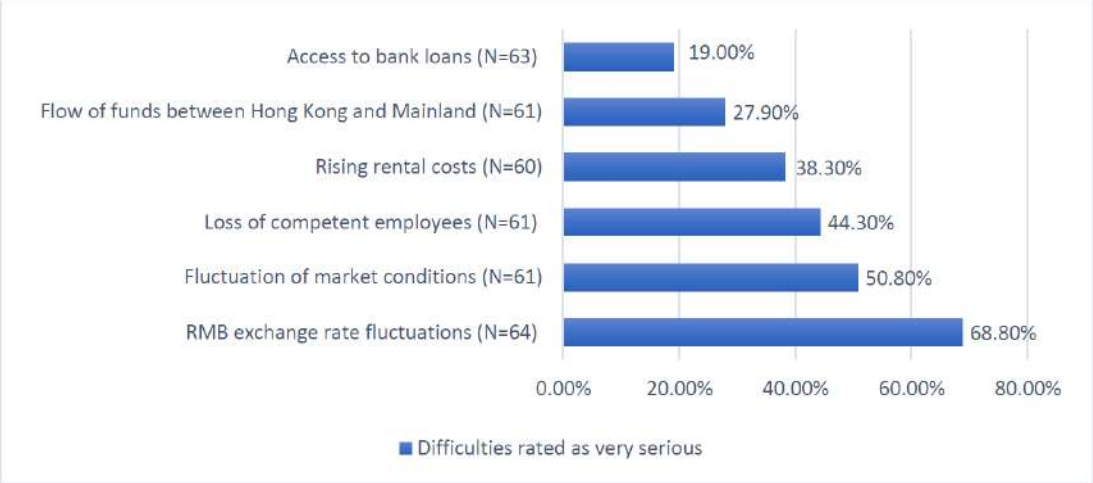


Figure 8 Difficulties Experienced by SMEs in Doing Business in Hong Kong

(Source: The Hong Kong Chinese Importers' & Exporters' Association, Hong Kong Baptist University- School of Business, Institute for Enterprise Development, 2011)

Besides offering support during the initial growth year, government regulations play a role in growth of SME culture.

2.4 Social Capital

Social capital, defined as expected collective or economic benefits derived from the preferential treatment and cooperation between individual and groups, plays an important role in SME's internationalisation process.[10] The Neo-Capital theory

[10] While social capital is viewed in different ways by different theorists, for the purpose of this report, I view social capital on the basis of the Neo- capital theories as shared by theorists Lin, Burt, Marsden, Flap and Coleman. This level of analysis is individual based (Lin, et al., 2001). I have chosen this as it accounts for the ability of workers and employees to themselves invest and acquire capital of their own.

explains social capital as access to and use of resources embedded in social networks (Lin, et al., 2001).

Investing in social capital by building inter-firm networks is essential to SMEs to acquire valuable information, helping to overcome market information hurdles and develop new capabilities in an efficient manner (Chaney & Lin, 2007). SMEs find it beneficial to build long-term relationships with network partners as a strategic benefit since the partners provide direct and indirect access to key resources, skills and knowledge controlled by other members of the network (Roy, et al., 2004).

It has been argued by Zhou, et al. (2007) that simply an international orientation of an SME does not bring in sufficient knowledge to tackle the risks and capture market opportunities. Instead, these SMEs rely on readily available interpersonal ties and social interactions to build on information benefits. These eventually lead to improved performance outcomes.[11]

Kontinen & Ojala (2011) suggested two ways for international networking. Firstly, attending international trade exhibitions as an option for SMEs to create ties leading to international markets. It provides excellent opportunities to network with international operators in the same industry, which may help SMEs to explore the new foreign markets. Another option is to work with export-promotion organisations which are able to mediate the relationships between SMEs and potential foreign customers or distributors and provide SMEs with overall market data and with some contact details.[12] This extends to family SMEs with strong, inner bonding networks as social capital may be especially strong in family-owned business, owing to the unification of ownership and management (Melin, 2008).

2.5 Uppsala Internationalisation Model (U-model)

The Uppsala model or U-model is a traditional internationalisation model that describes the different level of internationalisation in a series of incremental steps: an "establishment chain" as shown in Figure 9. The company would start internationalisation by direct export, and then indirect export through local sale

[11] Information benefits here refers to knowledge of potential market opportunities, personal advice and experiential learning and referral trust and solidarity.
[12] This is of relevance as I too used these ways to enter foreign markets in my initial years and have continued to do so. It has been explained in more detail later.

representatives. After that, they would develop sales subsidiaries and finally establish the local production.

Figure 9 Different Level of Internationalisation
(Source: Johanson & Vahlne 1977)

The Uppsala Model identified two distinct decisions (Johanson & Vahlne, 1977): choice of country and choice of mode of entry (commitment) and how both these choices will be determined by the psychic distance, ceteris paribus.[13]

Johanson and Vahlne (1977) further refine the model into a dynamic model in stage and changes aspect. The stage aspects (market knowledge and market commitment about foreign markets and operations affect the change aspects (current activities and commitment decisions). When market knowledge and commitment increase, commitment decisions increase, thus the business activities in the foreign market will also increase. Figure 10 presents the interaction of the four aspects.

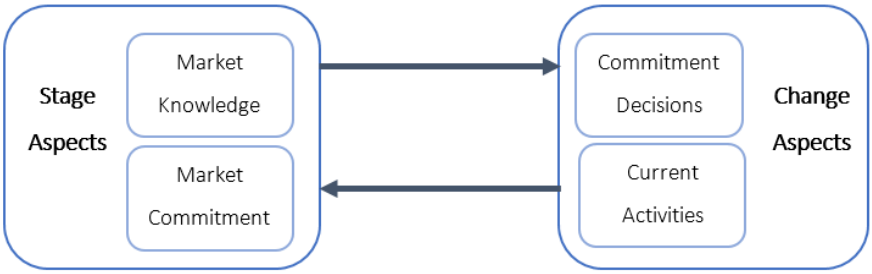


Figure 10 Basic Mechanism of Internationalisation – State and Change Aspects
(Source: Johanson & Vahlne 1977)

Though the Uppsala Model is well recognised, there are limitations during the changes in business environment. Doole & Lowe (2008) think that the model did not consider the management incentive and its effect on decision making. Also, a limited form of market entry has been considered and other market entries that may have high return with less risk have not been sufficiently considered.

[13] The sum of factors preventing the flow of information from and to the market. For example, differences in language, education, business practices, culture and industrial development (Johanson & Vahlne, 1977).

Pandian and Sim (2002) revisited this model in the context of Asian multinational firms. They observed that the Asian companies with little experience in internationalisation went to high psychic distance countries with the high commitment modes of entry. They succeeded in joint ventures if the companies had high absorptive capacity for information gathering and assimilation and had an ethical network.

2.6 Internationalisation Strategy for Small Enterprises

There are three major types of methods for SMEs like WET to enter the international markets: exporting, foreign direct investment (FDI) and alliances (Lu & Beamish, 2001).

2.6.1 Exporting

Exporting is regarded as the first step in internationalising, especially applicable to the SMEs due to the lack of resources and financial (Shaker, et al., 1997; Golovko & Valentini, 2011). Advantages gained by exporting include: (1) SMEs can gain international experience with relatively little capital investment. (2) SMEs can enjoy the economic benefit of increasing the production volume such as lowering the labour cost and specialising the production procedure. (3) SMEs can increase the market power in the presence in the diverse international market. Among these three methods, exporting is the one involving the minimal capital risk.

2.6.2 Foreign Direct Investment

Foreign direct investment (FDI) is also an attractive option of internationalisation for SMEs (Fujita, 1995; Pu & Zheng, 2015). Though FDI involves more capital investment, it allows the company to minimise the transaction-related risk in propriety asset exchange (Rugman, 1982). It is worth to notice that SMEs' performance might decline in the very beginning due to the suffering from liability of foreignness. In foreign countries, there are numerous dissimilarities in the formal and informal institutions such as regulatory, language and culture difference. Local companies definitely take the advantages in predicting and dealing with the operating environment. However, performance will increase in later years when new international markets are exploited and the foreign SMEs that manage to overcome

these problems (Peng, 2006; Musteen, Francis & Datta, 2010; Ebersberger & Herstad, 2013).

2.6.3 Joint Venture / Alliance

Alliance is also a good option for SMEs when they are facing the problem of shortages of capital, equipment or other tangible assets. Alliance partner can help the SMEs to solve the problem which may be encountered in FDI. Indeed, alliances are not risk-free. Problems including goal conflicts, lack trust and understanding, cultural differences, and disputes over the division of control lead the failure of the alliance (Lu & Beamish, 2001; Chelliah, Sulaiman, Yusoff, 2010; Argente-Linares, López-Pérez, & Rodríguez-Ariza, 2013).

2.7 New Project Development (NPD)

New Product Development (NPD) is a route for SMEs to practice their innovative ideas and it can provide a platform for long-term financial success. SMEs must develop appropriate new product strategies, be they formal or informal (Huang, et al., 2002; Nicholas, Ledwith, & Perks , 2011; Park & Kim, 2013). In this way, SMEs can learn about problems, develop solutions, and improve their strategic responses to the environmental complexity and uncertainty that is an inherent part of NPD through such planning. Nevertheless, NPD is not only technologically challenging but also expensive and risky process, especially for SMEs in emergent industries or in structurally weak regions (Rese & Baier, 2011). A study carried out by Ettlie and Subramaniam show that only companies with a structured approach to innovation are likely to succeed in terms of profit growth and competitiveness. (Ettlie & Subramaniam, 2004).[14]

Most SMEs attempt to develop new markets and spend more on Research and Development (R&D) to cope with the challenges. However, research suggests that in terms of effectiveness, R&D would have a better return than developing new markets

[14] Hence, I have chosen to include a section discussing how WET implements NPD to improve their profit growth and competitiveness but with a comprehensive approach.

(The Hong Kong Chinese Importers' & Exporters' Association, Hong Kong Baptist University- School of Business, Institute for Enterprise Development, 2011).[15]

2.8 Conventional Water Treatment System

The conventional steps of Wastewater treatment are as follows:

Primary Treatment: This process is undertaken to produce a homogenous liquid that is capable of being treated biologically and the sludge can be separately treated/ processed. This allows all the heavy and dense particles to settle through sedimentation and allows the less dense floating matter (oils and greases) to rise to the top. The clarified water flows to the next step of treatment (Kelessidis, & Stasinakis, 2012).

Secondary Treatment: Sewage contains high levels of organic matter which needs to be treated by using biological treatment process. Thus, the homogenous liquid from the primary treatment is treated with microbes and bacteria which consume the organic matter. This can be done in two methods; attached growth process, where the liquid is passed through a plastic media containing microbial growth or suspended growth process, where the microbial growth is suspended in an aerated water mixture. While attached growth process units include trickling filters, bio-towers, and rotating biological contactors, suspended growth process units include variations of activated sludge, oxidation ditches and sequencing batch reactors (Demirbas, 2011; Singh & Srivastava, 2011).

Tertiary Treatment: This process is vital for wastewater reuse and to achieve drinkable water standards. It includes the process of disinfection. The effectiveness of disinfection depends on the quality of the water being treated (e.g., cloudiness, pH, ammonia content, etc.), the type of disinfection being used, the disinfectant dosage (concentration and time), and other environmental variables. Common methods of disinfection include ozonation, chlorine, and ultraviolet light (Charles P. Gerba, 2015; Gupta, Ali, Saleh, Nayak & Agarwal, 2012).

[15] Over 80% of interviewees in the study conducted by The Hong Kong Chinese Importers' & Exporters' Association, Hong Kong Baptist University- School of Business, Institute for Enterprise Development.

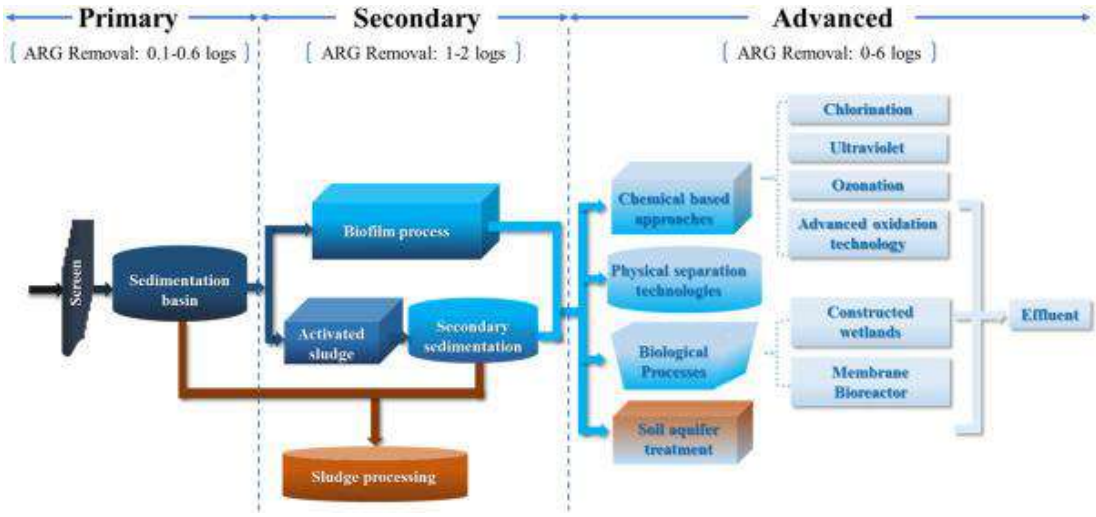


Figure 11 Conventional Treatment Wastewater Treatment Process
(Source: Pei et al, 2019)

2.9 Social Impact

According to Schwarzenbach et al. (2006), wastewater contaminants have been the key challenges to environmental integrity and sustainability globally. The social impact caused by water issues have been widely discussed in the past couple of decades, from a study in Bangladesh which indicated a positive and negative social impact due to industrial activities (Mahbub, et al., 2014) to the blackwater reuse in Europe (Estévez , 2014).[16]

The social impact of the company's action how to affect the surrounding environment will be one of the discussion topics in here. First, we need to understand what social impact is and what positive impact created from WET.

The definition of social impact varies from one literature to another literature, but we can conclude its meaning to 'The effect of an activity on the social fabric of the community and well-being of the individuals and families (Centre for Citizenship Enterprise and Government, 2018).' The social fabric included its ethnic composition, wealth, education level, employment rate and regional values and many other aspects, but we are not going into details in here as they are not relevant to this discussion.

The WetSep product range created by WET are to improve wastewater treatment, not only in construction site but also with a minor alternation, it can be used

[16] Blackwater refers to wastewater from toilets.

in other applications such as toilet water for remote area and refugees camp. The social impact of our WetSep system can improve the creation comfort on so many different levels. The WetSep system develops from a simple idea and employing appropriate technology concept, offer minimum energy (electric) requirement, lower cost and suitable solution for low-density communities. Acting in concordance with the objectives of appropriate technology idea (Oladoja, 2017).

2.9.1 Appropriate Technology

Appropriate technology is an ideological movement encompassing technological choice and application that is small scale, decentralised, labour intensive, energy efficient, environmentally sound and locally autonomous (Hazeltine & Bull, n.d.; Sianipar, Dowaki, Yudoko, & Adhiutama, 2013). It was originally articulated as the term 'Intermediate Technology' by the economist Dr Ernst Friedrich "Fritz" Schumacher in his work 'Small is Beautiful', as it signified the transition from traditional technology to modern technology. Both Schumacher and many modern-day proponents of appropriate technology also emphasise the technology as people-centred (Akubue, 2011).

The Indian ideological leader, Mahatma Gandhi, is often cited as the 'father' of the appropriate technology movement. Though the concept was not given the name then, it was proposed that small, local, and predominantly village-based technology to help India's villages become self-sufficient. Gandhi disagreed with the idea of technology that benefited a minority of people at the expense of the majority or that put people out of work to increase profit (Akubue, 2011). Gandhi recognised that the peasants should be the basis for economic development in Asia, emphasising the idea that the growth of small industries will help in the growth of larger industries through the ripple effect.

Another example, during the reign of Mao Zedong beginning with the so-called Great Leap Forward of 1959 and then during the ensuing Cultural Revolution, China also implemented policies like appropriate technology. In this era, development policies based on the idea of 'walking on two legs' advocated the development of both large-scale factories and small-scale village industries (Akubue, 2011; Zhang, Tan & Gersberg, 2010).

Given the limited capital and abundance of unskilled labour in India and China, the concept of appropriate technology was quick to be adopted as it embodied simplicity, cost effectiveness, user centrality and pedagogy; concepts which were crucial for the development and expansion of technology in these countries (Oladoja, 2017).

According to Schumacher, a process can be considered simple if the production methods employed are simple and the demand for high skills are minimised in all aspects of the organisation such as raw material procurement, as well as financing and marketing activities (Schumacher Center for New Economics, 2013). Moreover, for the technology to be implementable, the actual cost of production must not exceed the capital available. Therein lies the importance of appropriate technology being cost effective (Kaplinsky, 2011).

Appropriate technology is also user centred and pedagogical, making it usable as well as implementable in labour-driven economies. For technology to be user-centred, it must first understand and then cater to user desire, intuition and comfort (Schumacher Center for New Economics, 2013). Furthermore, it must be easily understood, so that it can be modified from time to time by improving upon certain basic concepts. This pedagogical characteristic of appropriate technology allows for it to be expanded over the region to meet the diverse needs of individuals and industries (Fu, Pietrobelli & Soete, 2011).

2.10 Worldwide Growth of Tunnel Industry

From 1845 to 1930, many civil engineers attempted to develop and use the idea of a tunnel-boring machine which was then known as “a mountain slicer.” By 1930 or so, the message had sunk in that such a machine was impossible to construct with the limitations on electricity to run the machine. The engineers gave up. According to Barbara Stack (Brierley, 2015), the pre-eminent historian of this technology, "or the next twenty years ... few, if any, patents for rock machines were submitted by engineers, nor were any units built."

Later in 1952, James Robbins was contracted by a tunnelling contractor F. K. Mittry to help dig a water diversion tunnel for a dam just outside Pierre but the bedrock around the town was riddled with cracks thus the traditional technique of drill and

blasting could not be used (Brierley, 2014). James Robbins used his knowledge from the mining industry to construct a tunnel boring machine. His idea was to push a group of metal fingers or picks into the face of the rock and then rotate the group, scoring deep circular cuts into the rock. This machine of his had the potential of building the tunnel at a pace of 160 feet in 24 hours, ten times faster than the contemporary drill and blast projects. It also minimised the risks involved in the industry, making this a breakthrough in the tunnelling industry.

Eventually, with many more similar breakthroughs in the industry and innovations to reduce the financial, capital and labour risks in the industry, tunnelling started being adopted more by Governments, Mr. Jonathan D. Klug, Vice President of Devid R. Klug & Associates, Inc., in a discussion held by Tunnel Business magazine 2016, supports the idea that with advancements in TBM technology, as machines grow in size, the engineering that is employed increases exponentially (Tunnel Business Magazine, 2016). The development of multi-mode machines has made way to build tunnels despite changing ground conditions. He claimed that as tunnels are designed deeper underground, machine manufacturers are competing with innovations to tackle these high pressures. Overall, the tunnelling industry has become a competitive and innovating industry in the recent year.

According to the International Tunnelling and Underground Space Association that the world has principally been built upon in a two-dimensional manner; by going underground, urban planners can overcome the land use problems as well as problems of overpopulation and urbanisation, especially in mega cities (International Tunneling and Underground Space Association, 2016). Another advantage identified of building underground are in term of isolation from climate changes and natural disasters. It helps in environmental protection as well as helps to overcome topographical barriers such as mountains and seas. The use of underground spaces for water storage, multipurpose utility tunnels, car parks and to reduce traffic are also increasing in popularity due to their many benefits. They help achieve environmentally-friendly development by reducing pollution and noise nuisance.

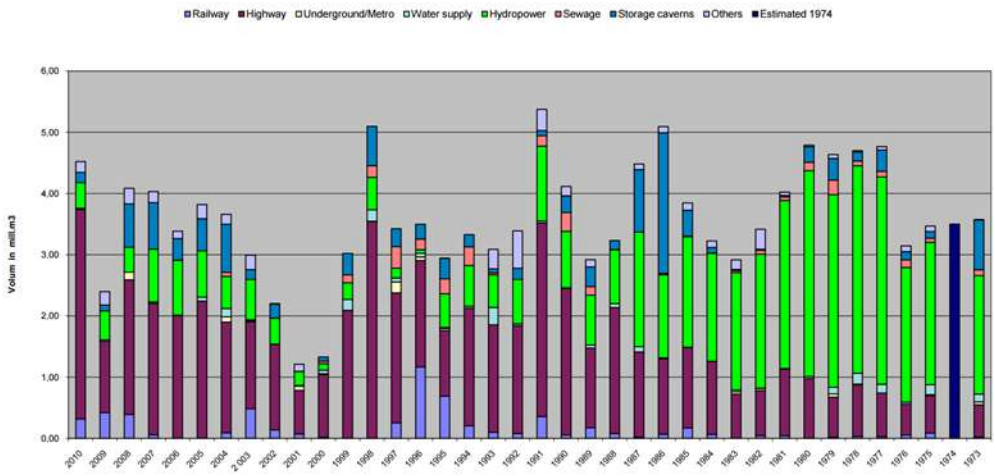


Figure 12 Tunneling Statistic 2010
Excavated volume from tunnels and caverns in Norway 1973-2010
(Source: Norwegian Tunnelling Society 2017)

The bar chart shown above represents the change in purposes of underground construction in Norway and the stability in the volume of tunnel constructions in Norway for the years 1973-2010.

According to a panel discussion of leaders from the Tunnel industry, held by Tunnel Business Magazine in 2016, an increasing need for tunnels in fresh water distribution systems, wastewater applications for combined sewer overflow (CSO) control, and other significant transportation projects was identified (Tunnel Business Magazine, 2016). However, the availability of funds has been a primary concern and the reason for the constrained growth in tunnel construction primarily in the United States as well as around the world. Mr. Verya Nasri, Global Tunnel Lead for AECOM claimed "I see 2016 being better than 2015, but the U.S. market is certainly not comparable to the growing market in Asia and Middle East, which the scale is on a different order of magnitude. The economy overall is not bad here, but certain political factors are limiting investment." (Tunnel Business Magazine, 2016)

In the same discussion, Mr. Jonathan D. Klug, Vice President of David R. Klug & Associates, Inc. from the panel stated, "From the large major metropolitan areas which have outgrown their current capacity and need to expand/upgrade, to the mid-sized cites looking to utilise underground transportation for the first time, these types of project will continue to be the baseline for our industry." (Tunnel Business Magazine, 2016) On the other hand, Mr. Nasri believed the new tunnel constructions were primarily driven by environmental regulations including CSO tunnels, and he

believed that the trend will continue and will be a source of revenue for the industry in the upcoming years (Tunnel Business Magazine, 2016).

Overall, the tunnel industry will be stable in size but might grow in engineering difficulty in the upcoming years due to climate change factors.

In 1974, the International Tunneling and Underground Space Association (ITA) was established to encourage the use of the subsurface and has promoted advances in planning, design, construction, maintenance and safety of tunnels and underground space (International Tunneling and underground Space Association, 2017). Currently, with over 70 Member Nations and hundreds of Corporate and Individual Affiliate Members, the ITA is now recognized as a leading international organisation promoting the use of tunnels and underground space through knowledge sharing and application of technology.

Each year, ITA holds its General Assembly meeting and simultaneously the World Tunnel Congress (WTC) in a different member nation around the world. This event gives participants the opportunity to gather and share information to improve their industry. In 2017, the WTC was held in Bergen hosted by the Norwegian Tunneling Society (NFF). Not only focusing on the latest technology for tunnelling, WET participates and spreads the concern of the large amount of wastewater generated during the process. A tunnelling project in urban area has limited space which does not allow a traditional wastewater treatment plant. A modular system like WetSep will easily adapted to address the project's need and comply with the local regulations. The concept can be compared to the functions of a convenience store. We measure and put together multiple containers as a whole system, to be shipped anywhere around the world and cater to clients, using the appropriate technology possible in the local conditions.

2.11 Influence on Research Design

This literature review started by discussing the role of SME's in development of a country and its importance in employment. Furthermore, it discussed constraints faced by SMEs in terms of entrepreneurial capacity, financial capability and others. Figure 13 illustrates how the background findings from literature review influence the

research design and the contribution to the design of WET's future global business model:

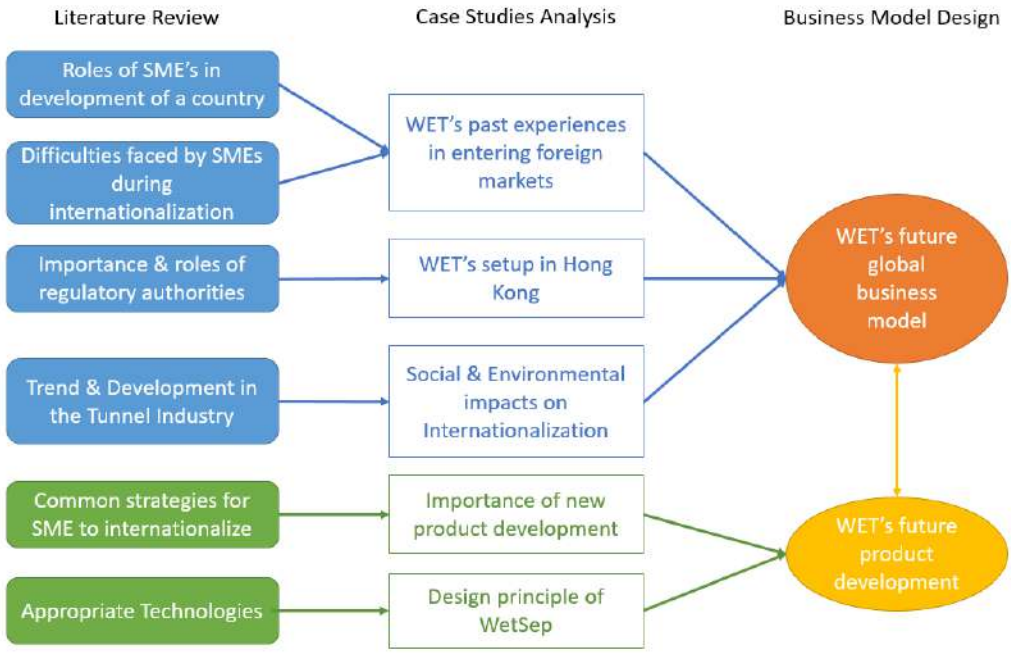


Figure 13 Diagram of Influence on Research Design

Arbnor and Bjerke (2008) explained that the more precisely you determine isolated characteristics of a human being and her activities, quantitatively and statistically, the less you understand her as a whole. Therefore, the better you can understand her as a whole, the more uncertain the quantitative or statistic aspects will become (Ingleman and Bjerke, 2009).

Given that an international orientation is insufficient for internationalisation due to the lack of information and knowledge on the part of the internationalising firm to take risks and rapidly capture market opportunities (Zhou, et al., 2007). Moreover, during the internationalisation of SMEs, there are other problems faced such as liability of newness, liability of outsidership and liability of foreignness (Johanson & Vahlne, 2009). In Chapter 5, it is evident how WET was faced with some of these barriers to entry. By understanding the characteristics of these barriers, gives us an understanding of the type of resistance WET will face in the future in its goal to internationalise.

Having anticipated this, it can take a pro-active approach and come up with a more effective strategy. For example, one liability faced by WET was that of outsidership. WET chose to form strategic alliances with certain well-known companies, only for them to copy the design and the same product cheaper and sell it. This was a major problem faced by WET and it needs to be analysed and solved in this report. The solution can either be found by developing a fixed criterion for partner selection or by eliminating the need for partnerships.

In summarising, the literature review proceeds to discuss the importance and role of regulatory authorities. These problems were also faced by WET and have been highlighted in the case study of WET's setup in Hong Kong. It was also established that there are multiple ways for an SME to internationalise; by exporting, through foreign direct investment and through joint-venture. An optimal technique for entry should take into consideration: ownership factors, locational factors and institutional factors (Dunning, 2001). The Uppsala internationalisation model explains the relationship between the psychic distance, adsorptive capacity and the choice of entry. This information can be used to understand the psychic distance and adsorptive capacity of WET for various markets that WET intends to enter and based on these factors, to choose between one of the two entry strategies that have been developed.

Furthermore, the literature review also discussed some international strategies which have been commonly adopted by SMEs around the world. The section on social capital gives an insight into the importance of social capital and potential methods to consider building on social capital such as by engaging in international trade exhibitions and export promotion organisations. It goes on to discuss the importance of new product development in the process of internationalisation and the potential competitive advantage which it gives an SME. Having understood its importance, I have chosen to come up with a comprehensive approach for future product development.

As the entry strategies depends on knowledge of the Tunnel Industry, the characteristics of this industry have been noted. An understanding of the characteristics enables the management team of WET to establish a more comprehensive plan for implementation.

Besides evaluating the monetary benefits of a decision or implementation of a strategy, it is also necessary to realise the social and environmental impacts. Sometimes, these impacts can be leveraged to win favours from governments, thus making entry into the market easier; especially for an organisation like WET which deals in wastewater management.

Finally, as wastewater treatment impacts society, it is important for WET to take into account the social impact while considering design. The WetSep has been based on the idea of 'Appropriate Technology' and this has been discussed in the case study. This appropriate technology design of the WetSep is critical as it directly links to the social impact it makes, hence can be positively portrayed to the government as a benefit to society.

3. Methodology

3.1 Considerations

In this chapter, I am mapping out the factors that determine a global business model and marketing strategy for internationalisation of the WET business and technology from a business research perspective.

The purpose of this study is to determine a global business model and marketing strategy for internationalisation of the WET business and technology from a business research perspective. Given the nature of this project, there were some additional considerations that needed attention while determining the theoretical framework. These include the inclusion of experiences and new data over time, as well as a reliable method to determine the selection criteria for the cases to be analysed. Given that WET presented a database of 19 years of business operation across seventeen different countries, the cases analysed must be as representative as possible of my experiences to ensure a robust global business model.

As the result of the above, there is the need for myself (the principal investigator) to come up with accurate and reliable conclusions. For this reason, I am motivated/encouraged to be ethical, professional and critical through the research process. It is also necessary for me to be transparent in the process in discussing the operational details with respect to WET. As WET is not a public corporation, such details are not publicly accessible. By being transparent, I refer to the approach of maintaining reliable results and conclusions.

In devising the methodology of this research, cultural factors in play may affect the outcome for the final business plan/model and marketing strategy. Fundamentally, business operation in Southeast Asian countries such as Singapore, Thailand and even Cambodia, Laos and Vietnam (if opportunity arises) takes place in East Asia, where Asian business practices are customary. On the other hand, WET's expansion into Australia, Canada and United Kingdom takes place in the West. At the same time, Hong Kong—the working base of WET—has roots in both cultures, as a former British Colony and now part of Chinese territory. Therefore, to indicate these cultural factors that may influence the outcome and interpretation of this study, a brief review of the business practices in both Western and Eastern cultures will be included so as to allow for local cultural considerations.

Besides ensuring that the research questions are answered, the methodology adopted has been written to ensure that the final global business model can and will be implemented at WET. Thus, it is of great importance for WET to have accurate quantitative data and qualitative information, and to undertake this research with utmost transparency and criticality. The method for deriving the final strategy from the research findings ought to produce a feasible and implementable outcome.

To obtain reliable results, I have chosen to adopt multiple research techniques. The case study approach has been employed to objectively explain the background of WET's past international operations. Critical reflection has also been undertaken for some of the more important successes and failures, to better analyse the factors that might have contributed in the respective successes and failures.

3.2 Case Study Approach

3.2.1 Business Research Ontology and Epistemology

The ontological building block for this research is what Colin Robson (2011) calls pragmatic `real world research'. A real world research refers to applied research projects that focused on the real world problems. Following, Felitzer (2010) by looking into personal experience, social life and social systems, as well as policies, real world research focuses on getting a better understanding on the problems and seeking solutions to address the problems for societal benefit. It is a relatively small-scale research carried out with limited resources. This research seeks an understanding of real business activities, transactions and exchanges between institutions and relevant actors (Onwuegbuzie & Leech. 2005). Given this, its epistemological approach will be post-positivist, reflecting this condition, and deploying a range of tools as in mixed methods including case study, qualitative and quantitative empirical data collection and analysis (Johnson, & Onwuegbuzie, 2004). As discussed by Henderson (2011:342), "Further, Ryan (2006) described the characteristics of post-positivism as broad, bringing together theory and practice, allowing acknowledgment and encouragement for the researchers' motivations and commitment to the topic, and recognizing that many correct techniques can be applied to collecting and analysing data".

According to Yin (2014), case studies can be used to explain, describe or explore events or phenomena in the everyday contexts in which they occur. Thus, it enables us to understand casual links and pathways resulting from a new policy change or strategy implementation (Crowe, et al., 2011). Unlike in experimental designs which seek to test a specific hypothesis by manipulating and the environment, the case study approach captures information on more explanatory "how", "what" and "why" questions. To develop a business model, the case study approach will enable myself to obtain information on the "how", "what" and "why" a particular strategy or partnership worked or did not work. This method allows the exploration and understanding of complex issues. It allows us to focus on multiple variables, namely the economic, financial, political and social aspects simultaneously.

In this deductive research, I believe that the context of each case study has a critical role to play. Although I am aiming for a 'Global' business strategy, the context will allow for taking into account the future situations that the decisions are being made in. Better understanding my past experiences, will assist in establishing an analogous decision-making process for the future global business strategy. This idea makes the explanation of the variables economic, financial, political and social aspects more important. One concern that was brought to my notice by Welch et al. (2011), is that by "contextualising" I face the risk of trading off the luxury of "theorising" and "generalising" for the "Global" business strategy. Yet, this is a tradeoff that will enable me to make my final strategy more comprehensive and slightly flexible.

As such, the research has been undertaken in a qualitative format. A qualitative format has been adopted for two reasons. Firstly, I need to consider the impacts, ethical, political and organisational issues such as human interactions and cultural differences. This is best done through the case study approach along with a critical reflection of my past experiences. Secondly, there is not enough numerical data to analyse to establish concrete ideas. Some might argue that given my 30 years of experience, there should be sufficient available data. However, there is some information that is confidential and that prevents me from sharing it. I shall any how try to share as much as I can for research purposes (Noor, 2008; Baxter &Jack, 2008; Eisenhardt, 1989).

3.2.2 Case Study Selection

A multiple-case design study has been adopted to explain the different real-life events of the past. As suggested by Campbell (Campbell, 1975), by replicating the case through pattern-matching, multiple case design enhances and supports the previous results. This raises the level of confidence in the robustness of the method. Thus, to ensure reliable findings and results, the multiple case design method has been adopted. This can also facilitate triangulation.

The unit of analysis for the case studies is my company - Waste and Environmental Technologies (WET). The embedded units of analysis would include the business development and marketing strategies that were employed at different times in different geographical locations. For better understanding the time frame can be divided into 1) the initiation of WET, 2) gaining momentum in the local market and 3) the initial attempt at internationalisation.

The case selection has been done with a phenomenon-driven lens as I place emphasis "… on identifying, capturing, documenting, and conceptualizing a phenomenon of interest in order to facilitate knowledge creation and advancement." (Schwarz & Stensaker, 2014, p.480)

While some of the cases have been approached in an exploratory manner, others have been conducted in a descriptive sense. At the beginning of each case study, the objective of each case study has been stated in the beginning to ensure clarity in thoughts and the process. The exploratory case studies explain a specific point of interest to the research. For example, the case study on Hong Kong, aims at explaining the initial establishment of WET in a country. It explains the challenges faced and the solutions that helped overcome the challenges. This case study gives an insight into the requirements in the initial set up of business operations for the global internationalisation process.

On the other hand, the descriptive style has been used to simply describe the natural phenomenon which occurs in the process of internationalisation. These case studies give an insight into the factors which are beyond the control of WET, such as economic conditions, political stability and social perceptions. It digs deep to understand actions that WET can undertake to influence these factors and reduce the risks.

One main challenge of this technique as expressed by Zainal (2007) is that the researcher must begin with a descriptive theory to support the description of the phenomenon or story. When the researcher fails to include a descriptive theory, the description lacks rigour. The descriptive case study has been used for the past international operations of WET. These experiences have been compared to look for similarities and differences by pattern matching, to identify the successes and mistakes and learn from them.

As this is an 'Insider research', the 'descriptive theory' arises from my experiential knowledge. While writing my 'Review of Learning' nearly 10 years ago, I learnt to transform my personal and tacit knowledge into 'context-specific' understanding and good practices; that can be shared with the environmental technology SMEs. Since this tacit knowledge might be difficult to explain verbally and in written form at times, I have chosen to conceptualise my experimental knowledge through critical reflections, to add rigour to the case studies.

3.2.3 Theorising from Case Studies

As the aim of the project is to devise a global marketing and internationalisation strategy, I intend to use analogies to theorise from case studies. This means that I will be drawing strategies for future situations based on my past experiences that have been critically reflected upon in the case studies.

Taking a pluralistic stance towards this research, I seek to 'benefit from the diversity of and tension between different approaches (to case study analysis)' (Welch, et al., 2011). I intend to go beyond the usual inductive theory-building approach to escape the trade-off between internal validity and thick description and have utilised an interpretive, logical approach.

Inductive theory - building is the most common method of theorising from case studies. From the multiple case-studies that have been used a thematic analysis will be done in an attempt to build certain theories. Based on the theories, I shall establish a global business model for internationalisation and a global marketing strategy.

Interpretive sense making is part of a social science that seeks to understand the particular rather than generate law-like explanations (Welch, et al., 2011). This approach will give way to internal validity allowing me to include case-studies that have one single aspect economic, financial, political and social aspects that it unique.

For example, my experience in Fiji where the political aspect made a difference. In terms of theorising, interpretive sense making will allow me to explain any deviations from the global internationalisation strategy and global marketing strategy that might need to be employed due to differences in culture, political status and geographic location.

3.2.4 Limitations

The main criticisms associated with case studies is the risk of biased results, and the extent of comprehensiveness of the research. Also, there is often insufficient sampling cases to develop a reasonable scientific generalisation from the data. It must be noted that although there is insufficient information about internationalisation in each of the countries, as a whole the challenges that arose for WET can be observed from the information. To overcome these issues, I have adopted a triangulation technique, where I have supplemented the findings with backings with my critical reflection of some of the incidents.

As this is a practice-based approach, subjectivity is inevitable and goes hand in hand with "insider research." Therein arises the need for transparency, to make clear my values, interpretations and positionality.

3.3 Critical Reflection

The critical reflection shall give me the time to contemplate the decisions of the past, present and future and reflect on their consequences. This is also where reflexivity comes in as I attempt to answer questions such as: "Why am I doing this like this?" and "What is my motivation to do this?"

This method forces myself as a researcher to think about my practice and ideas and then challenges me to step-back and examine my thinking by asking probing questions. As commonly described, it forces the researcher to not only delve in the past and look at the present but importantly it asks us to speculate about the future and act. Moreover, it enables me to understand my actions on the basis of my changing motivations. Thus, for the development of the global business model and the marketing strategy, such kind of analysis is essential.

Critical reflection is a guided process to aid analysis and increase the potential for positive outcomes. As this is a working project, this form of analysis is ideal to analyse the changing environment of myself, the company and its surroundings. As the managing director of the company, I am forced to make decisions regarding operation and management of the company on a regular basis. I will be encouraged to recall the important decisions and experiences and will be forced to step back and reconsider its impact on the company.

Besides that, this method highlights the assumptions, views and behaviours of the researcher, that is myself. Thus, allowing us to identify any biases that might be there while establishing the findings from the case studies and allowing for modifications or correction of such errors to meet other situations or come up with more accurate conclusions respectively.

In addition, as suggested by Mezirow (1990), who considers critical reflection as a precursor to transformative learning, which might lead to changes in personal understanding and most likely one's behaviour. This approach demands the researcher to look beneath the surface to see what may influence the situation, resulting in a critical depth of understanding. According to Lucas (2012), the ability to view the situation more holistically gives critical breadth and these enable us to develop a fuller understanding of experiences, so we are better equipped to manage similar situations in the future. Hence, considering this doctoral thesis has been written in the context of a work-integrated learning, this approach boosts my learning capabilities.

I shall be employing the Dewey's model of reflective thought and action. I do so because as explained by Miettinen (2000), Dewey distinguished primary and secondary experiences. He suggested that primary experiences are composed of material interactions with the physical and social environment. On the other hand," secondary experience is a reflective experience that makes the environment and its things as objects of reflection. It is failure and uncertainty of primary experience that gives rise to reflective thought and learning. This framework will assist me in understanding the standard decisions that I have taken, as well as the decisions I have made in times of adversity.

I have chosen this framework as it is a 'naturalistic technique', imitating the Darwinian biological theory of evolution (Miettinen, 2000), where organisms adapt to

their environments. In the context of this research, we shall use my past experience to understand how I have lead the adaption of WET through the years, enabling it to survive for the last 30 years and further enabling the company to adjust to new conditions and environment for the next 20 to 30 years as it internationalises.

To properly conduct a critical reflection, it is necessary to firstly define the learning outcomes (Lucas, 2012). The learning outcomes provide a scope of the probing questions and answers. Without some kind of direction, critical reflection is generally difficult and while it appears to be attractive on paper; it is complex to put into action. The learning outcomes of this report are as follows:

- Establish the evaluation criteria that will be used to assess each business model and to help select the most appropriate one for WET;
- Evaluate and critically assess the existing business model and marketing strategy;
- Review existing literature on SME's and how they operate, specifically in Hong Kong and China, and specifically search for literature for SME business in the environmental sector;
- Review the literature to study alternative business model and marketing strategies that are suitable to use as an entry strategy;
- Establish an interim business model based on existing model and literature review following the evaluation matrix;
- Conduct a case study for China and Australia for the interim business model and strategy;
- Evaluate the case studies and alternative business models and strategies against the established evaluation criteria; and;
- Formulate a comprehensive business model and global marketing strategy for WET based on the case study and literature review.

In the case study research design method employed, five components, namely goals, conceptual framework, research questions, method and validity, involved in the models are highly interacted which is shown in the following:

The aim/objectives of this research project have been presented in Section 1.5. The objectives are the driving force of the final outcomes of this project and dictate the type of methodology that will be used to arrive at such an outcome.

Figure 14 Interactive Model of Research Design
(Source: Ettlie & Subramaniam, 2004)

The conceptual framework has been defined in the following sections and outlines the general steps that were taken to complete this research. As such, the research design is required to be flexible and adaptive to account for any unknowns and/or new information collected during the research process.

This research proposes to use a combination of literature review, case studies, critical reflection and evaluation to reach the final objective. The narrative data has been collected from some of my daily conversations and/or case studies.

Phase 1: Review of Existing Business Model and Marketing Strategy: Due to lack of time, a general discussion will be conducted with the current management and business development team at WET to gain an understanding of their perspective of existing practices, use of existing resources (financial and human), organisation requirements and the focus of the company business.

Phase 2: Case Studies in Hong Kong, Australia and other countries: A brief research will be conducted into the background of the countries in terms of its water management system, political factors, economic stability and social perceptions on wastewater management if required. Furthermore, the case studies will include my personal experience and critical reflection of any prior business that was conducted in the respective countries. These experiences will be critically reflected upon based on Dewey's Critical Framework mentioned earlier.

Phase 3: Analysis of Case Studies and Development of a Future Internationalisation Strategy: My approach to case study analysis and development of a future internationalisation strategy has been explained earlier.

Phase 4: Peer Review: After the international business plan/model and marketing strategy has been formalised and approved by WET's management, an independent party will be asked as a consultant to review the research. The consultant will be an expert in the area of business development that will allow for insight and suggestions of the formulated plan. After the consultant has had a chance to review the document their comments will be assessed, and the suggestions will be incorporated to enhance the overall research. I have decided that the consultant will be Mr. Aloysius Lee, a trusted business partner and advisor.

3.4 Validation of Methodology

In order to increase the validity of this study, data triangulation has been adopted. Triangulation is a method used in qualitative research to check and establish validity in the study by analysing a research question from multiple sources of information. This method increases confidence in research data; creates innovative ways of understanding a phenomenon; reveal unique findings, challenging or integrating theories, and provides a clearer understanding of the problem.

It has been criticised for long that the method of case study lacks scientific rigour and the biased data interpretation by researcher. In qualitative research, determination of validity, referring to whether the findings of the study are true and certain, is important because the reliability is usually challenged due to the small sample size. Since there is no research that is likely to fulfil all the criteria in validity and reliability criteria (Cook & Campbell, 1979), setting up validation tools is especially important to uphold the rigor of this study.

Besides, reliability is maximised as early as in the design phase. The use of well-trained interviewers ensures consistency in data collection while it avoids interview bias. For example, less trained researchers may rely on their first impressions or assume correlation between simultaneous events when they recall some interesting or unique incident (Doole & Lowe, 2008).

To further increase the validation of the study, a peer review was conducted before drawing conclusions. Also, conclusion needs to be tested with "if-then" statement. It may suggest additional analyses to pursue. When summarising the findings, attention was paid to reporting findings in the context of guiding research questions and themes that emerge from the data and the cases.

Beside the Triangulation Tool for verification of the data, four validity and reliability criteria as described in Cook and Campbell (1979) and Gibbert and Ruigrok (2010) have also been considered to further increase the study rigor. The four criteria are namely internal validity, construct validity, external validity and reliability. Each criteria focuses on the validity of different parts of the study which thereby enhance the consistency and validity of the whole study. A summary of the action completed for each criteria is listed in Table 5.

Table 5 Summary of Actions Taken to Fulfil the Four Validity Criteria

Internal Validity	Construct Validity	External Validity	Reliability
Focus on data analysis phase and logical analysis	Focus on data collection phase	Focus on sample selection and rationing phase	Focus on the consistency within the report
Actions taken:	*Actions taken:*	*Actions taken:*	*Actions taken:*
Data analysed is related to the literature findings	Interviews conducted by professionals	Detailed case study (refer to Chapter 5)	Rationale for difference between planned and actual

(refer to Chapter 2 and 6)	Data triangulation, which include difference sources of information (as mentioned earlier in this section)	Rationale for choosing each information as a data in this study (refer to Chapter 5)	Methodology (refer to Chapter 3 and 4)

(Source: Author, 2018)

3.5 Qualitative Analysis

The data collected from this research was primarily qualitative in nature. As explained earlier, most of the knowledge and information is from critical reflection of decisions made by me in the past juxtaposed to the factual case studies. For a coherent discussion, analysis of the qualitative data required a disciplined and systematic approach. In other words, there was great need to consolidate my lessons from the past to formulate the new business plan. The steps I took were as follows.

First, I had to understand the information that I was gathering. Given that the information was from different sources, namely newspaper articles, research papers from journals, my own perspective and inputs from the consultant and my Australian client, the relevance of the information varied. Overall, my own subjective perspective was most relevant due to my invested interest into the results of this research. Yet the newspaper articles help provides the factors surrounding the decisions more objectively. The research papers on current practices and the opinion of the consultant help me view my experiences from an alternate perspective allowing me to make changes and evaluate more options that I previously might not have considered.

Given that there were so many experiences and so many lessons to learn from, there was need for me to define the scope of my study and focus the analysis. This task involved reviewing the aims and objectives of the research to focus the analysis (i.e. identify the useful information from the data collected). This will help in breaking down the data collected into manageable pieces to further conduct the analysis.

The collected data was categorised into coherent sections with similar themes such as: financial and human resources requirements for a new business, government regulatory environment and marketplace. This task is the most important task as it required the data to be re-read carefully to identify information that will meet the research objective and aims. During this process, the data will be split into categories that will be useful to identify patterns.

From the categorised data and information, a summary was done based on themes and patterns identified in the previous task. The data was reviewed to determine how the information is related to the research aim. Identification of the inter-relationships between the categories was also done to understand if there were other aspects that might contribute to the research aims.

The final task was to tie in all the information that had been gathered, analysed and categorised into a coherent conclusion. A list of the key issues found in the data were developed to gather the data. A holistic approach had to be used to interpret the data (i.e. stand back and view the entire research and see how everything fits into the big picture).

3.6 Ethical Concerns

As an "insider researcher," there is a fine line between me as the CEO/managing director and as the researcher. While I initially wanted to seek advice from my staff, there were some concerns regarding my positionality as CEO interviewing the staff. Hence, I thought it best to simply run my ideas by the staff and lay down the big picture for them. In other words, like most entrepreneurs and leaders, I set out the goals for my team based on the business strategy developed here. Instead, I have used an interview conducted by a third party in 2012 to understand Corporate Social Responsibility (CSR) at WET. The interview was given by two of my employees – one former and one current to understand their perception of the operations at WET and about the CSR initiatives at WET. The transcript for the interview has been attached in the Appendix II upon receiving permission from the interviewer.

The two interviews I took using the “Satisfaction Survey on WetSep”, I made sure to seek their permission before using their names in the report. While one allowed for their name to be used, the other had confidentiality concerns. I have however not utilised much of the information gathered here due to the small sample size.

It must be noted that my experiences are my perception of the events that took place. An alternate party might view the same incident differently. As the main purpose of the research is to share my knowledge and findings with other SMEs and companies looking to internationalise, the research is mostly with respect to my decision-making as the CEO, hence my perspective of the events is an important aspect. Also, a truthful narration is critical.

Having addressed the questions of research integrity, it is also important to understand the impact of this research on all stakeholders involved. This research affects my organisation in a big way. Besides the fact that I will be applying the end results of this research to my company, I will be spending a lot of my time organising my ideas and putting it into words. I have experience as a technical engineer and moderately as a business man, but I am new to my role as a researcher. Thus, this itself is a learning process for me.

Furthermore, as mentioned many times before, the main reason for taking up this research is my willingness to share my knowledge and technology with the world. I would like for other technical engineers to learn from my experiences and benefit from it to become entrepreneurs to their own SME or even born-global SMEs. I hope that other innovators will be inspired by my approach to simple innovations for the environment and create new technologies that will help solve the grand challenges of the world. Finally, I hope to make others realise the importance of water and wastewater treatment in our world today as well as explain the conscious steps WET seeks to take to monitor its own social and environmental impact.

3.7 Social Impact Assessment (SIA) and Environmental Impact Assessment (EIA)

To properly consider social impact and aid in the planning and decision-making process, social impact assessment and environmental impact assessment are a compulsory evaluation instrument to measure the effort (Teodosiu, et al., 2015).

WET has considered employing social impact assessment methodology to determine and drive improvements that increase the value of solutions to the customer WET serve.

The SIA and EIA will help WET to plan better in future direction, implement policy and more effectively and successfully bring initiatives to scale. The assessment also facilitates accountability, supports stakeholder communication, and helps guide the allocation of scarce resources. There is a great deal of debate on how to measure social impact, due to the difficult nature of assessing social change. It takes money. It takes time. It takes imagination and creativity. In spite of these challenges, social impact assessment is not only necessary but critical. The social sector's commitment is to serve its constituents and, while their lives cannot be measured in outputs and outcomes, they are ultimately the reason we should assess WETs achievement.

The interview given by two of WET's employees on Corporate Social Responsibility highlights how the organisation makes an active effort to recognise social and environmental impact. Also, my new drive towards humanitarian development will have large implications for remote societies that we hope to target as explained later.

A set of sample question we can use to establish our assessment parameter.

- Who are the stakeholders of the project/proposed action?
- Are project objectives consistent with their needs, interests and capacity?
- What social and cultural factors affect the ability of stakeholders to participate or benefit from the proposed policy or project?
- What will be the impact of the project or program on the various stakeholders, especially women and/or other vulnerable groups?
- Are there plans to mitigate adverse impacts?
- What social risks might affect project or program success?
- What institutional arrangements are needed for participation and project delivery?
- Are there plans to build capacity at appropriate levels?

3.8 Framework of Constructs and Linkages

I would approach context in the literary sense as defined by Cappelli and Sherer (1991:56) - "the surroundings associated with phenomena which help to illuminate that [sic] phenomena." Taking this definition, a step further, I believe that context refers to the contingent conditions that, in combination with a causal mechanism, produce an outcome.

Figure 15 shows the conceptual framework for this report keeping in mind the objective of developing a global model for internationalisation of WET on the business and technological front. For the model to be global, there is a need for the framework to be cyclic and repeatable. As a result, the model must be established as a standard strategy.

Figure 15 Simplified Conceptual Model for Internationalisation of WET
(Source: Author, 2018)

The starting point would be to conduct an analysis of the current situation by focusing on internal and external factors which influence the decision to internationalise. Internal factors are factors that are within the control of the company and can be influenced with some effort, such as financial capability, market connection and influence and ability to tackle competition and manage risk. External factors are factors that are out of the control of the company but will affect the decision to internationalise. For instance, governmental regulations, economic status of the country and globally, political stability of the new market and societal perceptions of the new market with regard to reuse of wastewater would fall under this category. Based on these factors, the decision to enter the market and the strategy for entry must be made, followed by the execution of the standardised global strategy for the market. It has been hypothesised by me that the extent to which the determined strategy can be executed would vary from market to market based on the market conditions at the time. Thus, this hypothesis makes way for the flexibility that is required from market to market. While a list for ideal market conditions can be developed, it is necessary to realise that the ideal market conditions need not always align with the opportunity. Thus, the focus leans towards the decision of accepting or rejecting opportunities. Finally, having executed the strategy, WET can operate for a while until it is fully established and

reaches a level of sustainable operations in the new market. Thereafter, the cycle begins again. There is also the scope of simultaneously entering two markets and the global model has been developed keeping this in mind.

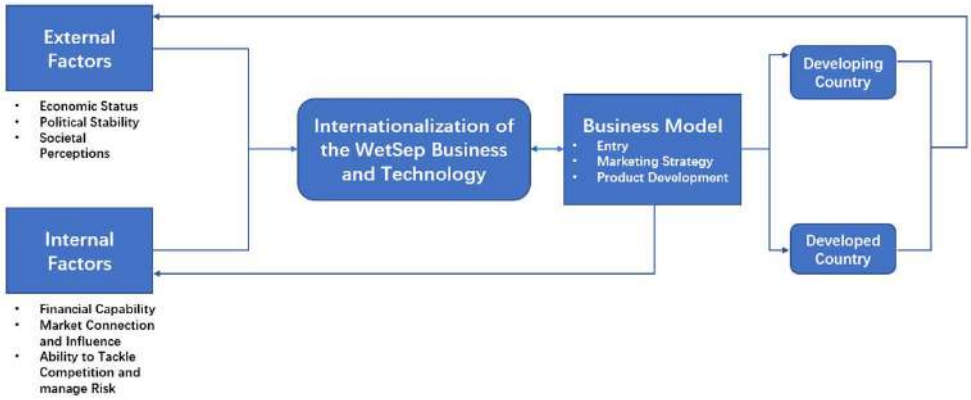


Figure 16 Descriptive Conceptual Model Representing the Links of Influence
(Source: Author, 2018)

The descriptive model represents links between the impact of the business model on internal factors. The final outcome of all the factors is the succeed in the Internationalisation of the WetSep Business and Technology. These links are assumed to be the effect which the implementation of the business model has on the internal factors. Hypothetically, if the business model is successful in the market, the internal factors will be positively affected and the financial capability of the company will improve, and WET will be able to enhance its market connections. On the other hand, it is possible that the business model fails in the market and negatively impacts the internal factors. There is also the third scenario where the implementation of the business model does not affect the internal factors at all. Furthermore, the implementation of the business model has the potential to affect external factors. It has been assumed that the affect a business model has on external factors is dependent on the initial status of the market. For instance, a developing country's external factors might be affected differently from that of a developed country with the introduction of the WetSep system to the market. This cyclic model helps account for most factors and influences that need to be considered before and after making decisions on grasping opportunities and establishing satellite operations. It helps develop and analyse different scenarios before making a final decision.

In conclusion, in devising the above methodology, I approached the subject matter from a business research perspective. By analysing the challenges in WET's internationalisation in Australia, Singapore and other international projects, one is better able to understand the issues faced by an environmental engineering SME in globalised business environment.

From the above, I mapped out the factors that determine a global business model and marketing strategy for internationalisation of the WET business and technology from a business research perspective. Specifically, I emphasise the methods and use of collecting quantitative data and qualitative information. Also, I explained the value of case study and critical reflection, as they offer qualitative information on how, what and why a particular strategy or partnership worked or did not work. Finally, I also indicated the importance and process of interpretation, in order to achieve feasible project outcomes.

4. Project Activity and Case Study: WET as a 'Born-global' SME

In this chapter, I highlight the business activities and factors affecting the operation of WET, using them as a case study with critical reflections and analysing these in the context of an SME business and the operating environment. It demonstrates the feasibility for WET as an environmental technologies SME and the method to growth by building a roadmap that emphasises the use of the 4Is, namely Innovation (uniqueness and creative product of the business), Incubation, Intellectual Property and Integration.

As discussed in Chapter 3 (Methodology), a case study is a kind of qualitative research approach that particularly useful to employ when there is a need to obtain an in-depth appreciation of an issue, event or phenomenon of interest, in its natural real-life context (Crowe, et al., 2011). One of the advantages in adopting this approach is that it can make a complex situation easier to understand, making it possible to analyse the business decisions and strategy taken.

This chapter has been written as a case study with critical reflections and external information about the variables I had established (economic, financial, political and social aspects) initially. Since these experiences took place from 1995 onwards, I have combined the critical reflections with external information to help myself and the reader realise the background of the situation I was in and my thinking process at that time. The narrative includes an insight into the reasons behind which certain key decisions made. There is no doubt that as times change, my business strategies change but my values do not change. Nevertheless, there are some business strategies that have stayed with me a long time and I would like to share those business strategies in greater detail, as I believe that they will continue to be relevant or establish good practice for any future business strategies.

Tracing the innovation of WetSep, I set out to explain how the approach of 'Ideation out of desperation' fosters product development for an SME like WET. It then goes on to discuss how I positioned and marketed the WetSep system in the local market and simultaneously built recognition for the brand in international markets.

Other than addressing the application of technology and my marketing strategy, I also analyse the more quantitative factors in the case study, by explaining the various revenue models involved in setting up my head office in Hong Kong with

the help of the Hong Kong Science and Technology Parks Corporation (HKSTP). This section sheds insights on the cost-effectiveness of expanding into new locations and the factors taken into consideration in the process.

Using the example of the internationalisation of WET to Australia, I aim to explain the entry, positioning and challenges WET faced as a 'born-global SME'. Moreover, it discusses how WET eventually found opportunities for export to United States of America, United Kingdom, Singapore, the South Pacific islands and other parts of the world. We learn from our mistakes, so I have not hesitated to include projects that we pursued but failed. This would enable me to better understand the overall situation and the decisions I made, and have relevance for other SMEs. By showing WET's setup of a strong local foundation and its further growth into an international operation, I seek to enable other born-global SMEs to learn from my successes and failures. By discussing various entry strategies employed during the first internationalisation procedure, I enable a discussion into what entry and business strategies might be universal and the variables that affect these strategies.

The case study should be appropriate and sufficient to address the project questions raised in Chapter 2. As the main research questions in this study is to review the business model of WET in Hong Kong (China) and Australia from the past till present and to develop business models for the future. Therefore, what I have experienced during these years has been provided in order to address the research questions. I understand the importance for a clear narrative of events as many companies tried to build their businesses overseas but failed, it is necessary for me to emphasise on those key factors and important decisions.

4.1 Background: Hong Kong Context

The Hong Kong government has provided a series of supporting measures to facilitate the development of SMEs in Hong Kong and help them enhance competitiveness through the follows:

a. An appointed Small and Medium Enterprises Committee (SMEC), comprising businessmen, professionals, bankers, academics, representatives from organisations that provide support to SMEs and government officials, to suggest measures to support and facilitate their development and growth (The Government of the Hong Kong Special Administrative Region, 2016);

b. Industries Support Division of Trade and Industry Department (Trade and Industry Department- The Government of the Hong Kong Special Administrative Region, 2012)

- Policy initiatives and programmes of services to enhance the competitiveness of SMEs and their long-term development;

- A comprehensive range of free business information through the Support and Consultation Centre for SMEs, a one-stop provider of business information and advisory services;

- SME funding schemes;

- Secretariat support to the Small and Medium Enterprises Committee;

- Participation in the SME-related activities of the Asia-Pacific Economic Cooperation; and

- Coordinated efforts of the public sector and industry support organisations in supporting the development of SMEs and meeting their needs.

Over the years, the Hong Kong government has assisted many SMEs in helping them address the issue of newness, foreignness and outsidership. First, they try to diversify markets, such as through establishment of the Free Trade Zone between China and ASEAN, and the Economic Cooperation Framework Agreement between mainland China and Taiwan launched in 2008. Second, the Hong Kong Trade and Development Council (HKTDC) strengthen the dissemination of information including market information, legislation and regulations, incentives, government policies, investment opportunities and procedures, etc. and organise more trade related activities such as business tours, trade fairs and exhibitions, promotion of SME products and services (The Hong Kong Chinese Importers' & Exporters' Association, Hong Kong Baptist University- School of Business, Institute for Enterprise Development, 2011).

Marketing Strategy in China and Hong Kong

Siu and Kirby (1999) have compared the marketing practice of British and Chinese small firm, which is shown in Table 6. Comparing to western SMEs, Chinese SMEs do little strategic marketing planning but focus on product quality, personal networks, and relations with government and company reputation. The possible reason is that they perform as "production arms' of the overseas buyers under the original equipment manufacturing (OEM) system. Therefore, they focus on the product according to the client's requirement and the delivery schedule. Also, the specific politico-economic nature of China makes the Chinese SMEs have to ensure the specific requirements of government and immediate customer are met. Siu and Kirby (1999) also explained that there are differences between Hong Kong's and Chinese SMEs in marketing practices.[17]

In essence, SMEs in China and Hong Kong face their own specific challenges in developing and expanding their business, while enjoying certain support from the government as well as the higher flexibility in their operations and innovation. Thus, by developing market strategies these SMEs can learn about problems, develop solutions, and improve their strategic responses to the environmental complexity and uncertainty that is an inherent part of NPD and international expansion (as analysed in Chapter 2).

Table 6 Marketing Practices of British versus Chinese Small Firms

	British small firms	**Chinese small firm**
1	Marketing has the leading role	Marketing has a joint leading role together with product quality, credibility, personal network, and relationship with government officials
	Customer-driven	Order-getting

[17] Hong Kong previously was, and now is, a Chinese city with British characteristics and the findings of this report need to be completely applicable to SMEs in China.

2	**Strategic analysis**	Use annual or long-term marketing planning	Use annual budgeting or no marketing planning
		Place high importance on comprehensive situation analysis	Have knowledge about, but do not use comprehensive situation analysis
		Undertake both formal and informal market research	Rely heavily on personal contact network in market research
		Use a proactive approach in planning for the future	Deny the need to predict and plan for the future
3	**Marketing objective**	Adopt medium- to long-term profit objective	State-owned enterprises adopt short-term profit objective. Private enterprises adopt medium- to long-term profit objectives
4	**Marketing strategies**	Focus on market expansion	Focus on cost reduction
5	**Marketing organisation**	Adopt a flatter organisation structure	Adopt a pyramid organisation structure
		An open communication flow	A closed communication flow
6	**Marketing control**	Use explicit approach to control their marketing activities	Use non-objective performance assessments

(Source: Siu & Kirby, 1999)

4.2 International Growth Strategy

The current local Hong Kong marketplace for the niche market of environmental engineering solutions is a highly competitive market driven primarily by economics (i.e. cost). As WET is an SME with limited resources, it is a challenge to stay cost-competitive in the local market.

Currently, WET is located at the Hong Kong Science Park (HKSP) and has graduated from the Incubation Program that aims to help local technological companies start up and provide resources for them to grow a successful business. WET has used these resources to grow the business both locally and internationally. The support from the HKSP has been helpful for SMEs.

The current business strategy for the local Hong Kong market is to remain economically competitive. However, this model is unsustainable as the return from the product will continue to drop as costs for production increase over the long term. As such, the current local growth strategy is to continue with innovation and integration of environmental technologies to introduce new products into the market. The second (2nd) generation Modular WetSep System was developed in part due to this business model.

The second (2nd) generation WetSep system forms the core part of the current local growth strategy for WET.

WET has been in operation since 1998 and has sold the WetSep system to international marketplaces over the last 20 years. The majority of the successful projects have been developed from projects abroad, generated from the social and professional network I have built over the years. However, this approach relies heavily on my personal contacts and my personal involvement to complete the sale. As part of this research I would like to create a structured approach towards internationalisation, one that relies less on my personal requirements, a strategy that is led by the staff at WET.

Since WET was part of the Hong Kong Science Park (HKSP)'s Incubation Program for green technologies, I would like to explore if there exists incubation programs in other countries to use as an entry strategy into the international marketplace.

WET's current international operations and growth strategy has identified the tunnelling industry as an ideal industry for expansion into the global market. Therefore, WET intends to utilise its award-winning technology and experience in wastewater treatment for tunnel construction to win projects with some of the top 100 contractors in the world.

This report discusses WET's current operations in China, Australia and some other international projects which has helped WET's business by not only increasing profits but also in marketing the second (2nd) Generation WetSep system around the world. China has been established as WET's design and logistical support centre; while Australia has been the final point of sale of the WetSep treatment system (i.e. end-user sales). Based on the experience of setting up business in China and Australia and making use of WET's position and operations in these international markets, a comprehensive business model and marketing strategy has been defined for entry into the tunnel industry as the research outcome.

4.3 Ideation out of Desperation: Addressing Market Gap

During a trip in Australia, I was taking a casual stroll along the streets and observed the construction sites in the region. At that time, I noticed that the construction site seemed unable to manage their wastewater according to the required standard. The technology they were using was outdated and incapable of meeting the new standards. Confident about my problem-solving ability, I walked in and met the site engineer. I proceeded to explain to him how by using a grease trapping equipment, he can solve the problems that he was facing. The site engineer was impressed with my proposal and accepted my services.

As a result, I purchased the required grease trap system and installed it onsite. However, the system failed to work. Having given my commitment, I needed to find a solution to the problem. I stayed up all night for the next few days and conducted some research on fluid dynamics and wastewater treatment processes. That was when I came up with the WetSep system and implemented the basic version to that project. Throughout these years, I continuously improved the design of the system based on different requirements and came up with the current strategy.

4.3.1 WetSep Generation 1

The WetSep is a patented product providing a turnkey solution for wastewater treatment. It is a compact, all-in-one and versatile system that can be applied in various types of industries to serve different purposes. Some of the current applications including construction runoff, tunneling, bore-piling, sewage treatment, mining and leachate treatment. The system treats high concentrations of suspended solids, BOD, ammonia and E. Coli. It has a 70-75% BOD and COD removal efficiency and up to 99.5% suspended solids removal with effluent SS level <30mg/L conditions.

The WetSep was developed based on the principal of chemical enhanced primary treatment (CEPT); which has been recommended by World Bank as the most effective and energy efficient method of water and wastewater treatment because of its high treatment efficiency.

By using technologies such as coagulation, flocculation, impinging stream reaction, conical separator and lamella plate, it minimises the footprint for removing suspended solids. The WetSep system only requires the incoming water flow from the submersible pump for the driven force.

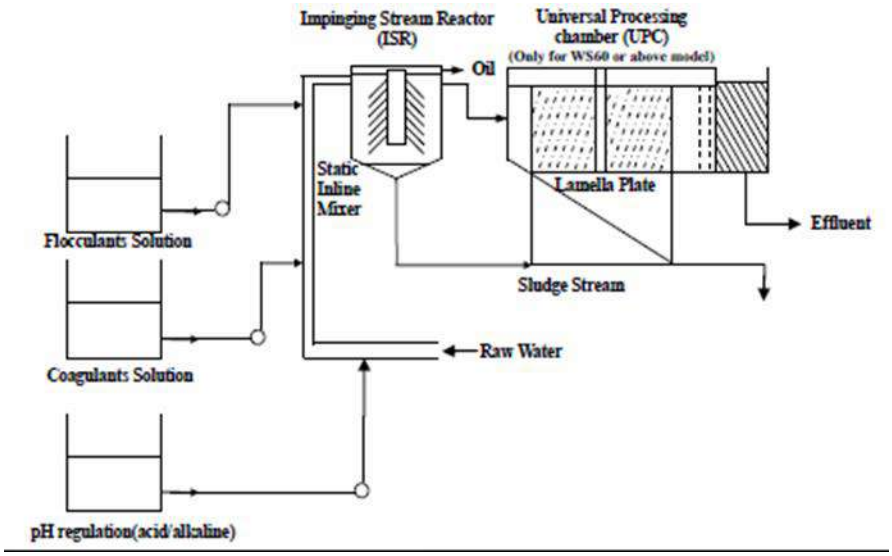


Figure 17 General Outline of the WetSep Generation 1
(Source: Author, 2018)

4.3.2 How Does It Work?

As mentioned earlier, the WetSep system makes use of the concept of CEPT. By also utilising Computational Fluid Dynamics (CFD) modelling, the performance of the WetSep system has been optimised to meet the needs of a wide range of influent water quality. The figure demonstrates the flow diagramme of the WETSEP filtration system.

The WetSep has two treatment sections, the first being the patented Impinging Stream Reactor (ISR) which consists of vertical inline mixer, hydrodynamic circular reactor, cone stacked separator and oil separator. Flow to the unit travels through a vertical inline mixer where coagulant and flocculant are dosed from a storage cabinet and dosing pumps. The flow then impinges to the circular reactor tank, which makes use of turbulence and centrifugal force provided by the spiral path to enhance the collisions between the particles and flocculants, hence enhancing the formation of larger flocs for settlement. The flocs are then separated from streams according to density. Less dense substances such as oil float to the top of the chamber, while suspended solids sink to the bottom, while the clearer water leaves via a cone filter to the next chamber.

The purified water then flows into the Universal Processing Chamber (UPC) where lamella plates are installed to further remove lighter, finer floc particles which have passed through the ISR. The separation speed can be increased by tilting the lamella plate compared to conventional clarifier. The theory is based on that settling depends on the settling area rather than detention time by a short distance of sedimentation.

It must be noted that the Impinging Stream Reactor (ISR) does not require any driven motors. Thus, reducing the energy requirement and simplifying the entire system. It combines the process of coagulation, flocculation and sedimentation in one system. By precise engineering of the flow path, flow rate, pressure differential and empirical data, the treatment can be completed in one single vessel. The ISR removes 80-85% of suspended solids (SS), oil and grease from the influent water.

On the other hand, the Universal Processing Chamber (UPC) is designed to be a modular unit that allows different treatment systems to be installed, such as lamella plates, coalescing plates, membrane or rapid sand filter, to treat various types of

wastewater. Effluent from the ISR and UPC treatment processes has the suspended solid removal efficiency more than 99.5%.

4.3.3 Adopting Appropriate Technology for WetSep

As the WetSep is simply a product which converts wastewater or sludge to reusable water, its target customers are mostly industries which produce wastewater which do not meet the disposal standards set by the government for discharge. Hence, they must process the water before disposal. To such industries, they often look for simple, cost effective and cheap solutions, which simply get the job done. Based on these needs, developing the WetSep to be an appropriate technology met the needs of WET's target customers. Therefore, from the beginning, WET's vision has been "to explore, pioneer and innovate in environmental technologies that people can benefit for a better quality of life and a sustainable future." This vision is achieved by focusing on development of the WetSep as an Appropriate Technology by ensuring that it is simple to apply and use, minimises capital expenditure, non-energy intensive, utilises local resources for operation and nurtures the environment and human health.

According to Dr. Akubue (AT for socioeconomic development in third world countries), appropriate technology is a multifaceted idea as it is the simplest level of technology that can achieve the intended purpose. Simultaneously, it can refer to engineering that takes adequate consideration of social and environmental ramifications. Such considerations make the technology robust and enables sustainable living. This characteristic of appropriate technology and adaptation of the WetSep as an appropriate technology gave a certain amount of flexibility to the WetSep, enabling its expansion to other developing and developed markets, like Papua New Guinea, Australia, Singapore and 14 other countries.

Developing countries are characteristic of extreme poverty, unemployment, unskilled labor, lack of capital expenditure and lack of infrastructure. Thus, to operate in such an environment, companies ought to adopt technology that is easy to use, cheap, requires less resources, non-labor intensive, low impact on the environment and decentralised. By designing the WetSep according to the principles of appropriate technology, most of these criteria were met.

Appropriate Technology meets the needs of developed countries as it results in less negative impacts on the environment and society by being environmentally sustainable and socially acceptable. WET's customers from developed countries worry about their image in society and in such societies- health, beauty and permanence are of important values. By treating their water before disposal, they hope to showcase themselves as a company which cares about the environment and the well-being of people, displaying a positive image in the eyes of society while simultaneously meeting the stringent standards set by the Government. By developing a sustainable waste treatment facility, they are optimising their process and reducing costs. For instance, some companies have opted for the WetSep model fitted with solar panels, thus reducing the energy requirement and in relation the cost of electricity.

This section discusses how the WetSep Generation 1 was designed to be an appropriate technology, and the importance to leverage on technology to meet the specific requirements of target customers or to help them with problem-solving. As the machine will be operated by unskilled laborers at times,, a PLC control panel was installed to regulate the dozing system automatically. This made the process simple, allowing unskilled labor to operate it efficiently. WET also offers minimal training for a period of 3 days to some of its clients. As the operation of the WetSep can also be easily understood, hence can be easily modified with time.

The user-friendly interface features a mobile-modular design so that the system can be easily fitted into containers and transported all around. It has a robust body which is suitable for all climatic conditions.

Most importantly, the WetSep is cost effective as it barely uses power driven mechanical parts and most processes are done through the force of gravity. It also combines two processes: coagulation and sedimentation. It minimises capital expenditure as it doesn't require extensive infrastructure to be set up, has a low operation and maintenance cost in comparison to its competitors. By using renewable energy such as solar power, the WetSep is non-energy intensive.

The WetSep understands the infrastructural constraint felt by many countries and for that proposes a decentralised wastewater treatment solution instead of a centralised system. This is beneficial to developing countries which often lack the infrastructure and it also benefits developed countries by allowing private companies to remain detached from the Government.

4.3.4 Development of WetSep System

The packaged treatment system - WetSep, was first invented in 1998 and has since continued to be improved and modified. The inspiration for WetSep or the WetSep Filtration System came from a domestic washing machine. Traditionally and even today, doing laundry without a washing machine is a laborious task. As an analogy, In the very old days, sailors put their clothes inside a strong fabric/canvas bag on the deck to allow water passing though the bag for hours to clean the clothes. As such, the 'washing machine' was a time saver for washing clothes.

During the design phase of WetSep, many challenges were faced. Firstly, the turbidity (a measure of how clear the water appears) in the construction's wastewater is high and the amount generated is high. The simple design like imhoff tank and frac tank alone could not treat the wastewater to meet the discharge standards. The traditional, compact Chemically Enhanced Primary Treatment (CEPT) system, could treat a large amount of high turbidity wastewater; however, it occupied too much space to build. Hence, the WetSep system was designed as a compact all-in-one system for construction sites with limited space. A traditional CEPT system including a coagulant tank, flocculant tank, primary clarifier or sedimentation tank, filter, and disinfectant tank, were fitted into a standard 20' container (L x W x H: 5.89 m x 2.33 m x 2.38 m). To boost the performance, some special features were incorporated into the WetSep system. For example, the vertical inline mixer was used to enhance the chemical mixing; lamella block is used to facilitate the suspended solid and turbidity removal. Coagulant and flocculant are added to aggregate and flocculate the particles. More detailed technical information is summarised in Appendix III Detailed description of WetSep Filtration.

Paying close attention to the industry allowed me to better design the WetSep System. I noticed that there were less people willing to engage in the construction industry recently, causing a surge in labour cost. Therefore, the WetSep system employs minimal mechanical and electrical parts thus requiring minimal labour to operate and maintain.

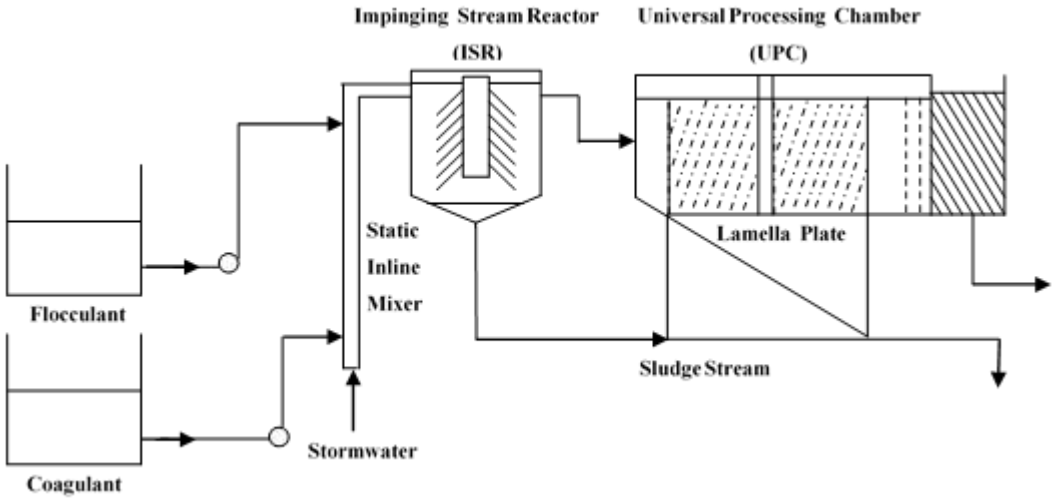


Figure 18 Flow Diagram of WetSep Filtration System
(Source: Author, 2018)

4.3.5 Product Development

This section describes the product development stage prior to the product being released to the market. Having a good sales volume is meaningless if customers do not realise the merit of the WetSep. Thus, it was necessary to acquire solid support for the WetSep before promoting WetSep into the market. Though the general concept of WetSep was generated with the support of theories, the actual performance of the WetSep was still undefined at the product development stage. Therefore, a series of performance tests were carried out.

The general stages that were undertaken in the development and commercialisation of the WetSep product are as follows:

1) Innovative Design Stage – This stage involves the development of the idea for the product. I could combine my practical experience and knowledge together to develop in concept this design that I felt would be successful in the treatment of wastewater in the construction industry. This stage involved thinking about the major components of the system and coming up with a plan to commercialise the product. Two principles that guided me through this stage were the Appropriate Technology principle and the Keep It Simple Stupid Principle. The idea of appropriate technology is to make a product that is easy to use, which utilises minimum energy and makes use of local resources and labour. Albert Einstein said, 'If you can't explain it, you don't understand it well enough.' The Keep It Simple Stupid Principle, popularly known as KISS, is a product design principle which focuses on designing something to be

extremely simple and easily usable by customers. It reminds designers to get rid of unnecessary features which would only complicate the use of the product.

2) Patent Application – To protect the Intellectual Property (IP) of the new design, a patent application was made for the innovative design. The patent application is a fairly long process that requires both time and financial resources. The patent helps ensure that other parties will not copy this idea and use it to get financial gains improperly. WET started off by patenting its technology in China as the manufacturing unit was set up in China. China is also a country which has abundant cheap labour and resources and would not hesitate to copy the idea and sell it more cheaply in Hong Kong, WET's primary market. Having anticipated this, I secured the patent to safeguard the innovation.

3) Prototype Development – A prototype WetSep system was created to try and test the overall concept of the treatment system. The system was used to determine the performance of the treatment process and help set the standard chemical compositions and flow rate of the process. These standards were then extrapolated to meet the dimensions of the marketplace.

4) Manufacturing – Once the prototype development was successful, a more structured manufacturing process was developed to allow for quality control (i.e. using ISO9000 quality control system) and mass production. The initial portion of this stage was challenging as suppliers for the components needed to be found and adapted to the system. Constant monitoring of both the manufacturing process and quality of the finished product is necessary to meet the customer's needs and requirements.

5) Sales/Marketing – In terms of sales and marketing, I decided to fully commercialise the product and to grow and operate my business. The marketing and sales activities have been largely carried out through my social network and word of mouth from our customers. This is a very important aspect of the business for growth of international sales. Besides that, I attended many exhibitions and competitions and met interested parties. This has been explained in greater detail in a following section.

4.3.6 Testing Processes

As mentioned in a previous section, there is a strict restriction to the turbidity of the water discharge in a construction site. Therefore, the removal efficiency is the most critical parameter for the WetSep and the equation of removal efficiency is shown as below.

$$Removal\ Efficiency\ (\%) = \frac{Influent\ Turbidity - Effluent\ Turbidity}{Influent\ Turbidity} \times 100\%$$

Figure 19 shows the removal efficiency of WetSep filtration system with different influent turbidities. It is found that the WetSep filtration system will remove greater than ninety nine (99) % of the turbidity for construction site storm water runoff with a turbidity of less than thousand (1,000) NTU (influent). For construction site storm water runoff with a turbidity of less than five thousand (5,000) NTU (influent), a properly engineered and deployed WetSep filtration system can remove greater than 99 % of the turbidity, producing effluent that will consistently meet the state surface water discharge standards.

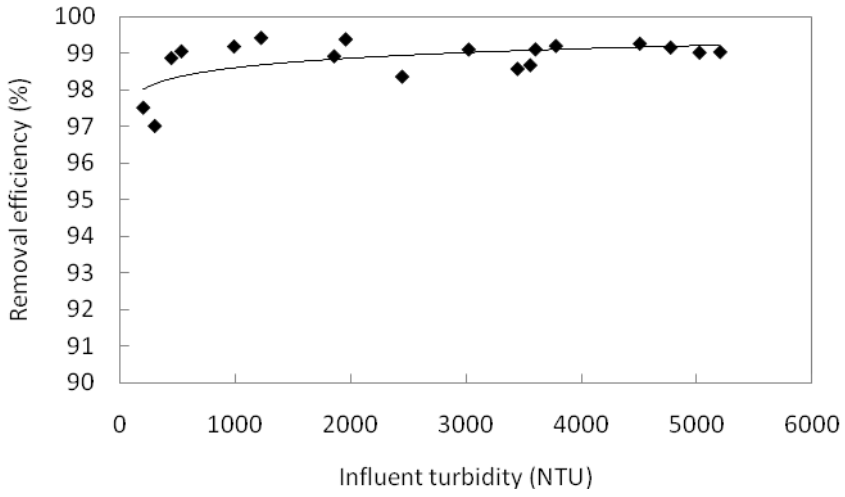


Figure 19 Removal Efficiency of WetSep Filtration System with Different Influent Turbidity (Source: Author, 2018)

4.4 Positioning and Marketing of WetSep

4.4.1 Urgent Market Need

Soil erosion due to water runoff is one of the leading causes of water quality problems in many parts of the world. Off-site environmental problems, such as sedimentation in streams and reservoirs and sediment-borne chemical pollution of

surface water bodies, have also become public concerns. The problem becomes more significant on construction sites due to exposure of the ground surface for erosion and potential for rainfall runoff, especially in Hong Kong where typhoons is a common phenomenon. Furthermore, construction activities like clearing, excavating and grading significantly disturb soil and sediment. If the soil in the construction site is not managed properly it can easily be washed off from the construction site during storms and potentially pollute nearby water bodies.

The construction industry has always played and continues to play a very important role in Hong Kong's economy. According to the Census and Statistics Department of Hong Kong Special Administrative Region (HKSAR), 'construction' contributes approximately 3.3% to the GDP in 2010 and employs 9.0% of the workforce in Hong Kong.

In Hong Kong, the urban runoff is discharged to the sea mostly by storm drain and box culverts. As a result, construction runoff carrying large amounts of soil and sediments block up the drain system and impact the environment. The traditional system such as imhoff tank and frac tanks were being used to treat the construction sewage due to its simplicity and cost-effectiveness. However, government regulations became stricter and public awareness of environmental protection rose, the construction sites needed a more effective system. Installing a conventional wastewater treatment at the job site, faced difficulties such as: space limitation, setting up, capital and operating cost and availability of skilled workers to operate. Cost and responsibility for treatment of wastewater from construction sites were borne by the General Contractors; thus, a solution for wastewater treatment had to be a turn-key operation that was user friendly and easy to operate. I realised this need and anticipated a strong future demand for treating construction wastewater.

As I had been working in the environmental industry for over twenty (20) years and had a basic understanding on mechanisms of the existing waste treatment technologies in the market, I used my professional knowledge and experience to develop this patented technology. With time, I kept improvising the design and presently the WetSep can be extended to treat wastewater from other sources besides construction. The WetSep employs chemical method to enhance the separation of pollutants from the wastewater.

Primarily designed for construction runoff, the WetSep system focuses on employing both chemical and physical technologies to separate suspended solids and other pollutants in water. It includes different technologies: coagulation, flocculation, static inline mixing, impinging stream reaction, cone filter, lamella plate and computerised fluid design (CFD). After treatment, the processed water can be reused or directly discharged into the urban storm drain or river nearby. The treated effluents meet established discharge standards in Hong Kong and can be simply adjusted to meet standards set by other countries. The WetSep system can provide a compact all-in-one system for the treatment plant. The WetSep filtration system only requires less than one six (6) m container footprint. It provides a safe and effective method for removing sediment from wastewater and the system requires minimal attendance of skilled labor or engineer to operate.

Later, in 2010, U.S Environmental Protection Agency (USEPA) implemented stricter regulations (Construction and Development (C&D) storm water rule) to reduce water pollution from construction sites. The rule required construction site owners and operators that disturb one or more acre to use best management practices (BMP's) to ensure that soil disturbed during construction activity does not pollute nearby water bodies. In addition, owners and operators of sites that impact more land area at one time will be required to monitor discharges and ensure they comply with specific limits on discharges. The use of chemical treatment is also available to remove the smaller particles which are difficult to settle to meet the USEPA discharge requirement. However, proper dosing, mixing, contact time and settling time are needed to ensure effective chemical treatment. Also, matching the right coagulants and flocculants to a specific sediment and water composition is important to ensure efficient treatment of the wastewater. This new regulation in the U.S. opened the opportunity to expand WET's operations. Currently, the WetSep filtration system has been applied to twenty (20) countries and has received global recognition.

4.4.2 Costing

Product cost includes the cost that is consumed to create a product. It includes manufacturing overhead, cost of direct labor and materials. Product costing is an extremely important component in evaluating and planning overall business strategies and become critically important to a business survival. It allows me to determine my

absolute bottom line. However, in most of my decisions, I compare the cost of storage in a country to the price I am being offered before making a decision to sell. The customer would not purchase the product if the price is set too high, but the company does not get enough profit to survive if the price is too low.

The first part of the product costing considers the range of factors which affect the price. Some of these are listed below:

- Volume and pumping rate of water being treated – larger clarifier or extra treatment may be needed causing the increase in the manufacturing overhead;
- Turbidity levels of the source water and reduction in turbidity needed;
- Water quality of the influent water; and;
- pH of the construction water.

Usually, the market value of a wastewater treatment with higher capacity (treating large volume of water) is higher than that with lower capacity.

The chemical cost is ($0.137 per m^3 of water treated). Substituting another chemical additive or polymer, such as chitosan, in the same system may increase costs, assuming they have similar performance characteristics. As with the other chemicals, the right chemical at the right dosage must be used for treatment.

Over the years, it was established that as an SME where 'Money can buy time,' adopting a strategy to maintain low risk and high margin has enabled SMEs like WET to survive despite limited financial resources. As a result of this realisation, WET operates on a 50% gross margin which is high and it usually avoids risky projects to maintain its reliability among clients. The detailed estimation of the running cost in the chemical and electrical consumption depends on each project based on the client's request. It varies with different design, influent water quality, types of electrical apparatus preferred. A specification on chemical and electrical consumption will be provided to each client for individual project.

4.4.3 Application of Patent

To have the right to practice or use the WetSep, application for a patent worldwide is necessary. Having a patent, I can enjoy the right to exclude others from making, using, selling, offering for sale, or importing the patent invention for the term of the patent.

First, I targeted the short-term patent in Hong Kong and discovered that there is a patent application grant offered by the Hong Kong government to assist the local companies and individuals to apply for patents of their own inventions. Through the grant, I successfully received the short-term patent thought the implementation agent in 1999.

In fact, the patent allowed me to enjoy the exclusive right of using WetSep, but also provided the recognition of the claimed technology, which helped in the marketing of the product. Therefore, I continued applying for patents in other countries including China, US, Australia, Japan, and so on.

The main reason for applying for the patent in China although WET did not intend to sell there was to prevent competition from Chinese copycats. This strategic move has truly benefited WET's operations worldwide. Had this not been done, copyright infringement could have simply reverse engineered the WetSep system and sold the same product for a cheaper price, forcing WET to reduce its profit margins.

In the case of the China operations, interviews were conducted with the current supplier base and engineering operations as that office was used for research, development and logistical support. Interviews with the supplier base allows for a better understanding of the downstream structure in China and how it currently functions with relation to current WET operations. The China office will also be the main office to handle the manufacturing operations for the WetSep unit. The interview questions were geared towards supply chain management, engineering support and logistical support questions. The outcome of the interviews has been used to analyse the capability of the downstream system in meeting the demands of the proposed business model and marketing position.

4.4.4 Standardising Products

In 2004, WET registered as an ISO certified company under the scope of 'Design, Supply, Installation and Maintenance of Water and Waste Water Treatment Equipment.' Later in 2009, WET registered under the scope of 'Design, Supply, Installation and Maintenance of Water, Waste Water Treatment Equipment and Green Roof Systems.' Within the context of the growth of international trade and global supply chains, ISO 9001:2000 is used by suppliers and customers located in different countries to establish confidence, or even select partners in the supply chain. This certification enables WET to win trust from international clients and potential suppliers. The standard for certification is that a company must have specific requirements for a quality management system, where the organisation demonstrates its ability to consistently provide a product that meets customer and applicable regulatory requirements. In general, this certification guarantees the standardisation of the manufacturing and delivery process and WET as well as the production of a standardised product for sale. The ISO 9001: 2008 certifies the same with a few amendments to the ISO 9001: 2000.

4.4.5 Securing Industry Recognition

WetSep being a very different technology and system needed some form of recognition in the market. It also needed to be viewed as a reliable, appropriate and the best method for wastewater treatment. To achieve this positioning in the market, instead of marketing it extensively, I chose to register it for certain competitions and assess its position in the market. These competitions not only gave WetSep some market exposure but also allowed me to build my social network and reach out to potential and interested public and private firms and some governments.

The international trophies are proof of the expertise involved in the product establishing that the country itself might not have the best technology for the given purpose and that the WetSep would be practical to use. In the end strategy, it is being assumed that the proof of expertise will ease the immigration permissions required for entry into the international markets. Below is a list of the awards won by the WetSep Filtration System.

Table 7 Awards Won by the WetSep Filtration System

Year	Award Name
2012	Partner Employee Award
2012	HK SME Business Sustainability Index
2010	Carbon Reduction Campaign
2008	Certification of Merit of HSBC Living Business
2006	Winner of Hong Kong Eco- Product Award
2005	Winner of The NOVA Awards
2004	Finalist of The World Technology Awards San Francisco, USA
2003	Silver Award of 6th Asian Innovation Awards Global Entrepolis in Singapore
2003	ISO9001:2000 Design, Supply and Maintenance for Water & Wastewater Treatment System
2002	Silver Award of 30th International Exhibition of Inventions
2002	Asian and Pacific Centre For Transfer Of Technology (APCTT)
2000	Silver Award of International Invention EXPO2000 – Hong Kong
2000	Winner of New SME Silver Award

(Source: Author, 2018)

Furthermore, these awards helped build connections with different people and provide memberships into elite societies. For example, I was a finalist for the World Technology Award, as a result, Waste and Environmental Technologies automatically became a member of the World Technology Network.

Besides entering competitions, a good way to market the innovation is by showcasing it in exhibitions. Participating in exhibitions offers a great opportunity for me to interact with technical experts from different industries and to get some feedback on the design. This also exposed me to new and upcoming technologies in my field.

The international exhibitions that I have participated in are as follows:

Table 8 World Exhibition Attended by WET

Year	Exhibition Attended
1999	JETRO Import Fair-Environment, Japan
2002	IFAT- Munich
2003	APEC -Thailand
2004	Sustainable Construction Work Management, Hong Kong
2005	Nexpo AICHI, Japan
2006	Eco Expo, Hong Kong
2007	The Innovation Expo, Hong Kong
2007	Bauma, Munich
2007	SIWW, Singapore
2007	HKTDC InnoDesignTech Expo, Hong Kong
2008	StormCon, Florida, USA
2008	IWWA Expo, Singapore
2009	ECO Expo, Hong Kong
2010	Sewage Works Exhibition, Nagoya
2010	Water 2010, Shenzhen
2011	Eco Expo, Hong Kong
2017	Shanghai New International Expo Centre (Include other recent conferences.)
2017	World Tunnel Conference – Bergen, Norway

(Source: Author, 2018)

The World Tunnel Conference inspired and reassured me of the efficacy of WetSep in tunnel constructions due to its uniqueness as a compact and comprehensive wastewater system, as well as its experience in the area. I now know about ongoing and upcoming tunneling projects around the world. In the conference, I noted that the tunnelling industry has become more popular through the years due to improvement in tunnelling technology, explicitly the tunnel boring machine. Malaysia and Melbourne, two densely populated cities are finally considering underground metro systems as the technology to accomplish the task, given the geographical conditions of the places, is finally available. Through the years, Turkey (Istanbul) and Norway have been recognised as top tunnel constructing countries. These are all potential markets for the WetSep. Considering that the conference is held in a different country each year, it provides the opportunity to develop a network of contacts in the industry.

4.5 Evaluating Hong Kong Success

4.5.1 Market Competitor Analysis and Differentiation

There are existing wastewater treatment systems used in construction site such as The Total Treat Continuous Precipitation System (CPS) from Siemens and sand filter. To gain the market share, I have explored unique advantages other than just water treatment. Apart from the high effectiveness in turbidity removal, the following is a list of benefits of the WetSep technology used in both the water and wastewater packaged systems:

- Environmental compliance to relevant standards and regulations;
- Simple engineering design;
- Easy installation and setup;
- Localised chemical preparation and storage;
- Equipment can be operated by unskilled labour;
- Low maintenance requirements as there are no mechanical moving parts;
- Small physical footprint of packaged systems;
- Low carbon footprint as very little energy is required to run the entire system (primarily gravity driven system);

4.5.2 Product Diversification

Different quality and quantity of the construction water produced required different size of the wastewater treatment system. To meet the customer requirement, production diversification is needed.

Four capacities of WetSep filtration systems (Generation 1) are provided for treating different volume of construction runoff. The treatment capacity of WetSep WS10, WS20, WS60 and WS100 are 10, 20, 60, 100 m^3/h (20-40, 70-90, 220-260 and 350-440 gallons per minute) respectively. The sizing chart for various models of WetSep is listed in Table 9. In general, WS 10, WS 20 and WS 40 are used for road work (40 GPM), building project (100 GPM) and site formation (250 GPM) respectively.

Table 9 WetSep Filtration System Sizing Table

WetSep Model	ISR Diameter (m)	Water Inlet (m)	Water Outlet (m)	Water Quality Treatment Flow (m^3/h)
WS10	1.6	0.08	0.08	10
WS20	2.2	0.08	0.08	20
WS60	2.4	0.08	0.10	60

(Source: Author, 2018)

4.5.3 Exploring New Markets

Though the WetSep System is mainly targeted on wastewater from construction site, the potential use of the WetSep is not limited to such. The WetSep Filtration System can be modified to have different configurations to cater to different site conditions.

In the remote area, the supply of electricity is insufficient. As mentioned, the electricity requirement for the WetSep system is very low, using simple M&E equipment, thus allowing the WetSep to be run entirely by solar energy. The flow rate starts from five (5) to sixty (60) m^3/h and all can be set up within four (4) hours.

Figure 20 Solar WetSep Filtration System

The environmental restriction on the use of strong acid such as use of sulphuric acid is to adjust the pH of the influent solution keeps getting stricter. The WetSep Wastewater Filtration System can be modified to use CO_2 neutralisation, a more environmentally-friendly method.

4.5.4 Internationalisation

The WetSep System is a patented product providing a turn-key solution for water and wastewater treatment. In 2000, it had been adopted by Gammon Skanska during construction of a HK$500 million ($64 million) sewage tunnel in Hong Kong. It has also been applied for contaminated soil treatment project and achieved 25 ppb in removal of Total Petroleum Hydrocarbon (TPH) from a retired Bus Depot. Apart from Hong Kong, WetSep was also applied overseas such as United States, Taiwan, Sweden and Australia. In Taiwan Pinglin tunnel project, the system treated wastewater of 300 m3/h underground at 250 m below the surface before discharging to the nearest reservoir. More than 150 installations have been installed around the world to date. Figure 21 shows the WetSep filtration system in New Jersey, U.S.

Figure 21 WetSep Filtration System in New Jersey, U.S.

The WetSep system has had an overall positive effect on my professional career. Over the years as more WetSep units have been sold in Hong Kong, my social network of professionals has increased allowing for further business growth. The knowledge and experiences gained from the development, manufacturing and sale of the product has increased my technical skill set that has allowed me to apply these experiences onto other environmental projects. Therefore, the WetSep unit produced a financial gain and increased the number of different projects I have been able to undertake over the years.

At first, the WetSep system did not comprise a large portion of the overall business, approximately 25% in the first few years. However, since 2011, the WetSep system comprised of approximately 45% of the overall business. Additionally, the international export of the WetSep system has increased from 0% since the start to approximately 10% in 2012 and is currently at 40%. The growth of the WetSep system has been a positive revenue stream for my company. The constant development and refinement of the WetSep product has also allowed my staff to learn new technical skills and allowed the workforce to become more skilled that contribute positively to the overall company. The following sections discusses the setup of operations in Australia and certain success and failure projects abroad.

4.5.4 Product, Services and Solutions Approach

After the launch and promotion of WetSep, I still believe it is important to develop a robust revenue model for WET to follow. In the current revenue model, there are many sources of income. Some of the approaches used have been explained below:

1. **Selling of individual units:** WET receives a lot of call ins from contractors around the world requesting units of the WetSep system to be deployed to their construction sites. They learn about the product from exhibitions, references and through competitions.

2. **50-50 rental arrangements:** WET had set up a 50-50 share rental business contract with Coates Hire. The details of this contract are explained in detail later in the report. In summary, WET gave them a free unit with every rental unit and Coates Hire had to share the profit from the rental units on a 50:50 basis.

3. **Maintenance and servicing of the units sold:** Having sold the WetSep units to customers, customers sign up for varying lengths of maintenance and servicing periods based on the duration of the project. Although a highly labour intensive process given the limited workforce of WET, it builds trust and proper customer relations and ensures a steady flow of income.

4. **Sales of complementary products:** The WetSep generation 1 operates on the use of multiple chemicals. These chemicals are bought from suppliers and then sold to customers. The profit generated from here is another source of income.

5. **Wide range of products and services sold:** besides the WetSep system, WET has worked on other projects such as green roofing and vertical gardening. WET has also provided solutions for mosquito trapping and aerated wastewater treatment system. By ranging out, WET has developed a safety net for itself and expanded its customer base to beyond construction sites.

6. **Solutions-based approach:** motivated and eager for challenges, I would often enter construction sites where I believed I could improve their process and would talk to the engineer on duty. This technique led WET to work on projects from the influent to the disposable or reusable effluent and waste. I would look at projects online and come up with whole solutions which utilised the WetSep, filter presses, sand filters etc to achieve the desired process such as dewatering. This is how WET entered a solution-based approach in the environmental technologies industry.

4.5.5 Incubation Programme - HKSTP

The Hong Kong Science and Technology Park has an Incubation Program. In the program, a government subsidiary is offered to selected company to set up business, and research and development activities within the Science Park. WET was accepted as an incubatee and graduated from the programme within 24 months instead of the usual 36 months.

As an incubatee, I received an office space to set up the business. This reduced the overhead costs borne by the company and enabled me to focus the limited resources of WET towards research and development as well as marketing. Incu-Tech is a 3-year programme provided by the HKSTP to its incubate to facilitate technology start-ups at inception stage. It mainly provides services for business and professional development. The programme is especially targeted at companies conduct research and development in green technology which is applicable for my company's development (Hong Kong Science and Technology Parks Corporation, 2014).

HKSTP also provided opportunities for fresh graduates to come and work for lesser wages, who had ideas to contribute to the company. Researcher Programme in TecFunding – Talent Development Support is one of the supporting programme provided by HKSTP to incubate to recruit full time graduate for research and development work (Hong Kong Science and Technology Parks Corporation, 2020). This can facilitate the company to strive for continuous innovation and product enhancement through research and development stage. The Hong Kong Science Park also organises many exhibitions and product launches which provided opportunities to publicise WetSep further.

Besides the services, incubation program also provides business support and financial aid packages. Overall, this program provided cash, rental and professional assistance to the company to enable its growth and establishment. The greatest benefit from joining the incubation program at that time was that it introduced the company to an angel investor.

4.6 Establishing WET in Australia

In Australia, the urban water sector delivers water and wastewater services to 17 million Australians and in the next 50 years, these services will be required for an additional 21.5 million Australians (WSAA, 2012).

Figure 22 shows consumption of the water usage of Australia's population in 2011. This distribution helped WET realise the different markets which can be catered to in different regions of Australia. For instance, while most states; Queensland, New South Wales, Tasmania and South Australia use water primarily for agriculture, some states utilise a higher percentage of water for household use (Australian Capital Territory). The graph also suggests that the mining industries in Western Australia and Northern Territory utilise a huge percentage of Australia's water.

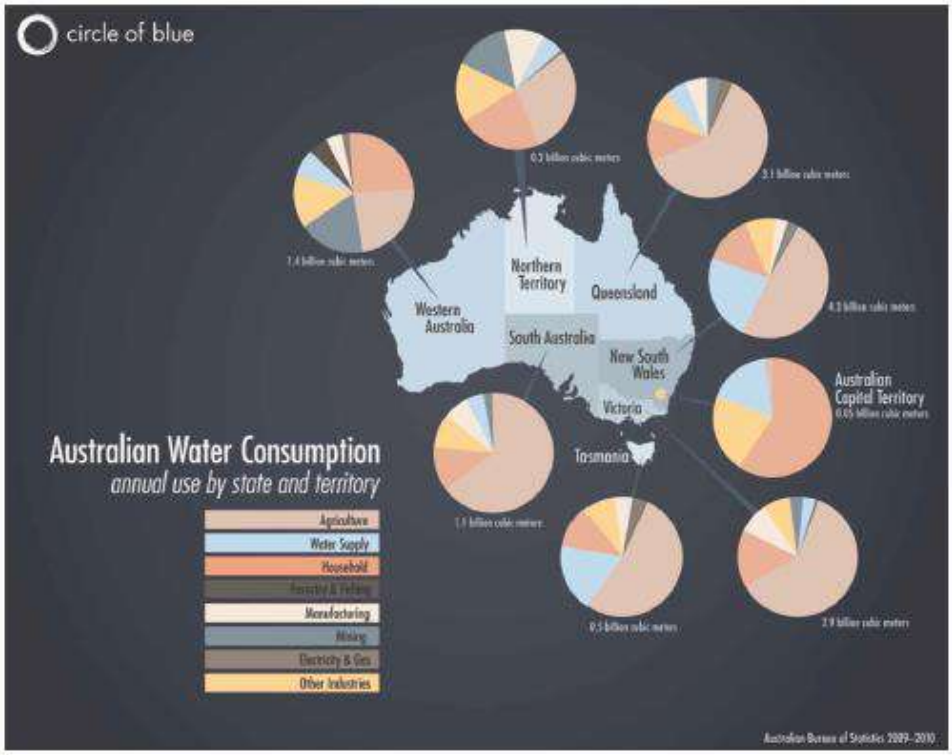


Figure 22 Australian Water Consumption
(Source: ABS, 2011)

In 1991, the Australian and New Zealand Environment and Conservation Council (ANZECC) was formed by combining the Australian and New Zealand Environment Council (ANZAC) and the Council of Nature Conservation Ministers (CONCOM). Later in 1994, the ANZECC in collaboration with Agriculture and Resource Management Council of Australia and New Zealand and National Health

and Medical Research Council came up with the National Water Quality Management strategy for Australia. The aim of this was to deliver a nationally consistent approach to water quality management. As a result, policies were passed which imposed disposal standards and measures on all industries and citizens of Australia and New Zealand.

4.6.1 Entry into Australia Market

In 1978, I undertook a lengthening project at the Hong Kong united Dockyard where I recorded the process by camera. Post completion, my album, a set of 6 photos drew attention among the Captain, officers and others at the Dockyard where my father worked. The album was then sold to other parties and the Captain offered me a free one-way trip to Australia. It was a risky trip but it was the breaking ground for WET's entry into Australia. The ship left me at Adelaide and I had to hitchhike to Sydney where I worked and saved money for a ticket back home. This experience allowed me to meet different people, all very nice and great in hospitality. It also gave me some cultural knowledge of the area.

Later in 1982, I started my own company- Leung's Engineering Services and my role was that of Bulk Material Handling Specialist. While in this position, I had to sub contract to the Fire Protection System for a coal fire power station from Wormald- an Australian Fire Protection company. This role and work gave me further insight into the work culture, criteria and work ethics of Australians and made WET's entry into Australia easier.

Some of the key insights which encouraged us to do business in Australia was their emphasis on Safety which is also a prime focus at WET where our slogan is "Safety first, Service Always." This was the point where we realised that as safety is a priority, the system must be simple to set up and operate. Thus additional features such as automatic dosing and the mobile container shaped treatment system was established.

Another important insight was that their environmental protection regulations are extremely robust, as a result environmental protection and water conservation is every individual and organisations' duty instead of just the Australian Government's.

This made us realise that a rental system might be better than regular purchase orders in such a market.

On 5th August 2012, Waste and Environmental Technologies Pty Limited was registered in the Australian Business Register as a private company. WET obtained a registered GST and ABN status.

4.6.2 Positioning in Australia Market

The WetSep system was positioned as –

"WET aims to provide appropriate and reliable technologies for water and wastewater treatment. The WetSep system was developed by WET in 1998 and has since continued to be improved and modified with our client's needs factored into the subsequent designs. In 2000, it had been adopted by Gammon Skanska during construction of a $64 million US sewage tunnel in Hong Kong. It has also been applied for contaminated soil treatment project. Apart from Hong Kong, WetSep is now sold internationally into such markets as United States, Mexico, Taiwan and Australia. More than 200 installations have been completed around the world.

4.6.2.1 Legacy Way

In 2013, I received a call from an associate in Australia who informed me about a tunnel project in Brisbane, the Legacy Way Tunnel Project. The project consists of two 4.6 km long parallel tunnels. Considering the strict water disposal standards of Australia, it was evident that they would require a comprehensive water treatment facility. Hence, we submitted a proposal to MECA the contracting company at that time.

The positioning statement for the technical proposal was that the system could be operated both automatically and manually and can be easily operated by workers with minimal training. This was used as the positioning statement as it is known that tunneling projects are huge projects requiring various expertise so it is unreasonable for them to hire more experts just to manage a secondary activity such as water treatment. A preliminary project schedule was also submitted to suggest the pace of setting up such a system. WET has been designed to be easily set up in foreign

countries. In projects like this, time is money so they require a fast setup and reliable system.

The proposal was for the design, supply, delivery, training and commissioning of the equipment. It was a solution that we were offering them instead of just the WetSep product. In the end, we received an acceptance for the proposal and started work.

At that time, we would only accept projects if they had an up to 60% gross profit margin to cover the risks of completing an international project.

4.6.2.2 Northwest Rail

Besides the Legacy Way Tunnel project, in the same year (2013) we received the opportunity to work on wastewater treatment plants for the North-West Rail contracted to Thiess John Holland Dragados West-Joint Venture. This was a big project which involved setting up water treatment systems in different locations; BellaVista, Epping, Castle Hill and Cherrybrook.

As mentioned previously, the concentration of constituents varies from location to location. It was necessary to visit the site and gauge the wastewater being generated and the standard of the effluent they require for each location and based on that come up with a proposal.

This project also helped realise that most tunnel projects need to move their wastewater treatment systems along the tunnel. As the WetSep system did not contain any moving parts, the time to move the system was minimal and the wastewater could be treated where it was being produced.

4.6.2.3 Coates Hire

Having completed the tunnel project in Brisbane, WetSep gained some recognition in Australia and later in 2015 I received a call from Coates Hire for a purchase order of four units. To set up a rental business in Australia we proposed to send them another free unit for every purchase order under a 50/50 Hire Revenue share agreement. This meant that we shall send them an extra unit which they can rent out to companies in Australia and earn a profit but they must share half of their earnings from the rental deals. To keep it flexible, WET also supplemented the proposal with

fixed prices at which Coates Hire could purchase each rental unit at the end of the first five years. The contract was designed in a manner to ensure that the payback period from the deal would be nine months.

As part of the proposal, we had to submit our design details and process details. This deal, turned out to work against us as there were two major issues that arose. The first problem was that although we had estimated a minimum and average level of revenue, it became difficult to tell how often the rental units were rented out. It so happened that the units given to them on a 50-50 basis were simply standby units for the company and were rarely rented out. It is also highly possible that they rented out the system off the books to avoid sharing their profits with WET.

Another major issue that arose from this international deal is that eventually they copied the design and started manufacturing the unit themselves and selling it. As a result, they had no need to purchase more units from WET, furthermore they became WET's direct competitor making it difficult for WET to set up a proper rental business in the Australian market.

4.7 Analysis and Examples of Internationalisation

WET has already successfully completed projects in 17 countries and failed in many others. The following case studies discusses some of the key learnings from the successes and failures experienced. These learnings will enable me to develop a more comprehensive strategy for the expansion of global operations.

4.7.1 US

In 2005, I received the World Technology Award in Florida. On my journey back, while walking through New York, I came across a flooded construction site. It then struck me that the WetSep system would truly benefit such a site and I decided to call the equipment providing company Ground/Water Treatment and Technology Inc (GWTT). I then proposed selling them a few units of WetSep for them to lease out or sell in the United States of America. When they learnt about our technology and its unique features, they were enthusiastic to work with us and they ordered four units for purchase.

The United States of America is a big country and there are many parts that are shifting from a manufacturing hub to a commercial centre. Thus, a lot of remediation work is required for ground water treatment. Although GWTT is a good partner to work with, their reach around the country is not as strong.

There is also heavy competition from two well-known companies; Rain for Rent and BakerCorp. Rain for Rent is a leading provider of temporary liquid handling solutions including pumps, tanks, filtration and spill containment where as BakerCorp is an industry leader in temporary containment tanks, pump, filtration and shoring equipment rental solutions. These companies tend to recommend the use of frac tanks for sedimentation and do not suggest treatment techniques. As a result, it has become the industry practice to only conduct sedimentation. To introduce the WetSep into the market, we sold a unit to rain for rent and showed them that one WetSep can replace 5 frac tanks. Thus, WetSep is not only good for treatment but can also be used in tight spaces.

WET and Ground/Water Treatment and Technology LLC (GWTT) has a business corporation, such that GWTT helps WET to push the WetSep system in the US market. GWTT offers both sales and rental services for the WetSep system for the US clients.

4.7.2 Singapore

The Public Utilities Board (PUB) was founded in 1963 to manage the city state's utilities (water, power and piped gas) and from 2001 it has been solely responsible for Singapore's water, drainage and wastewater services (Owen, 2013). During this period, it has developed the most advanced and comprehensive water management systems in the world and potentially the first that manages water resources in an urban area in a manner which resembles the natural water cycle. This suggests that national, economic and environmental sustainability can be interlinked. Apart from ensuring an efficient and sustainable water management network, PUB also integrates the values of giving and sharing into its business practices and philosophy. PUB advocates being responsible and caring toward both society and the environment, exemplified through its Corporate Social Responsibility (CSR) framework.

Singapore has implemented the Earth Control Measures (ECM) program in construction sites since 2006, aiming at preventing silt from polluting the waterways and generating bare surfaces. Therefore, contractors are required to implement an ECM plan with PUB, Singapore's national water agency, designed and endorsed by a Qualified Erosion Control Professional before the commencement of work (Kong & Leung, 2015).

In January 2005, Public Utilities Board (PUB) signed the S$226 million Marina Barrage construction contract with Koh Brothers Building and Civil Engineering Contactor (PTE) Ltd. One of the objectives of building this dam was to convert one-third of Singapore into a catchment area and allow it to flow into the reservoir and store freshwater. A major challenge of this was controlling the silt running into the water. Thus, they were looking for solutions in erosion control. Seeing this as a good opportunity, I decided to ship a few WetSeps for trial. Eventually the WetSep gained popularity in Singapore.

In 2008, an existing customer in Hong Kong ordered 60 units for purchase to be delivered for a project and to set up a joint rental business in Singapore. This was a big deal for WET but turned out to be a wrong decision later. A few years after selling the units, I discovered that the same customer copied the design and set a production warehouse in Malaysia and was selling in Singapore. This discovery forced us to set up an independent office in Singapore.

Another reason for setting up the Singapore office was to manage the business development for South Asia and Australia. This experience gave us a first-hand knowledge into the Singaporean work culture which ought to have been known before entering the market. Most of the labour force in Singapore are from neighbouring countries such as Malaysia, Thailand, Philippines and India. This diverse mix of labour made it difficult to control the operations in Singapore from Hong Kong.

As part of a business growth strategy, we also decided to partner with a Singaporean Company to set up operations in the Middle East. Early in this partnership I realised that Singapore focuses on sales and management and not as much on engineering projects and design. They prefer outsourcing those responsibilities. It is however, important to mention that the Singaporean Government is still very innovative. Another important learning from this partnership was that as Singapore

bears close relations with Israel, they often find it hard to get permits to work in Middle Eastern countries due to political and religious conflicts.

Overall, the entry for a Hong Kong company into the Singaporean Market is easy. However, running an engineering based company is tough. It eventually became difficult to sell and rent out WetSep units in the small and highly competitive market of Singapore due to the many copycats. Also, as the Singaporean Government competes to make Singapore the most important financial hub, engineering companies do not receive enough support. Furthermore, the diverse labour force makes it slightly more difficult to operate.

4.7.3 UK

On 28th July 2016, the EDF board approved the construction of Hinkley Point C nuclear power station (HPC) in Somerset, England, which has an estimated construction cost of 19.6 billion to 20.3 billion pounds. A few days later, the same project was approved by the UK government with some safeguards for the investment. Financing of the project is yet to be finalised, but the construction costs will be paid for by the mainly state-owned EDF of France and state-owned CGN of China.

Balfour Beatty Limited was selected by EDF to deliver the Hinkley Point (HPC) inlet and outlet cooling water tunnels. They intend to use three tunnel boring machines for the construction and as a result require wastewater treatment solutions. I received a cold call from the company to send them a proposal for a packaged wastewater treatment plant. They had received a referral from one of my previous clients. They were not looking to purchase only the WetSep units but wanted us to design an entire water treatment facility for their construction operations.

4.7.4 South Pacific Islands

The South Pacific Islands of Kiribati, Fiji, Papua New Guinea and Tonga are some islands which have been facing water issues. These countries depend on the Asian Development Bank to provide them funding for their water management projects. Below is an example of the issues Tonga and Fiji are facing with respect to wastewater management plans and how WET attempted to enter the Fijian market.

4.7.4.1 Tonga

With a population of only 103,036, Tonga has difficulty in providing fresh water to its citizens. With most of the people settling around the Fanga uta Lagoon and all factories disposing their waste into the lagoon, Tonga is struggling to find alternatives for clean water. Due to the dense settlement, it is extremely difficult to set up pipeline infrastructure to a centralised wastewater treatment facility without displacing people. Thus, as an alternative, a decentralised system is under consideration.

4.7.4.2 Fiji

Fiji is a country in the South Pacific Ocean and surrounded by several neighbouring sister islands, including Tonga, Niue, Samoa, Vanuatu and New Caledonia. Fiji is a country blessed with natural scenic beaches and is well known for its sugar production, garments and tourism industries. These are the three major industries which drive the Fijian economy (Narayan & Prasad, 2003).

The water supply is managed by Fiji Water Authority (FWA) where they use ground water and river as sources within the water treatment facilities.

The scenic beaches in Fiji bring a significant amount of income from the tourism industry. However, whether there are rules and guidelines to protect these beaches or not, the beauty of these beaches is threatened daily (Rathnayake, et al., 2014). Other water management problem faced by the people of Fiji are with regard to the rising sea levels, changing weather conditions leading to regular droughts and flooding and increasing tourism activities which are straining the water resources to the country. Furthermore, Fiji being an island country with all the islands far apart from each other makes it extremely difficult to lay down pipelines to build a centralised system. Hence is such a geography, a decentralised waste water management system appeared to be appealing.

In 2006, Pacific Waters consulted the country and helped it plan its approach to water resource management. The table below was developed to help the country overcome its water issues.

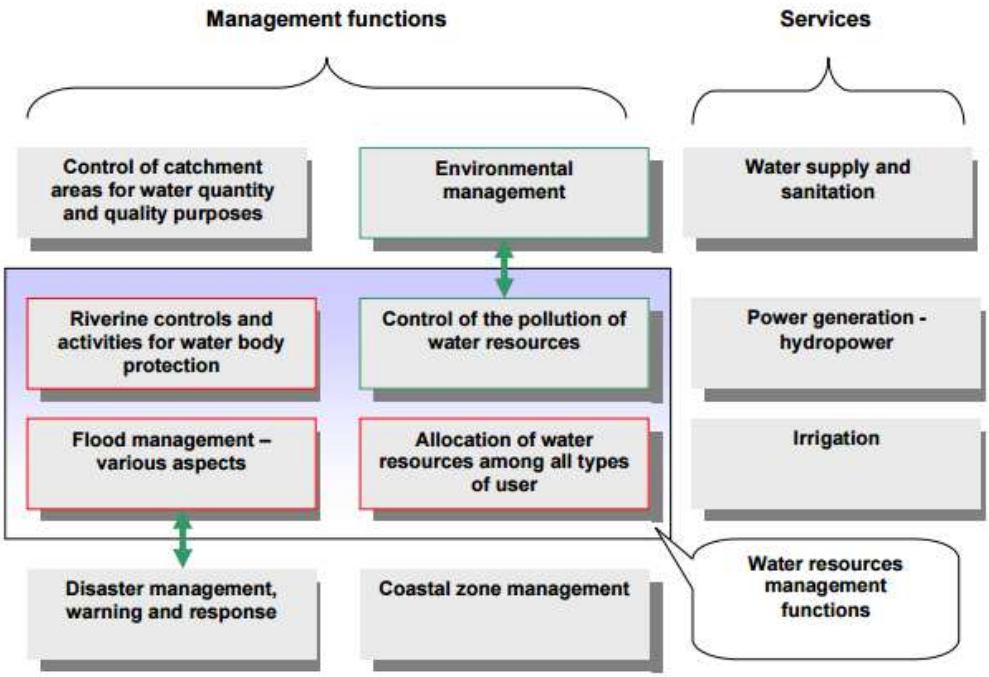


Figure 23 Water Management and Related Function of Government in Fiji
(Source: Narayan & Prasad, 2003)

Thus, while planning, some of the key considerations in the future projects are environmental management, water supply and sanitation, control of the pollution of water resources and allocation of water resources among all types of users.

In 2010, WET was assisting Fiji to conduct a study on the Island country's water issues, Fiji was planning to purchase 50 WetSep systems for a total cost of $115 million to improve their water environment, the project was sponsored by Asia Development Bank. In opposition to building six treatment plants, the WetSep system was supposed to be installed in strategic locations around the country to improve water and sewerage treatment. An example of a sample solution alternative (appropriate technology). The project was aimed at improving the living condition of the Fiji's residents by refining the water management system.

According to an article published in "The US Fiji Times," Mr. Tony Fullman the chief executive officer of Water Authorities of Fiji stated that the WetSep system is environmentally friendly as it uses solar power, releases treated waste into the environment and will reduce the country's fuel import bill. He also mentioned that this solution would take just six months to install whereas the 6 treatment plants would take up to two years to construct. Another advantage identified by them was that the

system requires less maintenance (on a six-month basis) and less space. The water supply from these systems are sufficient to serve up to 10000-20000 people which fits the population distribution of the islands.

The Asian Development Bank (ADB) approved a loan of $47 million from its ordinary capital resources on 8 December 2003 for the Suva–Nausori Water Supply and Sewerage Project. In January 2009, the Government asked ADB to provide supplementary financing to cover anticipated cost overruns for the Project caused by factors beyond the control of the interim Government, including rising global commodity prices and the depreciation of the US dollar against regional currencies. As contracts are usually denominated in US dollars, its depreciation resulted in construction costs that were substantially higher than estimated when the Project was appraised.

The original project rationale remains valid as the provision of reliable and sustainable water supply and sewerage services, and improvement in public and environmental health, are high priorities of the Government and major concerns of the people of the Fiji Islands. The Project supports the development policy objectives articulated in the Government's draft Strategic Development Plan, 2007–2011. The Project also supports ADB's Water Policy by (i) improving and expanding the delivery of water and sewerage services, and (ii) increasing water and sewerage service efficiency and sustainability through institutional reforms.

The Project contributes to better living standards in the Suva–Nausori Region, particularly for the urban poor. Outcomes from the Project include (i) increased delivery of safe water supply and sewerage services in the Suva–Nausori area through physical and Institutional improvements and (ii) enhanced the sustainability of water supply and sewerage services throughout the Fiji Islands through institutional reforms.

Through the years of 1987 and 2006, Fiji experienced three military coops that were ethnic and religious divisions based. In the last coop of 2006, authoritarian ruler Bainimarama rose to power. The then Fijian Army Chief of staff, Lieutenant-Colonel Ratu Tevita Uluilakeba Mara, was unsatisfied with the leadership and was accused of plotting to overthrow the government.

Consequently, investigations into the then Chief Executive of the Fiji Water Authority, Mr. Tony Fullman, began as it was discovered that they were close friends.

As a result, the wastewater treatment plans and the trial installation of WetSep units was cancelled. This illustrates that situational factors are at play and that these can often exert impact on the product.

4.8 Geographical Expansion

In terms of promoting the product market on an international scale, it is important to recognise and flexibly address the specifics of the market.

4.8.1 Vancouver, Canada

The WetSep system was installed for a mass transit infrastructure project to treat construction runoff consisting of high volume of silt. Hence the positioning was – a mobile silt management solution with over 99% removal of suspended solids.

4.8.2 Washington, US

This project was operated by one of the top construction companies in the U.S., JE Dunn Construction. The WetSep system was used at the construction site of a new government building at the U.S. Port of Entry to Canada in Blaine, Washington. A WetSep 40 was used to treat and discharge construction wastewater from the site.

4.8.3 Mexico

High volume of wastewater from the textile industry (i.e. dyeing, processing and printing) was treated using WetSep in Mexico. Effluent from different stages in the process requires special attention to ensure that the treated water meets the required water quality standards.

4.8.4 Sweden

The WetSep system is currently in operation in Sweden to treat construction wastewater produced from tunneling work and excavation for a Hydro-Electric Power Station. Two (2) out of the four (4) generators at the Hydro-Electric Power Station will be replaced. New tunnels are being blasted and the excavated material removed.

4.8.5 Taiwan

WetSep is a designed to be flexible and strong resistance device that can fit in different industries and locations, such as a tunnel. A customised WetSep device was setup and configured in Taipei, Taiwan, designed to handle additional incoming flow rate of the wastewater from tunneling.

4.9 Mapping a Global Marketing Strategy

Waste & Environmental Technologies Ltd. (WET) won the Small-Medium Enterprise Silver Award back in the year 2000. The developing business strategy so far has been to specialise in providing technological-based solutions to environmental problems. After all these years, the most successful and sustainable business product as with regard to sales is the Water & Wastewater Filtration System (WetSep). The WetSep product is a patented packaged treatment system that has been used successfully for water and wastewater treatment applications in over seventeen (17) countries since 1998.

Upkeep of WET's local Hong Kong client base is an important part of the core business. However, due to the rapid pace of infrastructure development currently in Hong Kong, and it is considered as secondary machinery (i.e. not machinery for production (money making) in the construction sector where it is has applied for many years locally in Hong Kong. Along with the current market conditions, the local market is driven heavily by the sale price of the product. The aggressive pricing structure currently needed to have successful sales puts a downward pressure on profits.

An alternative business model such as setting up a rental fleet or franchise should be considered and/or established for the International Market or Licensing.

The current focus for WET's business development is to grow our international sales for the WetSep product. Over the last few years, due to increased government regulations to improve the water quality of wastewater discharges around the world, there is an increase in the potential market for the product. Along with the increased government regulations, WET has identified through various business connections that international organisations such as the Asian Development Bank (ADB) have funding for development of water and sanitation infrastructure in the South Pacific. Therefore,

through increased government regulations and studying the market trend, there is a large and growing international market to be tapped for growth of the current business.

The growth in the international business is not only a source for increased revenues but also an opportunity to understand other countries requirements in the field of water resources. Not only are the technical issues being investigated but an understanding of local cultural, economic and environment factors is also being done. This additional knowledge base will allow for further improvements to the WetSep to manufacture a better product for current and future clients around the world.

In an ever-changing global marketplace, a company should develop a Global Marketing Strategy to adapt to various markets and situations. The goal of this research is review the current WET strength in global marketing strategies. Specifically, a review of company structure will be done to understand what current practices should be improved. Along with a review of the marketing strategy, a review of the existing literature related to marketing in the environmental sector. The environmental sector that inclusive of government, developer, and even pressure group is unique in the sense that there are many stakeholders that have a vested interest in the outcome of any water and wastewater infrastructure project.

After a review of the existing literature has been completed, a more detailed comparison of WET's current practices and the practices that are used by other SME's in the environmental sector. The goal is to take the best approaches found and see if a unique Global Marketing Strategy can be created for WET. Based on a brief review of the existing literature, there is little information on developing a marketing strategy for SME's in the environmental sector and also for Hong Kong. The final strategy would have to be simple that optimises both staff and financial resources to have the greatest impact to grow the sales as both resources are limited. The strategy would also be flexible to adapt to various different requirements for each unique project and incorporate social, economic and environmental concerns.

In conclusion, the case study of WET shows that both qualitative and quantitative factors are important in determining the directions of its internationalisation process. By taking steps to obtain the patent at an early stage, it helps to offer a more sustainable platform for business growth and development, and has strong relevance for the long-term growth of other SMEs.

Tracing the innovation of WetSep, I set out to explain how the approach of 'Ideation out of desperation' fosters product development for an SME like WET. I discussed how I positioned and marketed the WetSep system in the local market and simultaneously built recognition for the brand in international markets including e.g. Singapore, the UK, Australia, South Pacific, Canada and Mexico. I covered the strategies to make SMEs more rigorous such as standardising products and establishing industry recognition.

Other than addressing the application of technology and my marketing strategy, I also introduced the various revenue models involved in setting up my head office in Hong Kong with the help of the Hong Kong Science and Technology Parks Corporation (HKSTP).

To summarise, the section sheds insights on the cost-effectiveness of expanding into new locations and the factors taken into consideration in the process. In this way, I aim to explain the entry, positioning and challenges faced by WET as a 'born-global SME', Hong Kong-based company, and its relationship with China. Understanding and developing 'guanxi' (connections) would be an important asset for businesses in this challenging century.

5. Project Findings

5.1 Overall

In this chapter, I capture the project findings, including the use of partnerships and the value of understanding the strategy to expand research and development to build up expertise. This expertise is not limited to knowledge and experience, but extends to Asian culture, or the Chinese way of 'Guanxi'.

In this research, I have summarised SME leadership experiences in preparing WET for internationalisation. To provide context, I have outlined a literature review into the relevant sector. The literature review reflected on some key concepts, like internationalisation of SMEs, social capital, international strategy for small enterprises, conventional wastewater treatment system, social impact and others. These concepts pave the way for the future direction that WET would like to undertake. I have analysed business challenges from multiple lenses: the environmental, economic and financial, societal and technological advancement. My research project report begins with an introduction of my background and the circumstances that the company was founded, with rationales for its business model in Hong Kong as well as the invention of the WetSep. It gives a briefing on the current reputation and market reach of the company. From mapping business experiences and problems to identifying the right strategy for the company, I derive findings from WET's case study that have implications for SME companies.

The WetSep system was designed to meet a need in the construction industry for wastewater treatment. The system has been successfully used in many applications around the world but predominantly here in the local Hong Kong market. Since the first generation of WetSep (1998), there have been many small and major improvements to enhance the performance of the WetSep system or to incorporate new features for customers. Recently a modular WetSep system (2nd) Generation has been developed to enhance the flexibility of the system to meet a wider range of applications. It is this second generation WetSep unit that is the focus of my company's growth in the international market. The goal of my DProf study was to produce a structured business model and marketing strategy to increase the sale of the WetSep overseas.

In terms of methodology, I approached the subject matter via business research. By analysing the challenges in WET's internationalisation in Australia, Singapore and other international projects, one is better able to understand the issues faced by an environmental engineering SME in globalised business environment. Finally, I provide a detailed analysis of the business model and marketing strategy adopted for the long-term internationalisation for WET. My findings support that the 4 Is—innovation, incubation, intellectual property and integration—are crucial in promoting the success of SMEs in internationalisation and business operation. Moreover, key resources, key activities, key partners and market characteristics are important attributes for internationalisation.

While general interviews with my staff and clients were conducted to understand the sentiments within the organisation and among stakeholders, the multiple case-study approach is what was primarily used to objectively recommend on the future direction for the organisation. The methodology and perspectives in this study allow for the applicability of the case studies to other contexts and business operations beyond the waste management sector. It is hoped that this report will allow other companies to learn from my mistakes and avoid them as well as learn about the things that has worked for me and encourages them to apply those things to their own businesses.

5.2 Financial Resources and Funding

Banks are usually not willing to lend money to small-medium enterprises (SMEs) looking to globally expand due to the high risk involved in such a strategy. Also, most countries are currently closing its doors to immigrants to provide more opportunities to their own citizen making the process riskier.

To tackle these issues, I hope to leverage on awards which the WetSep has won for its innovativeness, efficiency and design. As seen in the Singaporean Case Study, the company and I could easily enter the market and obtain work visa as WetSep had won a silver medal in the 6th Asian Innovation Awards organised by Global Entrepolis in 2003. The award had been presented by the then prime minister of Singapore Mr. Lee Kuan Yu.

While countries try to close their doors to immigrants, they are still trying to ensure that some expertise manage to enter through. The awards won by WetSep, establish the system and my expertise in the field. As a result, I believe that this can be leveraged to enter new markets and even obtain funding from financial institutions.

Considering that the manufacturing plant is in China, to set up reliable distribution channels, shipping companies (or a good forwarder) is an important partner. Besides that, setting up proper customer relations with tunnelling companies and government representatives is important to ensure that they hire WET for upcoming projects and grant permission to conduct operations in the new markets respectively.

To set up the rental operations, it is necessary to partner with honest parties, who would be willing to share revenues fairly. The partners must also possess proper connections and a good location to be able to attract rental and purchase opportunities.

Below are some of the proposed standard strategies to be followed to establish the key requirements mentioned above.

5.2.1 Partnerships

As stated earlier, finding the right partners is an important step. For this reason, I propose to conduct business only with partners who have proven to be trustworthy in the past.

When it comes to setting up new partners, I shall choose to be picky and only select partners who meet certain criteria. For instance, new partners might receive a revenue share model where WET receives a greater percentage to reduce the payback period from the investment, hence covering the risks of doing business with them.

From experience, I prefer not to go through middlemen contracts for projects. The main reason for this is to maintain the guarantee and trustworthiness of the WET brand name. I have been approached multiple times by consultants who see the potential of WetSep and hope to employ the system in other parts of the world. However, the problem in such transactions are that the trader might tend to find the cheapest solution for the process which need not be sufficient for the end user's requirements. Hence, when the system fails, all the liability is borne by WET.

5.2.2 Incubation Programmes

The HKSTP Incubation Program in Hong Kong proved to be highly beneficial to the set-up of WET in Hong Kong. Similarly, it is anticipated that by registering for incubation programs abroad would give the company access to funding, partnership advice and overall business support to operate in the unfamiliar market and be cautious of regulations and political aspects.

5.2.3 Global Internationalisation for WetSep

In Asian cities like Hong Kong and New Delhi, there are more public-pool facilities. Whereas European and Australian cities have more private houses, hence private pools. In these European and American countries, it can be observed that due to the mass demand for private pools, many swimming pool hardware stores have been set up which cannot be seen in Asian cities. These stores sell swimming pool cleaning products, parts, tiles and other things. The wastewater treatment system can be juxtaposed to the swimming pool industry.

In the world, there are currently two types of markets for the wastewater treatment systems. One market is where the governmental regulations for water and wastewater management are not stringent, as a result wastewater treatment is primarily undertaken by government authorities and some global organisations for Corporate Social Responsibility (CSR) purposes. The second market constitutes of a market with strict regulations because of which individuals and as well as private organisations takes a more active role in wastewater management, for example Australia. WET proposes introducing the rental system with services in the second market as such a market often requires wastewater treatment for short term activities as well which might be less than 3 months and they might not have enough funds to afford a full system.

Having decided to get into a rental business instead of selling individual units, there are two main strategies that can be approached, the first being setting up WET's offices in each country, selling and renting WetSep units whereas the second strategy would be to partner with Equipment manufacturing and rental companies and selling WetSep units to them under a revenue sharing format. Each alternative has its pros and cons which is discussed in detail through the rest of the report.

Another concern while deciding the best strategy for WET is the capacity capability. A main reason why WET is steering away from selling to individual clients directly is because in such a business marketing plays a huge role in obtaining clients in the long run. From the case studies, it is evident that building customer relations is a weak point of the organisation and all the burden falls on a single person. Thus, to minimize this burden, it is proposed to reduce the number of clients by simply creating a rental model.

Figure 24 Rental Model for WET
(Source: Author, 2018)

Given that the final stance is to expand in a city and create rental site offices, this can be achieved by focussing on two (2) entry strategies as shown below. Both strategies have one common approach and that is of first obtaining a large-scale project which can easily absorb the high costs of set up and act as the sustainable source of income in the new market despite ups and downs experienced in the first few years of set up. The first approach is to target large tunnel projects in specific countries and sell the WetSep system to them. The second approach would be to target large scale wastewater treatment projects planned by Governments for the welfare of the country. From the case studies, it is evident that WET has experience in both kinds of projects and it can use this experience to leverage on more projects but as resources are scare, WET must decide which approach is marginally better considering the benefits and risks of each.

Entering a new market and setting up operation for an SME is a time and money consuming process as a result there is a risk of bankruptcy. To combat this risk, I have come up with two strategies:

1. Tunnel Projects
2. Slurry Treatment for Urban Construction and Demolition Waste.

The basis for choosing these types of projects as the entry point is because both strategies have a high revenue earning model for WET to help it tackle uncertainties involved in the setup process. The business model for each strategy has been discussed in more detail in section 6.4 of the report.

5.3 New Product Development at WET

Innovation is one of the key competitive advantages of WET and appropriate technologies and KISS are the main approaches to innovative designs according to myself. Thus, we hope to come up with a new patentable design by February 2018.

The new aim for WET is to increase the efficiency of the system. Efficiency of a wastewater treatment system can be achieved by improving on multiple aspects; the size of the system, variety of contaminants treatable (purity of effluent) and volume of water treated in a specified period. WET has decided to focus on improving the variety of contaminants treatable as by doing so, it can further expand to other industries, such as the paper, mining and textile industry, sewage treatment and maybe even storm-water treatment. This will in turn benefit the rental business by increasing the client base.

By designing for a system which can handle heavily polluted wastewater, that is sewage; the system would equivalently be capable of handling less polluted wastes from the mining, textile and paper industry. As discussed in the literature review, the conventional wastewater treatment process involves a primary, secondary and tertiary treatment. The technique has always been implemented as a process; but at WET, we hope to design it in a chamber system to the greatest extent to maintain the size of the WetSep system.

The core of the design shall remain the same; a combination of an Impinging Stream Reactor (the master unit) and a modular flexible secondary treatment unit. The Secondary treatment unit would typically be a lamella gravity settler that effectively removes suspended particles at a much smaller footprint than traditional wastewater treatment systems. For easy transportation and shipping, the system will be set to a standard size of 20 feet or 40 feet shipping container frame. As done previously, the new system can be separated into two (2) three (3) m (10’) offshore container modules. This modular system is a flexible and versatile design that allows more freedom to how it can be assembled using coupling parts.

Although WET uses some environmental-friendly chemicals as coagulants, I believe that we can do better and eliminate the use of chemicals which might end up polluting the effluent. Hence, I am currently looking for alternatives and believe that electrocoagulation might be able to eliminate the need for chemicals in wastewater treatment.

To the Impinging Stream Reactor and Settling tank (secondary treatment), WET is working on a design to include electrocoagulation (for chemical-free treatment) as well as other advanced oxidation process (for tertiary treatment) to the chamber. Although there is enough scientific research on the topic, this combined chamber treatment has not been implemented yet in wastewater treatment. The rest of the section shall discuss the scope of the design and the research approach that will be employed briefly.

5.3.1 Appropriate Technology and KISS Principle

As discussed in the case study, I am a strong advocate of Appropriate Technologies and KISS- Keep it simple, stupid. By using these concepts in designing, I ensure that the technology is easy to use by all and there is very little input that goes into the process making the system very standardised for all countries.

When aid money comes into developing countries, there will be a shortage of skilled engineer or labour capable to operate and maintain the system. To apply Appropriate Technology and KISS at the design stage, it would be easier to practice train-the-trainer in order to spread knowledge and skills with much less effort and more sustainable.

5.3.2 Design Considerations for a Global WetSep System (2nd Generation)

In the global market, the competition level increases exponentially as the company tends to compete with the local competition as well as international competition in that industry. Also with time, there are new entrants and it is essential to continuously improve on the design to stay relevant and ahead.

The first generation WetSep system was initially designed nearly twenty (20) years ago in 1998. As with any product, various research and development refinements have been made over the last decade to refine and improve the WetSep system. Some

of these refinements have been successful and other refinements have not been as successful to improve performance. At WET, the direction and focus of research and development is determined by:

1. **Client Demands:** Clients are a main driver to make improvements to the WetSep system as they are essentially the end user for the product. The end user is generally concerned with the operational and maintenance aspect of WetSep system as this is the most impacted area for them. This area will incur the most cost over the operational life of the system. There have been improvements to reduce the operational costs and reduce maintenance requirements by introducing new methods and technology such as simplified electrical controls for easy operation.
2. **Government Regulations:** From time to time, government regulations are modified or added to require different discharge requirements that have required modifications to the process and/or machinery to be compliant. Different jurisdictions require different standards. For example, to acquire approval for the State of Washington, only chitosan can be used for the chemical treatment because of the residual effects of the chemicals (chitosan is bio-degradable) being discharged into the surrounding environment.
3. **Integration of New Technologies:** Since the initial introduction of the WetSep system in 1998, there have been new technology and upgrading of existing technology to have more efficient designs and/or improved functions. For example, the WetSep has been recently installed with an updated Programmable Logic Controller (PLC) to allow a more streamlined control for the system. The previous system relied on a relay control panel system that required more manual input.
4. **Cost Implications:** Technology and manufacturing processes have improved over time making them either more efficient and/or lower production costs. The WetSep system has incorporated the upgraded components at lower costs to overall improve and lower WetSep's manufacturing costs. This has allowed the WetSep to remain competitive in the marketplace.
5. **Market Share/Competition:** Due to local and international competition and maintaining current market share, constant monitoring of competitor's designs

is necessary to ensure that the WetSep system offers equivalent and/or superior options and functions to meet the Client's needs.

6. **Innovation:** Based on observations and field tests of the performance of the system, improvements to the design and process have been made recently such as introduction of electrocoagulation and positioning of the different processes to optimise on space versus efficiency. The new innovations will be incorporated into new patents for the second generation WetSep.

5.3.3 Electrocoagulation in Wastewater Treatment

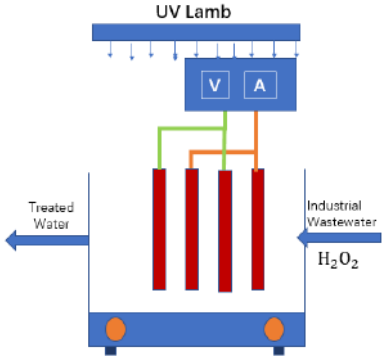


Figure 25 Combined Chamber Process - H_2O_2, Ultra-violet and Electrocoagulation (Source: Author, 2018)

Electrocoagulation is not a new technology to be used in wastewater treatment. However, it has never been implemented in a chamber process and certainly not in combination with other technologies as shown above. Scientific research has gone into establishing that such a system, as shown above, can be developed but it hasn't been accomplished on a large scale. The reason for opting this technology instead of the recently developed anammox is because I prefer to improve the system with treatment approaches with a proven record of performance.

As of July 2017, the electrocoagulation was in testing process. A test kit was purchased to check different spacing between the aluminium and iron electrodes as well as to identify the optimal flow rate. The next step is to conduct tests using the six-channel chart recorder to gather information such as dissolved oxygen level, air flow, temperature, UV, voltage, conductivity and pH. While the voltage can be controlled the current applied is accordingly adjusted based on the resistance applied according to Ohm's law. The conductivity of the wastewater can be controlled by adding Sodium Chloride salt to the water. The turbidity of the water cannot be adjusted. It has been

anticipated that the source of power must be from an alternating current source in order to obtain a square wave to avoid the rapid wearing out of the anodes and cathodes.

WET believes in sustainable inputs in the wastewater treatment process. Following the footsteps of Tanac, developer of Tanfloc a range of environmentally safe coagulants and flocculants for drinking water and industrial effluent treatment. It produces its chemicals from the bark of *Acacia mearnsii* tree, which is biodegradable and is mostly used to treat water from the leather industry. This material is not strong enough and must be used in combination with other coagulants to meet desirable results. Other biodegradable and natural coagulants which are being looked into are bean curd wastewater, seaweed, tapioca and sweet potato.

WET entered the partnership with Thailand. WET recently signed the Memorandum of Understanding with Thailand Institute of Scientific and Technological Research (TISTR). This partnership is an attempt by WET to remain updated on new developments in environmental industry. In some ways, we hope that this relationship will help boost the research and development of WET.

5.4 New Global Marketing Strategy

In my opinion, every market is different and requires a different wastewater treatment. As established earlier, these needs are dependent on the economic structure, governmental regulations, natural environment/resources and societal perceptions of reuse of wastewater in the country. The above-mentioned entry strategies realise this. Thus, similarly it is important to accordingly develop different marketing strategy for the different market segments. The various global marketing strategies for WET can be explained using Igor Ansoff's Product-Market Matrix.

Table 10 Igor Ansoff's Product Market Matrix

	Existing Products	New Products
Existing Markets	Market Penetration (Rental Model)	Product Development (Solutions Approach for Big Projects)
New Markets	Market Development (Establishing WetSep to tunnel construction and setting up Comprehensive Wastewater Treatment Plants in foreign countries)	Product Diversification (Entry into Green Rooftops and Vertical Gardening Market)

(Source: Gibbert, M. & Ruigrok, W., 2010)

1. **Market Penetration**: When the firm aims to increase sales of the same product to the same market. WET has been using a referral based strategy. By providing the best possible service to our clients, they refer our work to others and we get cold calls in on a regular basis. Our new rental strategy being applied in Australia can be categorised as the same because we have sold units there before and by setting up rental services, we can provide for smaller projects as well to the same clients.

2. **Market Development:** When the firm targets new markets, or new areas of your existing market like a different geographical market. The establishment of WetSep in Tunnel construction is an example as although the product has been used in construction industry, its entry into the tunnel construction in various geographical areas is new. The setting up of a Comprehensive Wastewater Treatment Plants in foreign countries is another example of market development.

3. **Product Development:** When the firm sells different products to the same customers**.** By creating packages such as a full wastewater treatment system which includes the WetSep, filter press, sedimentation tanks and providing solutions, WET is engaging in a product development based marketing strategy.

4. **Product Diversification:** When the firm sells different products to different people, it is called product development. WET as a Waste and Environmental Technologies is always on the lookout for new opportunities, hence has accepted projects on Green rooftops, aerobic wastewater treatment systems and insect prevention systems.

5.4.1 Different Customer Segments and Their Needs

1. **Global Tunnel Construction Companies**

   Need a reliable, durable, quick set up and operate, mobile wastewater treatment system for high levels of suspended solid with minimal maintenance requirements and minimal skilled labor for operating it.

2. **Governments looking for a solution to wastewater treatment for liquid construction and demolition waste in countries charging gate fees for waste disposed.**

   Need a full planned liquid waste processing system solution for different geographical features and compositions, including disposal for the sludge extracted, occupying minimal footprint and easily operable by local labor of the country.

3. **Clients looking for rental of wastewater treatment systems for short durations and who cannot afford to buy the system.**

   Need a comprehensive, small footprint, easy to operate wastewater treatment system which is mobile and can handle a wide range of impurities.

5.4.2 Gaining a Competitive Advantage

By internationalising, WET will face competition from local and global companies. Hence, I have decided to work and focus on the competitive advantage that the product and company can offer and align it to the needs identified of different customer segments.

5.4.3 Research and Development

By continuously improving the WetSep system using tested upcoming technologies as well as incorporating older technologies which were not efficiently utilised in the wastewater treatment system, I hope to increase efficiency of the same. For instance, I am currently testing different design strategies which use electrocoagulation, accelerated oxidation and even electrolysis/ UV radiation.

My research goal is to be able to develop a system which can process water to drinkable water by including primary, secondary and tertiary treatment in one model instead of as separate flow processes. Such a system would have a very high efficiency as well as utilise a small footprint and would greatly reduce the water constraint faced in most countries.

5.4.4 Reliable Delivery, Product and Service

The construction industry is greatly schedule dependent. A day's delay can lead to losses in millions. As a result, for secondary activities (does not earn them a revenue) such as water treatment, they value speedy delivery, easy set up and operation and a durable system. To provide this level of reliability, I constructed the warehouse to enable easy and flexible production and have built on key partnership with shipping companies to ensure on time deliveries.

As mentioned above in section 6.2.1, I hope to develop a certain level of skilled labour through the Working Holiday Program, to ensure that they can handle unusual situations by themselves.

A Solutions Approach – Integrating multiple products for multiple users.

Instead of just having a buyer and seller relationship with our customers, I want to ensure a more personal relation with my customers by helping them solve any kind of problems that they may have with respect to waste management. My eagerness to solve a challenge is what enables me to pursue such an approach.

Providing solutions for different customers requires knowledge and research on the latest technologies and methods. IT requires a fair understanding of determining whether a process or design will work and then to test the process before construction.

Such an approach ensures that the client will return to us when they have another problem. It also gives WET a competitive advantage from copycat companies with no understanding of design procedures and which simply sell pirated products.

5.5 Chosen Entry Models

5.5.1 Business Model for Tunnel Industry and Competitor Analysis

One of the proposed internationalisation plan relies on entry into markets by partnering with tunnel companies and helping them treat their wastewater for their tunnel and underground space projects. Thus, a major part of the plan relies on the potential of establishing a business relation or recognition among tunnel companies.

As mentioned in the literature review, there is great scope of obtaining opportunities in the tunnel industry as this is a growing industry. As the tunnel boring machines become more and more technologically advanced and cost effective, more governments opt for underground construction to solve infrastructural problems by leveraging over the 3D space instead of only 2D surface. When tunnel boring machines are used, the water consumption in tunnel construction increases as water is used to cool the machine and there is often a lot of wastewater generated in the process. Thus, the WetSep system can help clean the wastewater and produce reusable water as a product to be used in the cooling of the machine.

As part of the study, here is the proposed and optimal business model for the targeted market segment – well-established tunnel contracting companies. The reason for targeting this segment is because tunnelling requires certain level of expertise and for that reason, top tunnel contracting companies get contracted all around the world, making them a global industry. The projects that they undertake are usually large and longer term, which suggests that they can easily absorb the high cost of the WetSep system and will act as a stable revenue stream for WET provided they avail our services. Currently, there is very little competition in wastewater treatment for tunnel construction and WET has experience in the area which was recognised in the World Tunnel Conference 2017- Bergen.

While the target customer has been established, it is crucial to understand their needs and realise the value proposition WetSep will be offering them. The proposed value proposition for WetSep is “An award-winning innovative and modular design

for wastewater treatment, with reliable delivery and servicing globally and a range of purifying capabilities enabling to adapt to different regulations and standards of wastewater disposal or reuse. The WetSep can be customised based on requirements for different projects and challenges underground." The highlights of this proposition are that it is easily transportable to anywhere around the world and can also adapt to different standards and regulations. It can be just as easily maintained and customized to meet the specific demands of building underground.

Now a big part of establishing an entry through a business plan would be building customer relations with the target customers. WET participated and set up a booth in the World Tunnel Congress 2017 – Bergen to understand the industry and scope its competition. During the event, many top contracting firms such as AECOM, Skanska, Vinci, as well as representatives from Sweden Highway Authority and some South African companies, visited the booth and expressed an interest in the WetSep. Most of visitors knew about WetSep's use in the Snow Mountain (Hsuehshan) Tunnel, Taipei (2011) and wanted to avail the technology for their current and upcoming projects. Representatives from Sweden suggested that we work with them on the Stockholm Bypass but this is currently still under discussion. Overall, the conference, acted as the first point of contact with some new companies. WET has already built an introductory recognition worldwide in the tunnel industry. WET has also worked with twenty-one out of the top one hundred contractors in the world according to Engineering News Record.

In this age of internet time and product, where most people prefer doing business online; WET receives a lot of call ins from Singapore, Mexico, etc, but an important part of the first meeting from my experience is shaking your partners' hand. Face to face meetings develop a level of trust between partners and the physical contact of a handshake establishes a personal connection. Hence it is encouraged that a WET representative, usually myself, travel to the destination and review the project scope. Similarly, the conference enabled WET to reach out to potential clients and build a connection with them which can now be followed through online. After the online connection, as wastewater concentration differs over locations, in the wastewater treatment industry, it is always advised to scope the site before providing a solution and WET takes this step very seriously as we care about our customers and want to ensure that they are happy with WET's system and services. The objective of

focussing on customer service is to establish a level of comfort between WET and the tunnel contracting company so they may employ WET' services for the entire project and bring back more business for WET.

Having built a strong relationship with the client, it is important to establish proper channels of distribution and ensure that WET can provide the proposed value. There are two key points which relate to channel distribution in the value proposition; delivery and servicing globally and customisable design. WET has its own workshop in Guangzhou, China where the WetSep units are produced and transported to different parts of the world through their many forwarding company connections. The ownership of the workshop enables WET to customise their WetSep model to meet the needs of the clients and the location of the workshop and network of distribution partners enables the smooth distribution to any part of the world. As mentioned earlier, the shape and size specifications also enables mobility of the wastewater treatment system in shipping containers.

For a business model to be robust, the key resources, activities and partners must be identified. In this business model, the key resource identified is labour and the China workshop. Key activities would be networking with the top hundred (100) contracting companies and finding opportunities in the markets WET hopes to develop its rental business in, identifying the specific needs of the client and having a skilled labour force to design an effective wastewater solution to meet those needs. As a pro-active step, WET has already signed up for the World Tunnelling Congress 2018-Dubai. The key partners are a critical aspect of the model; WET's management believes that the key partners would be the distribution partners, forwarding and shipping companies as they play a big role in providing the end value proposition to the targeted market segment, which is reliable delivery as with delay in delivery, the project gets delayed and the contractor faces heavy loses. Other key partners are like the partners established in relation to expansion of WET internationally.

The revenue stream has been identified as contractual rental basis, and purchase orders of the system or solution, basis the duration of the project. From experience and client interactions/interviews, clients utilising WetSep for long term projects prefer owning the WetSep system instead of renting it from equipment manufacturing and rental companies. Long term, large projects can easily cover the high initial cost of the WetSep. However, even after purchasing the units, these

companies might require chemicals. Thus, a razor blade approach, where the units are sold slightly cheaper than usual but the complimentary products and services which must be bought and availed regularly are more expensive. This strategy maybe employed as tunnelling companies often prefer a single company to manage such secondary activities (wastewater treatment) so they may focus on how to construct the tunnel.

Overall, by providing solutions to the tunnel industry, WET will be able to earn a constant source of revenue while it simultaneously tries to penetrate the international markets. The tunnel industry has constituted up to 50% of the gross profit of WET in the last 5 years, thus the bread and butter of WET. By focussing further on this industry, WET will be able to increase its absolute financial resources as well as gain an entry into international markets. The approach is to earn fifty (50%) percent of the gross profit from the tunnel industry (less risky project) and the other fifty (50%) percent by entering new markets.

During my trip to the World Tunnel Conference in Bergen, I had the opportunity to evaluate the competitors and their positioning in the global market. I also had the opportunity to realise what the tunnel constructors need and position WetSep on that basis. However, it is important to remember that there will also be local competitors in every country which must be analysed before entering.

To tackle the local competition, I intend to make WET popular among international construction companies who are willing to accept tunnel projects in different countries. Such international companies operating outside their normal district would prefer having reliable backend suppliers of certain services which are standard for construction. Wastewater treatment can be viewed as a standard operation for tunnel constructions as most countries require contractors to meet certain disposal standards. To show that regulations of the country will be adhered, international companies might choose to have a reliable wastewater treatment company helping them do all their projects around the world. To gain such a partnership with them, I hope to position WET as a company that can be relied on, to provide wastewater treatment solutions for all challenges in all environments. As wastewater varies from project to project and location to location, meeting standards for water disposal using a standard process is a challenge which WET has tackled by providing a range of efficiency that can be achieved.

As WET has experience in large projects around the world such as the tunnel project in Taiwan, Hshushuen, WET has gained a level of recognition in this industry and we have been receiving calls asking us to help them with their projects.

5.5.2 Business Model for Slurry Treatment for Urban Construction and Demolition Waste

The second strategy was through a Build, Operate and Transfer proposal for a slurry treatment for urban construction and demolition waste. Most construction and demolition contractors try to find services for disposal of their waste and are often charged by the tonne and is measured by truck load.

In Singapore, there are currently three pump truck service; Veolia ES Singapore Pte. Ltd, Easi Porta Services and Acme Equipment Pte. Ltd. These facilities are far apart and while Veolia has a proper disposal treatment facility, the other treatment plants are uncertain. It is probable that they travel more than 200 kilometres to dump the waste out of Singaporean jurisdiction. Therein lies the opportunity to set up a slurry treatment facility and provide them disposal opportunities within a 50 kilometre radius which according to a research is the maximum distance for paid disposal of waste.

In June 2017, WET received an order from a contractor in Hong Kong working on a large-scale slurry treatment system for the Hong Kong Government in Tseung Kwan O for a 100-truck capacity fill bank. WET had to design a packaged wastewater treatment facility as part of the project and include the process of removal of the leftover sludge and until the final disposal. WET hopes to utilise this project as a demonstration project to gain trust and confidence from potential international governments considering contracts for similar large-scale wastewater and slurry treatment plants.

The purpose behind targeting such projects is similar to the purpose of targeting tunnel projects. Such projects will give WET access to some land in the international market to setup a temporary office. It will also give WET the right connections and recognition in the new market to set up its own rental business which is the end goal.

WET has already started working on the demonstration project in Tseung Kwan O and it is estimated to be completed within the next three to four months. Once

complete, interested parties from around the world may visit Hong Kong to witness the capacity and efficiency of WET's packaged solution for a large scale wastewater treatment system. The objective behind using this specific project as the demonstration project was also a strategic move as it is based in Hong Kong which is Central to Asia and Asia is currently central to the World, making it easily reachable and enabling the recognition of the project to spread around the world more rapidly. As emphasised earlier, location and connection are everything to keep a business afloat.

By proposing a build, operate and transfer proposal, I will be bearing the huge initial investment cost of production, delivery and set-up. I shall only be able to recover when the plant is put into operation. Such projects will be beneficial in a long run as the payback period is around 3.5 years.

If one such project is successful, the government might consider commissioning a few more such projects in the area as it keeps the environment clean. The slurry need not always be generated from construction and demolition only. It might also arise from storm water drains.

5.6 Revenue and Cost Structure for Rental Business

The decision of whether to set up a rental business in the country or not can be made based on the valuation principle where the costs and benefits of setting up operations is evaluated. When the benefits exceed the costs, the decision to enter is viable and when costs exceed the benefits, the decision to enter would be inappropriate.

In this approach, it is important to set the scope for analysis. Cost and benefits can be realised in plain monetary terms or in terms of impact to society and the company. Moreover, as each country has different taxation laws, standards for setting up a business and economic conditions, the costs vary. Therefore, this section shall discuss the topic based on the Australian governmental regulations and will be purely in monetary costs and benefits.

The major costs to be considered are categorised as:

1. **Company Setup Cost:** Includes the initial costs of entry and setting up office.
2. **Account Fee:** When entering a new market, it is essential to open an account from which transactions can be managed. Hence, this category accounts for the costs of maintaining the account.
3. **Motor Expenses:** As a major part of setting up the rental business is reliant on the transportation of the WetSep systems from the manufacturing workshop in China to Australia, it is important to consider the costs of shipment. This would include cost for green slips, insurance, fuel expenses, parking expenses, E-toll and motor license. Some of these costs recur as they are based on a renewal system.
4. **Business Traveling Cost:** Includes the initial cost of travelling back and forth and staying for a period in Australia to set-up operations. Accommodation cost and flight fares fall into this category.
5. **Engineer and Operation Cost:** Includes monthly operational costs such as rental and salaries of employees and cost of maintenance for equipment such as chemicals for the process and repair of parts.
6. **GST payment:** Amount to be paid as taxation to the Government. In Australia, the tax is calculated as 10% of income.

The income from the rental business varies. For initial calculations, we assume a minimum of 2 units being rented out, each at a cost of 5000 AUD and the income varies in proportion to the number of units being employed. The rental cost was determined from the cost of competing products in the industry and accounting for the additional benefits of utilising WetSep.

One big limitation of using such a systematic decision-making approach is the time it takes to make the decision. There will be instances where if I take too long to analyse the decision, the opportunity maybe be lost. As a result, I prefer to follow an approach where I take the risk and enter the market and then make the decision to stay or not.

5.7 Social and Environmental Impacts in Internationalisation

For sustainable operations after setting up operations in a country, it is of utmost importance to realise the social and environmental impact of the operations to avoid future resistance from governments and activists. It is necessary to firstly identify the positive and negative impacts of the new operations, find and implement mitigation techniques for the negative impacts and simultaneously get the public to focus on the positive impacts. The impacts must be analysed with respect to societal impacts and environmental impacts.

WET's operations create a positive impact on societies by better utilising the limited resources to improve the infrastructure and facilities of the region and by providing more employment opportunities.

The WetSep system is a contemporary solution to the wastewater treatment infrastructure issues. It provides governments the opportunity to invest in a wastewater system that is cheaper than a centralised system which is often tough to construct in geographically dispersed towns. It is easy to maintain and operate, allowing for continuous operations with minimal interruptions. Most importantly, by producing reusable water from, it not only provides a waste management strategy but acts as an alternate source of water and helps solve the water scarcity issues in remote areas.

Besides helping in the development of a region, as each WetSep unit must be monitored and operated by people, it provides employment opportunities. The operation of the system has been kept simple so that it can be operated by the locals of remote regions. From the installation to the operation, the WetSep wastewater treatment system does not require much expertise.

In addition to the societal impacts, environmental impacts must also be considered. As the system occupies less space in comparison to traditional centralised wastewater treatment plants, there is close to no damage to society. The system has minimised the use of mechanical operations, thus the energy requirements of the system. Some WetSep models which achieve higher level of efficiency and use UV radiations to produce potable water, require some electricity. In these systems, we have included solar panels to utilise renewable energy sources instead of putting pressure on non-renewable energy.

Another positive environmental impact is that the system helps reduce environmental pollution by converting waste to reusable products. The system can effectively remove reusable water from wastewater and with a few additional equipment, the suspended solid wastes can be mixed with concrete to form bricks and blocks for use. It effectively reduces the amount of waste disposed into the environment and in turn the level of pollution. Furthermore, by providing reusable water which can be used for non-potable purposes such as cleaning or cooling of machines, it reduces the pressure on ground water level.

One of the negative impacts that has been identified is the misuse of the system. If the system is not monitored properly and operated according to the rules, the system might not treat the water well enough. There is also the risk that the constituents of the wastewater changes with time. If the influent and effluent are not tested and the system is not accordingly adjusted to the new requirements, there is a risk of spreading of diseases. Such risks can be mitigated by simply implementing proper monitoring measures.

5.8 Social Perception Affecting WET's Marketing Strategy

Future marketing campaigns need to be oriented around motives that are most relevant for population of concern. The main problem with this logic is that people are motivated by many things so finding a single determinant is close to an impossible task. Despite efforts to identify a single-determination of behaviour, people are motivated by many things. (Midgley 1978; Hartley 2006) Hence, WET has opted to shift its marketing focus to utilising multiple motives to encourage people to adopt its technology.

According to a research paper on “Motivators for treated wastewater acceptance across developed and developing contexts”, the more motives a person has, more likely will the person engage in environmental conservation. The paper discusses how cost and other economic incentives are the least motivating factors in both developed and developing countries, whereas ecological considerations and future water shortages are the most motivating factors. This suggests that WET ought to focus on marketing WetSep’s ability to reduce environmental pollution in rivers, lakes and protecting wildlife; and providing reusable water. By providing reusable water, it in turn reduces the pressure on demand for water, now and in the future.

From WET's personal experience, this theory is applicable. It has been observed that private companies are either forced to comply with disposal standards as set by governments or tend to adopt wastewater treatment systems to obtain a positive image in the eyes of the public. There have been very few cases where a company intends to reuse water for economic incentive (avoid paying for industrial water). Thus, it is wise to market the WetSep as a product which improves the environment.

Having established the basic marketing approach, it is necessary to evaluate social perceptions towards wastewater treatment systems to understand the optimal entry strategy for different countries. This might further help in understanding whether a rental business in that country might be a profitable approach or not. For simplicity purposes, I have chosen to categorise the various countries that can be internationalised into developing and developed countries and into sub categories as to whether they face water scarcity or not.

Water scarcity can be measured in multiple methods. Falkenmark's Water Stress Index is a measure of human water requirements to determine scarcity. Vorosmarty et al (2000) developed an index that reflects subnational differences by pinpointing smaller regions that are under stress. This index considers vulnerability from climate change impacts and population growth relative to thresholds defined by the United Nations. A standard measure ought to be chosen by WET to appropriately gauge the importance that the country would place on the WetSep and accordingly price the product.

People in developed regions tend to be more concerned with water quality that issues of availability or consumption (Larson, Ibes, and White 2011). Besides aesthetics having the greatest impact on perceptions of water quality, factors including ethnicity, water source and location have also been found to significantly affect water quality perceptions (Wright et al 2012; Rojas and Megerle 2013). A research by Larson et al. (2016) and Wutich et al. (2014), revealed that in developed areas, areas with more financial resources and other facilities, residents preferred regulatory strategies. On the other hand, less developed countries prefer hard or no path strategies. The people in developing location preferred small scale private and communal infrastructure as solution strategies (K. L. Larson et al, 2016). WET ought to leverage on its ability to provide a decentralised wastewater treatment system in less developed

regions as it could help avoid the problems associated with large scale infrastructure; leading to a more sustainable option.

From the above, I discussed the trends of the market, providing insights into the actual customer segments. I also highlighted the use of AT and KISS principles for the business model, the chosen market entry models and the deliberate design of the second generation of WetSep. In addition, I covered the financial factors for rental business as well as the social and environmental impact of the business.

6. Conclusion and Recommendations

6.1 Summary

In this chapter, I highlight the efficiency of WET as an SME, in relation to the chosen roadmap including innovation, incubation, intellectual property and integration to build and structure an SME.

WET is an SME with experience in environmental technologies that have been applied to more than 17 countries but in a small volume. Our staff are mainly engineering graduates from universities with little or no experience. To conduct international business development, top management has recognised the need to change WET's orientation to a more business sense. Although a lot has been achieved by serving green products and services; we are now also serving as a consultant for governments.

Previous strategy to enter the international market, understood the importance of providing rapid response to details for global projects by international contractors. To enable such service, the workshop was built in China for logistical support and for customisation of the WetSep and an Australian rental system was established to get a feel of the challenges of setting business globally. Moreover, as elaborately explained in the case study, other random individual projects were also accepted in Singapore, Fiji and Papua New Guinea and a joint venture scheme was tested with Ground/Water Treatment and Technology, LLC, USA, which rents and sells WetSep Filtration System.

As the aim of this project is to identify a strategy to penetrate the international market, this section discusses a proposal for expansion of WET for growth in North America, Scandinavia, Australia and the South Pacific. The proposal recognises the financial, technological and labour constraints of the SME and provides an entry strategy by leveraging WET's current recognition in the tunnel industry. This strategy is comprehensive and enables WET to continually generate profits and simultaneously use the additional financial resources in making contacts with clients in each geographical area.

The basis of the strategy is to make use of the opportunities and tackle the challenges that WET confronts. WET's opportunities can be categorised as per the

checklist mentioned in Peter Drucker's 'Innovation and Entrepreneurship' (Drucker, 1993):

- **The Unexpected:** it is a surprise to realise that most of the current staff are not experienced enough to respond to incoming calls on various environmental problems. As a result, all the burden lies on one staff member, myself.

- **Incongruities:** local customers appear to be after low prices but in reality, good quality and continuous improvement of a product is a necessity and a challenge for most environmental/technological companies, giving WET the opportunity to focus on this area.

- **Process Needs:** having a fair understanding of the company's process capabilities and continually improving on it enables the company to be competitive. WET leveraged this opportunity by setting up its own workshop, enabling it to provide quick customisable solutions to its clients as well as reliable delivery.

- **Industrial and Market Structure:** the current proposal realises the increasing need for wastewater treatment in the tunnel industry due to increased regulations in many countries and used it to reduce the risk of internationalisation of WET. Another trend which has been noted by WET is the growing need for decentralised wastewater treatment systems in Australia, North America, Scandinavia and South Africa. This report proposes setting up rental and purchase business in these countries.

- **Demographics:** Changing demographics plays a huge role in the acceptance of reusing processed water. The younger generation are more concerned about the environment and are more aware about environmental concerns like global warming. As a result, they prefer using environmentally-friendly technologies such as solar power operated WetSep and are more likely to reuse the processed water than simply dispose it. Thus, WET ought to ensure high efficiency of WetSep to produce reusable water.

- **People's Receptivity to Product Innovation:** water and Wastewater handling used to be a governmental concern. Over the years, this perception has changed and people are getting more aware and involved in environmental matters and

resource management. This change in perception is exhibited as a change in client profile. Previously Governments approached WET for our innovative solution, but now private companies approach WET either to be competitive in their own domains or to simply meet strict governmental regulations.

- **New Knowledge:** to stay relevant in the business, continual improvement is an important feature for all environmental technologies. Over the years, WET hopes to use innovative designing strategies to realise the marginal utility of upcoming technologies and make decisions as to whether to include it in the WetSep or not. Note that while WET could also consider making a new product, top management believes in thinking within the box and focusing on the patent it already has. The inclusion of electrocoagulation to the WetSep is an example of how WET plans to leverage new knowledge to improve the current WetSep model.

Besides the above opportunities and challenges, from the case studies, it is evident that dealing with technical and economic issues are relatively easier when compared to political problems. Like in Fiji, the political turmoil lead to the stalling and eventually cancellation of the project. As such, WET's current international business development can be characterised as more of a reactionary approach than as a proactive approach. The new business model, however aims at reducing the risk or losses in case of failure and adopts a more proactive approach.

6.1.1 A Global Approach

A key question that arises is why should WET focus on establishing an international branding when it is sustainable in the local market? The answer to this question is simple: as Hong Kong is the local market which fulfils the important criteria for setting up a business – location and connections, and it being an open market, allows for the free entry and exit of competitors. In a metaphorical sense, the globalising world is a desert. Although WET has found its oasis and is presently surviving, the water in this oasis will soon run out. So to survive WET must find a new oasis. Thus, the current sustainability that WET enjoys is only an illusion and WET carries the risk of being replaced by incoming competitors from around the world. As

a result, it is crucial for WET to take the opportunity to internationalise itself and compete worldwide and find a new oasis.

On a separate note, the free entry and exit of competitors is made easy by the process of globalisation. Globalisation is the process of interaction and integration among people, companies, and governments of different nations; a process driven by international trade and investment and aided by information technology (Institute, 2017). Globalisation is only a small part of the big picture. Global village on the other hand is the big picture that the world is striving to work towards and WET hopes to join the bandwagon. According to Marshall McLuhan, a global village is a world interconnected by an electronic nervous system. The term "Global Village" was coined to highlight his observation that an electronic nervous system was rapidly integrating the planet -- events in one part of the world could be experienced from other parts in real-time, just as news spreads like wildfire in villages (Stewart, 2017). The idea behind joining the global village movement can be juxtaposed in terms of the idea of opting in or out of the one belt one road initiative by China. Both are events which although difficult are bound to take place. The one belt one road policy, will lead to an increase in competition by easing trade and improving connections in the Asia, European and African Subcontinent. The countries which accept and contribute to it ought to greatly benefit from it, but the countries which opt out, would be left behind and be at a disadvantage in the future. Similarly, the advancement in technology increases the connectivity in the Global village, eventually making the world more competitive. Thus, WET must build its connections and position worldwide.

To summarise this discussion, in this ever-changing and increasingly connected global marketplace, a company like WET should develop a Global Marketing Strategy to adapt to various markets and situations to stay relevant and competitive. Hence, the goal of this research has been set to review the current WET strength in global marketing strategies.

6.1.2 Challenges in Internationalisation

Internationalisation is the adoption of a specific product or service internationally; this research discusses the adoption of WetSep Wastewater Filtration

system and it being an environmental technology, its acceptance relies intrinsically on the adoption of the idea of wastewater treatment.

The broken chair on the Place des Nations in Geneva has been viewed by outsiders as the biggest chair in the world with a damaged foot that hasn't been repaired over the years. However, the monumental sculpture by Daniel Berset, was constructed as a tribute to the handicapped people around the world and this is known by the locals and other knowledgeable individuals. Similarly, the WetSep is currently viewed by private organisations to satisfy governmental regulations on water disposal standards, and it is more widely adopted by governments. Over the years, the WetSep, has been recognised as a system following the 3P's – Pollution to Product and Profit, and private construction companies looking to gain a competitive advantage choose to adopt the WetSep system. Instead of disposing the water, they create a system where they reuse the water.

This idea of reusing wastewater is what WET is internationalising in general. The task at hand is made difficult due to different priorities in different countries which are often based on Governmental laws and regulations. For instance, Germany and Taiwan have adopted a policy where they must pay for their waste; India and China have no such policy in action. Hence, businesses utilise the 3R's – Reduce Reuse and Recycle and use this policy in Germany and Taiwan to generate less waste and bear a decreased expense. Meanwhile, in India and China, the 3R's is only a campaign and is not viewed as a business model nor a strategy.

Moreover, with the scarcity of water threatening Governments, stricter rules and regulations are being put in place in different countries. In Mexico, the cost of using ground water or water from surrounding lakes and rivers was free but now it is being termed as water for industrial use and is sold to textile and other factories needing it. This type of regulation encourages the locals of Mexico to look for alternative sources of water to reduce costs and that is where the WetSep steps in.

Besides the concept of adoption of ideas by different markets, this example also highlights the importance of understanding driving forces in international markets and accordingly modifying the product and selling it. Anticipating and understanding the changing local culture and perceptions, and adapting to it is often a challenge of internationalisation.

6.1.3 Overcoming Challenges

Using the case study of WET's initial expansion to the Australian market with other smaller-scale case studies, I derived that the success and failures of the internationalisation strategy are greatly dependent of the economic and political structure of the markets that I wanted to enter. A robust business strategy is necessary to overcome these volatile factors, and there is the need to modify the strategy from one country to another.

Firstly, the growth of a SME relies on the 4 Is, namely: innovation, incubation, intellectual property and integration. For a SME business, it is important to have the uniqueness in your products or services and that's where innovation takes place.

The key problems identified are understanding the cultural perceptions, obtaining financial resources and competing with local firms. WET aims to overcome these challenges by using a similar entry method as it did to set up the business twenty years ago, by following the 4 Is – Innovation, Incubation, Intellectual Property and Integration.

6.1.3.1 Innovation

Having studied the international market and recognising their priorities and needs, a company ought to modify the invention, thus innovate accordingly and provide solutions, especially in the technological industry. If a product does not meet the needs of the market, it will not be adopted and will eventually fail. It is also important to innovate and change the product to meet changing perceptions.

WET achieves this level of innovation by utilising the appropriate technology approach which is simple and easy to understand by all. It can be easily adapted to the local needs from time to time based on the current demands of the market. WET also keeps track and invests in upcoming technologies to stay relevant in the environmental technology industry. Instead of developing these new technologies separately, the development division at WET focuses on how the new technology can improve the existing WetSep model.

6.1.3.2 Incubation

Entering the international market is risky and expensive, as a result SMEs find it difficult to obtain funding from governments. The risk lies in the assumptions set before entry into the new market. If the assumptions are far from reality, the company might fail in the new market. If the assumptions are correct, the company most likely will succeed.

Business incubation program is an important platform for SMEs development and technology innovation (Cui, et al., 2010). It provides incubation service to assist technology start-ups in their vulnerable inception stages. Incubators can generally divide into four types: public or not-for-profit incubators, private incubators, academic-related incubators and public/private incubators (Bayhan, 2006).

SMEs are always facing the problem of lack of capital and resources. The business incubator provides the physical space and infrastructure, and a series of service support, including serving as agent to help SMEs strive for government finance and low-interest loan, to reduce start-up costs and risk (Cui, et al., 2010). Usually, well-structured incubators provide SMEs links to industry and business support services, technological advice that helps SMEs to make the correct assumptions in the initial stages.

In Hong Kong, Hong Kong Science and Technology Parks Corporation (HKSTPC) provide the business incubation programme to the innovation-based SMEs, to start-ups in web & mobile technology, and biotechnology (Hong Kong Science and Technology Parks Corporation , 2011). In Australia, the business incubator began in the early 1980s and it was operational in almost all the states in 1989 (Cornelius & Bhabra-Remedios, 2003) and they were initiated by a local municipally, regional economic development organisation, a community group or a coalition of these bodies (Schaper & Lewer, 2009).

To help align the assumption and build connections with time, incubation programs play a big role. WET initially signed up for the HKSTP Incubation program as an Incu- Tech. HKSTP provided WET with an office space, technical management and assistance, promotion and development assistance, business support and financial aid package. Thus, incubation programs simply act as a support in the unknown market until the company builds its own roots and starts growing. WET has identified similar

incubation programs in the countries it plans to expand its operations to, and intends to make use of these services as it has in the past.

6.1.3.3 Intellectual Property

In a competitive society, intellectual property provides a certain level of protection. The protection of intellectual property is granted by different regional regulatory institutions around the world. After innovating a product that meets the requirements of the market, by patenting the design, the company reduces the competition it receives as other companies cannot produce the same product and sell it in the market. The inventor of the incline drum washing machine wisely.

When WET first set up business, it patented its technology in China and other markets to ensure that the system is not produced by other copycat companies and sold for a cheaper price internationally. This move gave WET more time to establish itself as a wastewater treatment company.

6.1.3.4 Integration

Other than the incubation of the innovation and the preservation of the intellectual property, it becomes important for SMEs to integrate processes and come up with an organisational structure for the long run. Integration involves the setup of principles for the organisation to follow in research and design and decision making to make the company more sustainable.

6.1.3.5 The 4 Is

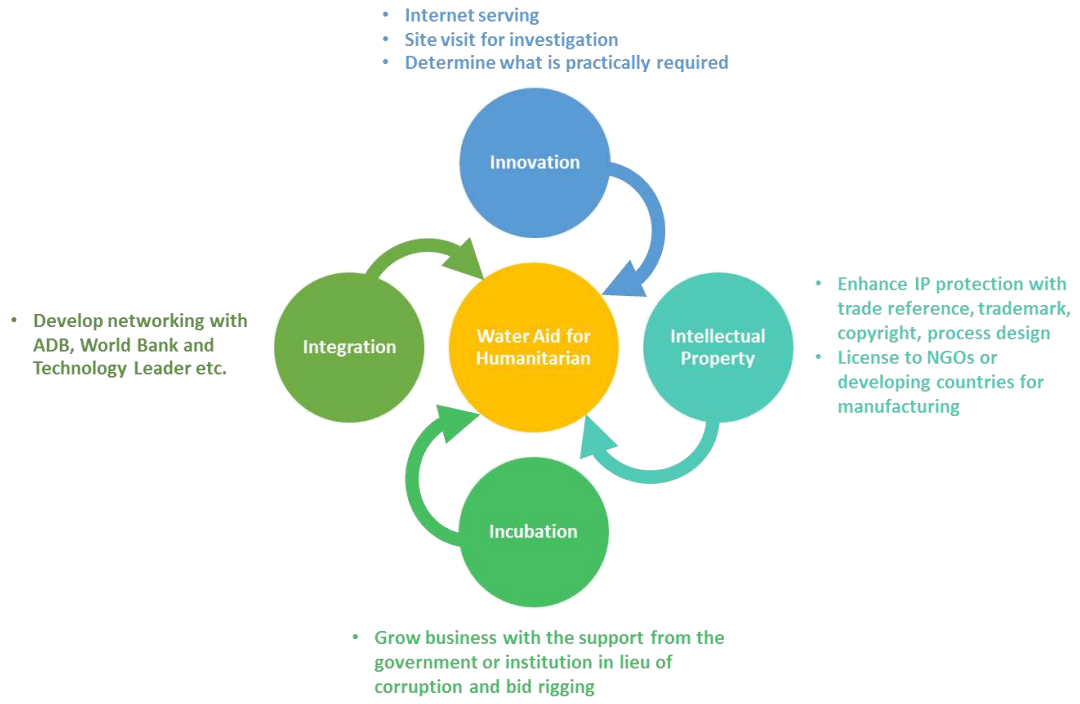


Figure 26 Ethical Roadmap for 4 Is

To better frame the idea of the 4 Is, we can compare the development of a company to the growth of a person in life. First there is the birth of the idea, which arrives through innovation. Afterwards, with the support of parents, social and educational institutions, a person will grow up as a healthy individual, as he acquires more knowledge. Similarly, an innovation requires support to establish itself in society and gain some recognition. Without support, the innovation will perish. Just like in life, we go through different exams to gain certification and merits to improve one's competitive advantage. Consequently, a business must also patent its technology and own some patents to gain a competitive advantage. Finally, all the above is neatly integrated to be a sustainable and independent enterprise, just like when a person leverages on his earned qualifications to get a job and provide for himself instead of relying on the others.

After the first step into the global market, the 4 Is can further be implemented in the operation and expansion of the company. A company should always keep innovation and new ideas flowing within the company. Once a new idea is raised, the company should provide facilities and a good system to incubate and create solid ground for the development of the new idea. Afterward, intellectual property should

be applied to protect the new idea and the new system generated and to integrate the new system to the company's existing products/services. For instance, with the success in internationalising the first generation of WetSep, I have continued to brainstorm on any new design for WetSep. Having the new idea of electrocoagulation (EC), WET provides equipment for our engineers to examine the feasibilities and efficiency of treating wastewater with electrocoagulation. When the design is mature, WET filed patents in US and China to protect our new EC WetSep design. At the same time, WET integrates the new system in our existing product line and introduces the new system to our clients according to their needs. With this 4 Is principle in mind, a company can continue to expand and grow not only locally, but globally as well.

Besides the 4 Is, there are four factors that I believe strongly affect global entry and set-up and they are: key resources, key activities, key partners and market characteristics. I have explained these factors in context of WET and respectively proposed ways that I intend to build on these. In most engineering companies, innovation has a huge role to play and influences product development. My reflection suggests that in a process as creative as research and development, it is still necessary to have some ground rules in this area. One must always be open to changes and continue to follow the set principles. For instance, new idea and changes may come from clients' demands, the integration of new technologies, market share and competition and more stringent government regulations, yet I upheld the principle of Appropriate Technologies and KISS while modifying and upgrading the WetSep system. Therefore, the company must remain open-minded to realise the future and exponential technologies in the industry, and either ride the trends or move beyond it. Finally, another key learning is to always think about competitive advantage throughout the internationalisation process.

6.1.4 Factors Affecting Global Entry and Operations

Based on findings from the interviews and discussions with WET's management team, I have identified the following crucial factor to achieve sustainable operation in an international market: key resources, key activities and key partners.

6.1.4.1 Capital

The most important resource for setting up operations abroad is capital, linked to this is the key activity of financing which shall be discussed later. Money is required to obtain entry permissions, for trips to set up the appropriate links and for production and delivery of the additional units.

Another key resource is labour force to manage the operations to be conducted. It would not be feasible to supply labour from Hong Kong for operations abroad due to travel expenses as well as to satisfy ad hoc demand of services from international clients. Labour force is also required to ensure a more pro-active search for projects and opportunities through marketing activities instead of having to wait for calls to come in and then react. Due to the limited funds of SMEs to pay out salaries, it has been estimated that it would be cheaper to hire fresh graduates and train them instead of hiring experienced workers.

6.1.4.2 Labour

One of the key resources identified in the business model are labour resources. As expressed earlier, the 17 employees who currently work for WET are from Hong Kong and China and they are mainly equipped with technical knowledge. Hence, new staff with other expertise (business development and management skills) will be required. Foreign language and management skills are also necessary. This was shown to be a major boost in the internationalisation of SMEs in countries like Vietnam (Thai & Chong, 2008)

Hence it is important to invest time and money into the training and hiring process. As I prefer fresh graduates because of their ability to come up with new ideas, I hope to build up a direct university hiring process by collaborating with incubators across the world.

One of the big ideas that I would like to implement as part of developing a strong reliable labour force is to give them growth opportunities and enable them to travel around the world and complete projects. By making use of the Working Holiday Pass, WET can send some students who have already worked at WET to go abroad and pass on their knowledge to the new local hires abroad. On the other hand, some of

the fresh graduates from foreign universities can also come and work in Hong Kong and learn the operations of the company first hand.

Presently, Hong Kong accepts workers between the age of 18-30 years from Australia, Canada, New Zealand, Ireland, Germany, Japan and South Korea to work for a duration of 1 year. Some countries which accepts Hong Kong citizens are Singapore, South Korea, Japan and New Zealand. Hence a linked labour network can be considered in these markets.

In Hong Kong, the training program will be such that they will get directly involved in the projects managed by WET at that time. In this business, it is crucial to meet the clients face to face. Therefore, staff training should include interpersonal skills, while trainees will gain experience in meeting clients and propose accurate solutions to international clients. By focusing on these aspects, some of the burden of planning for large scale projects can be transferred to them provided they prove themselves to be capable of the task.

As mentioned earlier, financing is an important activity for an SME like WET as it enables the company to stay afloat despite the various challenges and risks of failure in completion of projects. Financing is primarily the activity of managing the flow of money in and out of the company along a time frame as well as the ability to gather funds when required to meet operational expenses. WET understands this, hence proposes different strategies for entry into the market. One strategy of entry is by adopting a temporary project which would provide high revenue but for a short period of time whereas the other project would be a more continuous source of revenue for a longer period. While the second strategy does sound more appealing in financial terms, the cost of set up for the second strategy is much higher and the market for it although present, very little data regarding the volumes of business can be calculated and is based on estimations.

Another key activity identified for the proposed rental business is sales and marketing. Although WET receives a lot of cold calls in Hong Kong for projects abroad; to properly expand abroad, it is important to get more opportunities in the local market on a continuous basis. Thus, by actively focusing on sales and marketing in the new market, WET will be able to effectively set up and manage rental operations and earn a more sustainable revenue model.

Finally, a reliable distribution network was identified as another prime activity for international operations. Most clients, being from the construction industry require services almost immediately and every delay is costly to them, hence setting up a robust and reliable supply and distribution system would benefit WET in obtaining a good image in the new market.

6.2 Reflections

The completion of this report marks my final stage in the programme of Doctorate in Professional Studies. On and off, I have spent about 15 years in completing this programme. Throughout the writing process, I have gained more confidence in my company, WET and strongly believe that we are going in the right direction of internationalisation. I hope that this report can act as a successful example for other SMEs to follow and to learn from.

I have to address the importance of 4 Is for SMEs. Many of us started our business not because we are born businessman. We could be tradesmen with a new idea, accountants interested with their client's business format, academics with new ideas or singers with a good song. The interest would be an opportunity but also could become a trap to dry off the limited resources of a small business. With the accessibility of information via the Internet, not knowing how to protect the business and to keep it growing will be dangerous.

The development and commercialisation of WetSep system from innovative idea, design, prototype, patent application, marketing and sales has been a personal challenge that has been overall very successful as indicated by our current international reach in 20 countries as well as growing enquiries across the globe. The process of commercialisation of the product has both been challenging and satisfying for my professional career and has resulted in a positive financial return for my business. This is evident given the fact that small environmental engineering based company like WET has been stable through the last 20 years, surviving any and all economic turmoil. Though a lot of time and financial resources have been used to develop this product, I have felt that it has had a positive impact on my career, personal life and for my company. This experience has kept me motivated and I look forward to continue building on it.

The 4 Is have guided me in overcoming crisis over the years. Not limited to wastewater applications, new products and new business trends would also have impacts to my day-to-day activities. Innovation is key. Intellectual property law could protect our business assets but it is not always so for each sector, especially our neighbouring company could have interest to infringe at all cost. Protecting the Innovation by intellectual property law might not be enough to sustain a business especially at the early stage of an innovation, so we have to incubate it by Intellectual Property protection and most important to integrate it with other ideas, products or business partner, so that the business is more robust and fast-growing. The market share is an important milestone for any business.

We can maintain loyal customers who favour our products and services but nothing last forever if without change. We have been majoring in treating wastewater by Primary Treatment in the past 20 years. As continuous professional development is the rule of thumb for any professions, we are proceeding to 'Secondary Treatment' by using 'Electrocoagulation with Ceramic Flat Membrane' to achieve tertiary standard quality. The company is committed to practising the 4 Is in the coming decade.

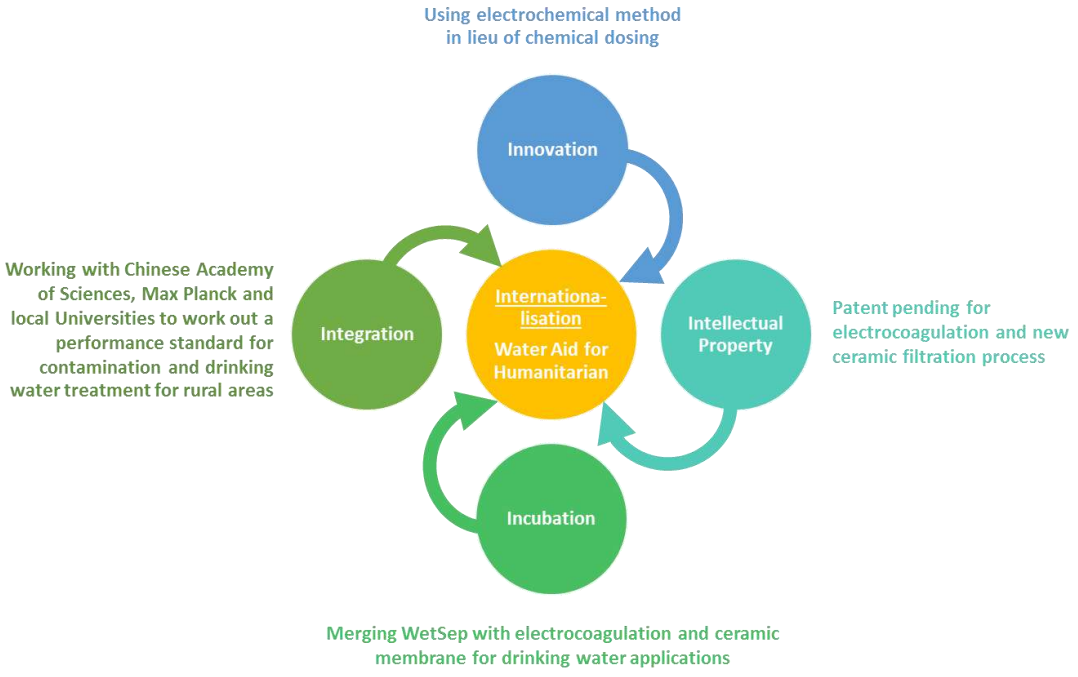


Figure 27 Practice of 4 Is in the Upcoming Development

To summarise, I have reviewed the existing SME practices and methods of internationalisation for SMEs in the environmental sector from present literature; as well as analysed the findings of WET as an SME that undergoes internationalisation. I have also demonstrated that the global business model and strategy to market the new WetSep modular systems and the overseas expansion into countries with conducive environments for WET, particularly through the use of patent, and its relevance for the survival and long-term development of other SMEs. By advocating a roadmap that combines the 4 Is and three key processes, as in the example of WetSep technology, one can help SMEs gain entry into new markets and to promote sustainable development in the environmental industry through innovation, protection of intellectual property rights, integration of technologies and incubation.

References

Akubue, A., 2011. Appropriate technology for Socioeconomic Development in Third World Countries. *The Journal of Technology Studies,* Volume 26, pp. 33-43.

AMD Law Group, 2012. *What is the definition of a "Born Global" firm? International Business Law, Case Study 2.* [Online] Available at: http://www.amdlawgroup.com/what-is-the-definition-of-a-born-global-firm-international-business-law-case-study-2/ [Accessed Jun 2018].

Anguil Environmental, 2020. *Frac Water Reuse Technologies.* [Online] Available at: https://www.anguil.com/aqua/frac-water-reuse/ [Accessed on Jan 2020].

Anon., 2006. *A Comprehensive Guide for Social Impact Assessment,* s.l.: Centre for Good Governance.

Anon., 2012. *Support to Small and Medium Enterprises,* Hong Kong: T.A.I Department.

Anon., 2018. *International Business Innovation Association.* [Online] Available at: http://www.nbia.org/resource_library/faq/index.php#3. [Accessed June 2017].

Anon., n.d. *Vocational Skills Training Programmes Influence Wealth Creation for Unemployed Youths.* [Online] Available at: http://academicperformanceresearch.blogspot.in/2016/04/vocational-skills-training-programmes.html [Accessed July 2017].

Arbnor, I., & Bjerke, B., 2008. *Methodology for creating business knowledge*. Sage: London, UK.

Argente-Linares, E., López-Pérez, M. V., & Rodríguez-Ariza, L. (2013). Organizational structure and success of international joint ventures in emerging economies: the case of Spanish–Moroccan SMEs. *Review of Managerial Science,* 7(4), 499-512.

Asian Development Bank Institute, 2015. *Integrating SMEs into Global Value Chains: Challenges and Policy Actions in Asia,* Tokyo: ADBI ADB.

Barry, A. et al., 1974. *Fri Alert.* Dunedin: Cavemen Press.

Baxter, P., & Jack, S., 2008. Qualitative case study methodology: Study design and implementation for novice researchers. *The qualitative report*, 13(4), 544-559.

Bayhan, A., 2006. *BUSINESS INCUBATOR PROCESS: A POLICY TOOL FOR ENTREPRENEURSHIP AND ENTERPRISE DEVELOPMENT IN A KNOWLEDGE – BASED ECONOMY,* s.l.: Competitive Support Fund.

Campbell, D. T., 1975. "Degrees of Freedom" and the Case Study. *Comparative Political Studies,* 8(2), pp. 178-193.

Cappelli, P. & Sherer, P.D., 1991. The missing role of context in OB: The need for a meso-level approach. *Research in Organisation Behaviour,* 13, pp. 55-110.

Centre for Citizenship Enterprise and Government, 2018. *Impact and Research.* [Online] Available at: http://www.cceg.org.uk/impactandresearc [Accessed 19 06 2018].

Chaney, I. & Lin, K.-H., 2007. The Influence of Domestic Interfirm Networks on the Internationalization Process of Taiwanese SMEs. *Asia Pacific Business Review,* 13(4), pp. 565-583.

Charles P. Gerba, I. L. P., 2015. Municipal Wastewater Treatment. *Environmental Microbiology (Third Edition).*

Chelliah, S., Sulaiman, M., & Yusoff, Y. M., 2010. Internationalization and performance: Small and medium enterprises (SMEs) in Malaysia. *International Journal of Business and Management*, 5(6), 27.

Chinta, R., Cheung, M.-S. & Capar , N., 2015. Double Whammy or Double Advantage: "Foreigness" and "Newness" as Determinants of Success in International Business. *Journal of Management and Strategy,* 6(1), pp. 76-87.

Cook, T. D. & Campbell, D. T., n.d. Quasi-experimental design: Design and analysis issues for field settings. *Skokie, II: Rand McNally.*

Cornelius, B. & Bhabra-Remedios, R., 2003. *Cracks in the Egg: Improving Performance Measures in Business Incubator Research.* Australia, s.n.

Crowe, S. et al., 2011. The case study approach. *BMC Medical Research Methodology,* 11(1), p. 100.

Crowe, S., Cresswell, K., Robertson, A. & Huby, G., 2011. *The Case Study Approach,* s.l.: BMC Medical Research Methodology.

Cui, Y., Zha, L. & Zhang, F., 2010. Financial Support System and Strategy of SMEs in the Incubation Based on Business Life Cycle. *International Business Research,* 3(4).

Czarnitzki, D., & Delanote, J., 2015. R&D policies for young SMEs: input and output effects. *Small Business Economics*, 45(3), 465-485.

Demirbas, A., 2011. Waste management, waste resource facilities and waste conversion processes. *Energy Conversion and Management*, 52(2), 1280-1287.

Doole, I. & Lowe, R., 2008. Analysis, Development and Implementation. In: *International Marketing Strategy.* s.l.:Cengage Learning.

Doole, I. & Lowe, R., 2008. *International Marketing Strategy: Analysis, Development and Implementation*, s.l.: Cengage Learning.

Drucker, P. F., 1993. *Innovation and Entrepreneur.* 1st ed. New York: Harper & Row, Publishers, Inc.

Dunning, J. H., 2001. The Eclectic (OLI) Paradigm of International Production: Past, Present and Future. *International Journal of the Economics of Business,* 8(2), pp. 173-190.

Dunning, J. H. & Lundan, S. M., 2008. Institutions and the OLI paradigm of the multinational enterprise. *Asia Pacific Journal of Management,* 25(4), pp. 573-593.

Dunning, J. H., & Lundan, S. M., 2008. *Multinational enterprises and the global economy*. Edward Elgar Publishing.

Ebersberger, B., & Herstad, S. J., 2013. The relationship between international innovation collaboration, intramural R&D and SMEs' innovation performance: a quantile regression approach. *Applied Economics Letters*, 20(7), 626-630.

Eisenhardt, K. M., 1989. Building theories from case study research. *Academy of management review*, 14(4), 532-550.

Estévez , B. V., 2014. *Blackwater sanitization with urea in Sweden, Master's Thesis*, s.l.: Department of Energy and Technology, Swedish University of Agricultural Sciences.

Ettlie, J. E. & Subramaniam, M., 2004. Changing Strategies and Tactics for New Product Development. *Journal of Product Innovation Management,* 21(2), pp. 95-109.

Fu, X., Pietrobelli, C., & Soete, L., 2011. The role of foreign technology and indigenous innovation in the emerging economies: technological change and catching-up. *World development*, 39(7), 1204-1212.

Fujita, M. (1995). Small and medium-sized transnational corporations: Trends and patterns of foreign direct investment. *Small Business Economics*, 7(3), 183-204.

Gaur, A., Kumar, V. & Sarathy, R., n.d. Liability of Foreignness and Internationalization of Emerging Market Firms. *Dynamics of Globalization:Location-Specific Advantages or Liabilities of Foreignness?*, pp. 221-233.

Gibbert, M. & Ruigrok, W., 2010. The "What" and "How" of Case Study Rigor: Three Strategies Based on Published Work. *Organizational Research Methods*, Volume 13(4), pp. 710-737.

Golovko, E., & Valentini, G., 2011. Exploring the complementarity between innovation and export for SMEs' growth. *Journal of international business Studies*, 42(3), 362-380.

Gupta, V. K., Ali, I., Saleh, T. A., Nayak, A., & Agarwal, S., 2012. Chemical treatment technologies for waste-water recycling—an overview. *Rsc Advances*, 2(16), 6380-6388.

Harash, E., Al-Timimi, S. & Alsaadi, J., 2014. The Influence of Finance on Performance of Small and Medium Enterprises (SMES). *International Journal of Engineering and Innovative Technology (IJEIT)*, 4(3), pp. 161-167.

Harvie, C., 2010. SMEs and Regional Production Networks. In: V. T. Thanh, D. Narjoko & S. Oum, eds. *Integrating Small and Medium Enterprises (SMEs) into the More*. Jakarta: s.n., pp. 19-45.

Hazeltine, B. & Bull, C., n.d. *Appropriate Technology: Tools, Choices and Implications.* s.l.:Academic Press Series in Engineering.

Henderson, K. A., 2011. Post-Positivism and the Pragmatics of Leisure Research. *Leisure Sciences*, 33(4), pp. 341-346

Hong Kong Science and Technology Parks Corporation, 2011. *HKSTP Incubation Programme.* [Online] Available at: http://www.hkstp.org/incu/incu/ [Accessed Jun 2018].

Hong Kong Science and Technology Parks Corporation, 2014. *TecFunding - Talent Development Support.* [Online] Available at: http://tecone.hkstp.org/t1_web/text_only/detail.html#194 [Accessed Jan 2020].

Hong Kong Science and Technology Parks Corporation, 2020. *Incu-Tech*. [Online] Available at: https://www.hkstp.org/en/how-we-serve/incubation-programmes/incu-tech/ [Accessed Jan 2020].

Huang, X., Soutar, G. N. & Brown, A., 2002. New Product Development Processes in Small and Medium-Sized Enterprises:Some Australian Evidence. *Journal of Small Business Management,* 40(1), pp. 27-42.

Hymer, S. H., 1976. The International Operations of National Firms. *Journal of International Management,* Volume 8, pp. 195-197.

Institute, L., 2017. *What is Globalization?.* [Online] Available at: http://www.globalization101.org/what-is-globalization/

International Tunneling and Underground Space Association, 2016. *Why go underground?*. [Online] Available at: http://tunnel.ita-aites.org/en/why-go-underground#collapse5 [Accessed July 2017].

International Tunneling and underground Space Association, 2017. *International Tunnelling and Underground Space Association.* [Online] Available at: https://www.ita-aites.org/ [Accessed 05 06 2018].

Iuliana, C., Sorin, M. D. & Razvan, D., 2008. The competitive advantage of small and medium enterprises. *Arhiva Revistei Facultatii de Stiinte Economice,* Volume 4, pp. 817-821.

Jensen, R. & Szulanski, G., 2004. Stickiness and the adaptation of organizational practices in cross-border knowledge transfers. *Journal of International Business Studies,* 35(6), pp. 508-523.

Johanson , J. & Vahlne, J. E., 2009. The Uppsala internationalization process model revisited: From liability of foreignness to liability of outsidership. *Journal of international business studies*, 40(9), pp. 1411-1431.

Johanson, J. & Vahlne, E., 2000. The internationalization process of the firm- A model of knowledge development and and increasing foreign market commitments. *Journal of International Business Studies*, 8(1), pp. 23-32.

Johanson, J. & Vahlne, J.-E., 1977. The Internationalization Process of the Firm-A Model of Knowledge Development and Increasing Foreign Market Commitments. *Journal of Itnernational Business Studies,* 8(1), pp. 23-32.

Johanson, J. & Wiedersheim-Paul, F., 2000. The Internationalization of the Firm - Four Swedish Cases. *Journal of Management Studies,* 8(1), pp. 23-32.

Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational researcher*, 33(7), 14-26.

Jones, N., n.d. *SME's Life Cycle - Steps to FAILURE or SUCCESS?*. [Online] Available at: http://www.moyak.com/papers/small-medium-enterprises.pdf [Accessed June 2017].

Kaplinsky, R., 2011. Schumacher meets Schumpeter: Appropriate technology below the radar. *Research Policy*, 40(2), 193-203.

Kelessidis, A., & Stasinakis, A. S., 2012. Comparative study of the methods used for treatment and final disposal of sewage sludge in European countries. *Waste management*, 32(6), 1186-1195.

Kim, S. & Doh, B., 2014. Government support for SME innovations in the regional industries: The case of government financial support program in South Korea. *Research Policy,* 43(9), pp. 1557-1569.

Kimura, H. L. a. F., 2010. *The Internationalization of Small and Medium Enterprises in Regional and Global Value Chains.* s.l.:ADBI Working Paper Series.

Knight, G. A. & Cavusgil, S. T., 2004. Innovation, organizational capabilities, and the born-global firm. *Journal of International Business Studies*, Volume 35, pp. 124-141.

Kong, W. M. & Leung, W. O., 2015. *Low Impact Development on Integrated Water Resources,* Hong Kong: HKIE Environmental Division.

Kontinen, T. & Ojala, A., 2011. Social capital in relation to the foreign market entry and post entry operations of family SMEs. *Journal of International Entrepreneurship,* 9(2), pp. 133-151.

Krause, R., 202). *Fujiyoshida Sengen Shrine- Traditional Starting Point for Climbing Mt. Fuji.* [Online] Available at: https://www.travelyesplease.com/travel-blog-fujiyoshida-sengen-shrine/ [Accessed Jan 2020].

Letmathe, P., & Balakrishnan, N., 2005. Environmental considerations on the optimal product mix. *European Journal of Operational Research*, 167(2), 398-412.

Li- Min Hsueh, A.-L. L. a. B. S., 2006. *White Paper on Small and Medium Enterprises in Taiwan.* s.l.:Small and Medium Enterprise Administration, Ministry of Economic Affairs.

Lin, N., Cook, K. & Burt, R. S., 2001. *Social capital: theory and research.* New York: Aldine de Gruyter.

Lopez, J., 2015. *Types of Innovation.* [Online] Available at: https://techblog.constantcontact.com/software-development/types-of-innovation/ [Accessed Jan 2020].

Lucas, P., 2012. *Critical reflection. What do we really mean?.* s.l., Australian Collaborative Education Network National Conference, p. p.163.

Lu, J. & Beamish, P., 2001. The internationalization and performance of SMEs. *Strategic Management Journal,* 22(6-7), pp. 565-586.

Mahbub, A., Tanvir, H. M. & Afrin, L. T., 2014. An Evaluation of Environmental and Social Impact due to Industrial Activities -A Case Study of Bangshi River around Dhaka Export Processing Zone (DEPZ), Bangladesh. *International Research Journal of Environment Sciences,* 3(2), pp. 103-111.

Makaela, M. M. & Maula, M. V., 2005. Cross-border venture capital and new venture internationalization: An isomorphism perspective. *Venture Capital,* 7(3), pp. 227-257.

Mason, M. K., 2018. *Research on Small Businesses.* [Online] Available at: http://www.moyak.com/papers/small-business-statistics.html [Accessed Jun 2018].

Melin, L., 2008. Creating value across generations in Family-controlled businesses: The role of family social capital. *Family Business Review,* 21(3), pp. 259-276.

Mezirow, J., 1990. How critical reflection triggers transformative learning. *Fostering Critical Reflection in Adulthood,* Volume 1, p.20.

Miettinen, R., 2000. The concept of experiential learning and John Dewey's theory of reflective thought and action. *International Journal of Lifelong Education,* 19(1), pp. 54-72.

Musteen, M., Francis, J., & Datta, D. K., 2010. The influence of international networks on internationalization speed and performance: A study of Czech SMEs. *Journal of World Business*, 45(3), 197-205.

Narayan, P. K. & Prasad, B. C., 2003. Fiji's Sugar, Tourism and Garment Industries: A Survey of Performance, Problems and Potentials. *Fijian Studies,* 1(1), pp. 3-27.

Ni'am, Moh & Othman, Fadil & Sohaili, Johan & Fauzia, Zulfa, 2008. Electrocoagulation technique for removal of COD and turbidity to improve wastewater quality. *Ultrapure Water*. 25. pp. 36-42.

Nicholas, J., Ledwith, A., & Perks, H., 2011. New product development best practice in SME and large organisations: theory vs practice. *European Journal of Innovation Management*, 14(2), 227-251.

Noor, K. B. M., 2008. Case study: A strategic research methodology. *American journal of applied sciences*, 5(11), 1602-1604.

NORWEGIAN TUNNELLING SOCIETY, 2017. *The Principles of Norwegian Tunnelling,* Oslo: Norsk Forening for Fjellsprengningsteknikk NFF.

O' Donoghue, T. & Punch, K., 2003. *Qualitative Educational Research in Action.* London: RoutledgeFalmer.

Oladoja, N. A., 2017. Appropriate technology for domestic wastewater management in under resourced regions of the world. *Applied Water Science,* 7(7), pp. 3391-3406.

Omondi, D. O., 2017. Wastewater Management Techniques: A Review of Advancement on the Appropriate Wastewater Treatment Principles for Sustainability. *Environmental Management and Sustainable Development,* 6(1), pp. 40-58.

Onwuegbuzie, A. J., & Leech, N. L., 2005. On becoming a pragmatic researcher: The importance of combining quantitative and qualitative research methodologies. *International journal of social research methodology*, 8(5), 375-387.

Owen, D. A. L., 2013. The Singapore water story. *International Journal of Water Resources Development,* 29(2).

Oxford Economics, 2017. *2017 American Express Global SME Pulse Report,* London: Oxford Economics and American Express Services Europe Limited.

Pajares, 2002. *Overview of Social Cognitive Theory and of self-efficacy.* [Online] Available at: http://ww.desemory.edu/mfp/eff.html [Accessed July 2012].

Pandian, J. & Sim, A., 2002. *Internationalisation Process: Revisiting the Uppsala Model in the Asian Context,* s.l.: s.n.

Park, K., & Kim, B. K., 2013. Dynamic capabilities and new product development performance: Korean SMEs. *Asian Journal of Technology Innovation*, 21(2), 202-219.

Pavlenko, A., 2002. Narrative Study: Whose Story Is It, Anyway?. *TESOL Quarterly,* 36(2), pp. 213-218.

Pei, M., Zhang, B., He, Y., Su, J., Gin, K., Lev, O., … Hu, S., 2019. State of the art of tertiary treatment technologies for controlling antibiotic resistance in wastewater treatment plants. *Environment International*, 131, 105026.

Peng, A., 2006. *Global Strategy,* Ohio: Mason.

Periathamby, A., Hamid, F. S., & Khidzir, K., 2009. Evolution of solid waste management in Malaysia: impacts and implications of the solid waste bill, 2007. *Journal of material cycles and waste management*, 11(2), 96-103.

Pu, H., & Zheng, Y., 2015. The FDI of small-and middle-sized enterprises: a literature review. *Technology and Investment*, 6(01), 63.

Tam, V. W., & Tam, C. M., 2006. A review on the viable technology for construction waste recycling. Resources, conservation and recycling, 47(3), 209-221.

Pilgrim, R. M. a. M., 1994. Policy- induced constraints on small enterprise development in Asian developing countries.. *Small Enterprise Development*, 5(2), pp. 32-38.

Pruppacher, H. R., Semonin, R. G. & Slinn, W. G. N., 1982. *Precipitation scavenging, dry deposition, and resuspension: proceedings of the fourth international conference*, Santa Monica: Environmental Protection Agency.

Rathnayake, U., Suratissa, D. M. & Chand, D., 2014. Water quality analysis in Nasese bay, Suva, Fiji Islands. *Water Quality*, pp. 18-27.

Rese, A. & Baier, D., 2011. Success factors for innovation management in networks of small and medium enterprises. *R&D Management*, 41(2), pp. 138-155.

Rohlander, D., 2014. *Management Skills: Easy-to-Follow Lessons on Effectively Managing People.* Penguin.

Roy, S., Sivakumar, K. & Wilkinson, I. F., 2004. Innovation generation in supply chain relationships: A conceptual model and research propositions. *Journal of the Academy of Marketing Science*, 32(1), pp. 61-79.

Rugman, A., 1982. *New theories of the multinational enterprise*. International Business Studies, Nova Scotia: Croom Helm.

Sarvodaya, B., 2011. *Complete Information on Gandhi: Timeline,* s.l.: Mandal/ Gandhi Book Centre and Gandhi Research Foundation.

Sianipar, C., Dowaki, K., Yudoko, G., & Adhiutama, A. (2013). Seven pillars of survivability: Appropriate technology with a human face. *European Journal of Sustainable Development*, 2(4), 1-18.

Schaper, m. T. & Lewer, J., 2009. Business Incubation in Australia: Policies, Practices and Outcomes. *Asia Pacific Journal of Innovation and Entrepreneurship*, 3(3), pp. 37-46.

Schumacher Center for New Economics, 2013. *Schumacher on Appropriate technology 1.* s.l.:Schumacher Center for New Economics.

Schwarzenbach, R. P. et al., 2006. The Challenge of Micropollutants in Aquatic Systems. *Science*, 313(5720), pp. 1072-1077.

Schwarz, G., & Stensaker, I., 2014. Time to Take Off the Theoretical Straightjacket and (Re-)Introduce Phenomenon-Driven Research. *The Journal of Applied Behavioral Science*, 50(4), 478–501.

Shaker, A. Z., Neubaum, D. O. & Huse, M., 1997. The effect of the environment on export performance among telecommunications new ventures. *Entrepreneurship Theory and Practice*, 22(1), pp. 25-46.

Signore, S., 2020. The Private Value of Patents for Government-supported Start-Ups: The Case of the European Investment Fund. *In Contemporary Developments in Entrepreneurial Finance* (pp. 175-199). Springer, Cham.

Singh, J. V., Tucker, D. J. & House, R. J., 1986. Organizational Legitimacy and the Liability of Newness. *Administrative Science Quarterly*, 31(2), pp. 171-193.

Singh, M., & Srivastava, R. K. (2011). Sequencing batch reactor technology for biological wastewater treatment: a review. *Asia-pacific journal of chemical engineering*, 6(1), 3-13.

Singh, N., 2012. *Localization strategies for global e-business.* Cambridge: Cambridge University Press.

Siu, W.-S. & Kirby, D., 1999. Small Firm Marketing: A Comparison of Eastern and Western Marketing Practices. *Asia Pacific Journal of Management*, 16(2), pp. 259-274.

South China Morning Post, 2017. *Hong Kong crowned world's most competitive economy, beating Singapore.* [Online] Available at: http://www.scmp.com/news/hong-kong/economy/article/2096456/hong-kong-crowned-worlds-most-competitive-economy [Accessed 29 05 2018].

Stewart, W., 2017. *Marshall McLuhan Predicts The Global Village.* [Online].

Stinchcombe, A. L., 2000. Social structure and organizations. *Advances in Strategic Management*, Volume 17, pp. 229-259.

Support and Consultation Centre for SMEs- Trade and Industry Department, 2017. *Small and Medium Enterprises (SMEs).* [Online] Available at: https://www.success.tid.gov.hk/english/aboutus/sme/service_detail_6863.html [Accessed 30 05 2018].

Support and Consultation Centre for SMEs, 2017. *Small and medium enterprises (SMEs).* [Online] Available at: https://www.success.tid.gov.hk/english/aboutus/sme/service_detail_6863.html [Accessed 05 06 2018].

Teodosiu, C., Robu, B., Cojocariu, C. & Barjoveanu, G., 2015. Environmental impact and risk quantification based on selected water quality indicators. *Journal of the International Society for the Prevention and Mitigation of Natural Hazards*, 75(1), pp. 89-105.

Thai, M. T. T. & Chong, L. C., 2008. Born-global: the case of four Vietnamese SMEs. *Journal of International Entrepreneurship,* 6(2), p. 72.

The Government of the Hong Kong Special Administrative Region, 2016. *Appointments to Small and Medium Enterprises Committee.* [Online] Available at: http://www.info.gov.hk/gia/general/201612/30/P2016122800649.htm [Accessed 20 June 2018].

The Hong Kong Chinese Importers' & Exporters' Association, Hong Kong Baptist University- School of Business, Institute for Enterprise Development, 2011. *The Road to Sustainable Development of Hong Kong SMEs: The Present and Future- Survey Report on Import and Export Trade Cum Manufacturing Sector,* Hong Kong: The Hong Kong Chinese Importers' and Exporters' Association.

The International Water Association, 2018. *The Reuse Opportunity: Cities seizing the reuse opportunity in a circular economy.* London: The International Water Association.

Tortajada, C., Joshi, Y. K. & Biswas, A. K., 2013. *The Singapore Water Story: Sustainable Development in an Urban City-State.* 1st ed. Abingdon: Routledge.

Trade and Industry Department- The Government of the Hong Kong Special Administrative Region, 2012. *SMEs & Industry - Support to Small and Medium Enterprises.* [Online] Available at: https://www.tid.gov.hk/english/smes_industry/smes/smes_content.html [Accessed 20 June 2018].

Tunnel Business Magazine, 2016. Tunneling Industry Outlook 2016. *Tunnel Business Magazine,* 23 February.

Vandenberg, P., Chantapacdepong, P. & Yoshino, N., 2016. *SMEs in Developing Asia - New Approches to Overcoming Market Failures,* Tokyo: Asian Development Bank Institute.

Welch, C., Peikkari, R., Plakoyiannaki, E. & Paavilainen-Mantymaki, E., 2011. Theorising from case studies: Towards a pluralist future for international business research. *Journal of International Business Studies,* Volume 42, pp. 740-762.

Wong, P. L. a. Y., 1992. *Small and Medium Enterprises in the Economic Development of Hong Kong* , s.l.: s.n.

World Intellectual Property Organization, 2003. *What is intellectual property?* (No. 450). WIPO.

Yin, R. K., 2009. *Case Study Research: Design and methods (applied social research methods).* 5th ed. London and Singapore: Sage.

Yvonne Feilzer, M., 2010. Doing mixed methods research pragmatically: Implications for the rediscovery of pragmatism as a research paradigm. *Journal of mixed methods research*, 4(1), 6-16.

Zainal, Z., 2007. Case study as a research method. *Jurnal Kemanusiaan,* Volume 9, p. 6.

Zhang, D. Q., Tan, S. K., & Gersberg, R. M. (2010). Municipal solid waste management in China: status, problems and challenges. *Journal of environmental management*, 91(8), 1623-1633.

Zhou, L., Wu, W.-p. & Luo, X., 2007. Internationalization and the performance of born-global SMEs: the mediating role of social networks. *Journal of International Business Studies,* Volume 38, pp. 673-690.

Zucker, D. M., 2009. How to Do Case Study Research. *School of Nursing Faculty Publication Series,* Volume 2, p. 17.

Appendix I

Volume 1 (DPS 5120)

RAL for Advanced Professional Knowledge Project
(120 Credits)

WETSEP - PACKAGED WATER & WASTEWATER FILTRATION TREATMENT SYSTEM – INNOVATION IN PROGRESS

Submitted to Professor Steven Li
Professor Paul Gibbs

Work Based Learning Centre, Hong Kong
London

Student Name: Leung Wai On
Student Number: 2436758
Advisors Name: Prof. Paul Gibbs

Submission Date: 20 August 2012
Version 7

Middlesex University
MIDDLESEX UNIVERSITY

Abstract

This claim is to present my career in the development of my patented packaged Water & Wastewater Treatment System (WetSep) and the continuous improvement of the design.

This claim summarizes the invention and innovation of the WetSep system. The pollution caused by soil erosion due to water runoff, off-site environmental problem, and construction site activities has been drawing the attention to the public. Recently more government regulations have been implemented in order to minimize the water pollution from the construction site. These changes have inspired me to invent the WetSep filtration system to address these problems.

The development of the WetSep system is then described in this claim. The concept of the WetSep is to incorporate the traditional Chemically Enhanced Primary Treatment (CEPT) system into a standard 20' container, with some special features including vertical inline mixer, lamella block and conical filter. In the product development, five (5) general stages are involved, namely innovative design, patent application, prototype development, manufacturing and marketing/sales. The patent of the WetSep has been successfully applied worldwide. Comprehensive testing on the turbidity removal by WetSep has been done and it is found that the WetSep system is able to remove more than ninety nine (99) % of the turbidity for construction site stormwater runoff with a turbidity of less than thousand (1,000) NTU. Four market strategies, namely discovering the unique features from the competitors, product portfolio, exploring new markets and internationalization, are developed for the WetSep system.

Continuous improvement on the WetSep system has been made and the second (2nd) generation of WetSep is invented driven by three factors: (1) requirement of client, (2) stricter government regulations, (3) integration of new technologies, (4) cost implication, (5) market share/competition and (6) innovation. The new design concept is to combine the Impinging Stream Reactor (ISR) which is the Master Unit and a flexible modular secondary treatment Slave Unit which is typically a lamella gravity settler. The effluent from the ISR Master modeul can enter various slave modeules depending on the purpose of the effluent. Apart from functional versatility, each unit is fitted into three (3) m offshore container which can be assembled using coupling parts, allowing much more freedom in transportation and shipping.

Table of Contents

1. Introduction

This claim is to present my career in the development of my patented packaged water & wastewater treatment system (WetSep) and the continuous improvement of the design to serve as a Level 8 claim for 120 credits in my Doctorate Professional Studies (DProf). This DProf research will present the background and development WetSep technology (RAL 8) to develop a comprehensive business model and global marketing strategy to market the WetSep system in the international market.

The purpose of this claim is to review the development of a packaged Water & Wastewater Filtration System (WetSep) which is has been used in Hong Kong and various parts of the world for treating different kinds of wastewater. It also demonstrates that my work experience and knowledge is closely relevant to my research topic for the DProf study. This claim first reviews the technologies inspired me for the development of the packaged plant.

A discussion of the development process of the WetSep system and its impacts to my career, company and profession will be conducted. Recent developments to the WetSep design to create a second generation will be discussed and will be used as a platform to produce a global strategy and business model to market WetSep in other markets.

2. Initiation of WetSep

I established my company, Waste & Environmental Technologies Ltd. (WET) in 1998 and is a solution provider for the environmental problems using appropriate technologies in an innovative way. As I started my career in the construction industry, I found that there was and still a strong demand for treating construction wastewater. Therefore, I used my knowledge and experience gained throughout my career to invent a packaged wastewater equipment for construction wastewater, WetSep. The WetSep filtration system has been applied to sixteen (16) countries around the world to date.

Soil erosion due to water runoff is one of the leading causes of water quality problems in many parts of the world [1]. Off-site environmental problems, such as sedimentation in streams and reservoirs and sediment-borne chemical pollution of surface water bodies, have also become public concerns. The problem becomes more significant on construction sites due to exposure of the ground surface for erosion and potential for rainfall runoff. Construction activities like clearing, excavating and grading significantly disturb soil and sediment. If the soil in the construction site is not managed properly it can easily be washed off from the construction site during storms and potentially pollute nearby water bodies.

In order to reduce water pollution from construction sites, stricter regulations (Construction and Development (C&D) stormwater rule) have been implemented in 2010 by U.S. Environmental Protection Agency [2]. The rule requires construction site owners and operators that disturb one or more acre to use best management practices (BMP's) to ensure that soil disturbed during construction activity does not pollute nearby water bodies. In addition, owners and operators of sites that impact more land area at one time will be required to monitor discharges and ensure they comply with specific limits on discharges. Imhoff tanks, frac tanks (which is also known as mobile storage tank for the storage of water) and settling ponds have been traditionally used to reduce the amount of soil runoff in construction stormwater due to its simplicity and cost-effectiveness. The use of chemical treatment is also available to remove the smaller particles which are difficult to settle in order to meet the USEPA discharge requirement. However, proper dosing, mixing, contact time and settling time are needed to ensure effective chemical treatment [3, 4]. Also, matching the right coagulants and flocculants to a

specific sediment and water composition is important to ensure efficient treatment of the wastewater[5].

I have been working in the environmental industry for more than twenty (20) years and have a basic understanding on mechanisms for the available waste treatment technologies in the market. I have used my professional knowledge and experience to develop my patented technology. Now, the application of WetSep has extended from the construction industries to treat wastewater from various other applications. The WetSep employed chemical method to enhance the separation of pollutants from the wastewater.

The WetSep system is designed for construction runoff with focus on the design of both chemical and physical technologies for separation of suspended solids and other pollutants in water. It employed different technologies including coagulation, flocculation, static inline mixing, impinging stream reaction, cone filter, lamella plate and computerized fluid design (CFD). After treatment, the wastewater can be reused or direct discharged into the urban storm drain or river nearby. The treated effluents are able to meet the established discharge standard. The WetSep system can provide a compact all-in-one system for the treatment plant. The WetSep filtration system only requires less than one six (6) m container footprint. It provides a safe and effective method for removing sediment from wastewater and the system requires minimal attendance of skilled labour or engineer to operate.

3. Development of WetSep System (1st Generation)

3.1. Urgent Need for a Compact Wastewater Treatment System in Construction Area

The construction industry has always played and continues to play a very important role in the Hong Kong's economy. According to the Census and Statistics Department of Hong Kong Special Administrative Region (HKSAR), “construction” contributes approximately 3.3% to the GDP in 2010 and employs 9.0% of the workforce in Hong Kong [6].

Hong Kong is one of the most congested cities (i.e. high population density) of the world. The urban runoff is discharged to the sea mostly by storm drain and box culverts. The construction runoff generally carrying large amounts of soil and sediments would create a heavy impact to the environment and block up the drain system [7]. As mentioned, the traditional system such as Imhoff tank and frac tank has been using to treat the construction sewage. However, government regulations have become stricter and the attention to the public awareness of environmental protection has been rising in recent times, the construction sites need a more effective system. In order to install a conventional wastewater treatment at the job site, difficulties such as: space limitation, setting up, capital and operating cost and availability of skilled workers to operate. Treatment of the wastewater from construction sites are treated by the General Contractors as an additional cost/expense therefore a solution for wastewater treatment must be a turn-key operation that is user friendly and easy to operate.

3.2. Invention of WetSep

The packaged treatment system - WetSep, was first invented in 1998 and has since continued to be improved and modified. The WetSep was inspired from a domestic washing machine and leads me to develop the WetSep Filtration System. Traditionally and even today, doing laundry without a washing machine is a laborious task. As an analogy, in the very old days, sailor put in their clothes inside a strong cloth bag overboard to allow water passing though the bag for hours to clean. As such, the washing machine was time saver in the case of washing clothes.

During the design phase of WetSep, a number of challenges have been faced. First of all, the turbidity (a measure of how clear the water appears) in the construction's wastewater is high and the amount generated is high. The simple design like Imhoff tank and frac tank alone is not able to treat the wastewater to meet the discharge standard. Nevertheless, although the compact system such as the traditional Chemically Enhanced Primary Treatment (CEPT), shown in Figure 3-1, can treat the large amount of high turbidity wastewater, it usually occupies too much space to build. Hence, the WetSep system was designed to a compact all-in-one system to a construction site. A traditional CEPT system including coagulant tank, flocculant tank, primary clarifier or sedimentation tank, filter, and disinfectant tank is fitted into a standard 20' container (L x W x H: 5.89 m x 2.33 m x 2.38 m). Also, to boost the performance, some special features are incorporated into the WetSep system. For example, the vertical inline mixer is used to enhance the chemical mixing [8]; lamella block and conical filter is used to facilitate the suspended solid and turbidity removal [9]. Coagulant and flocculant are added to aggregate and flocculate the particles[10]. Figure 3-2 demonstrates the flow diagram of the WetSep filtration system. More detailed technical information is summarized in Appendix C.

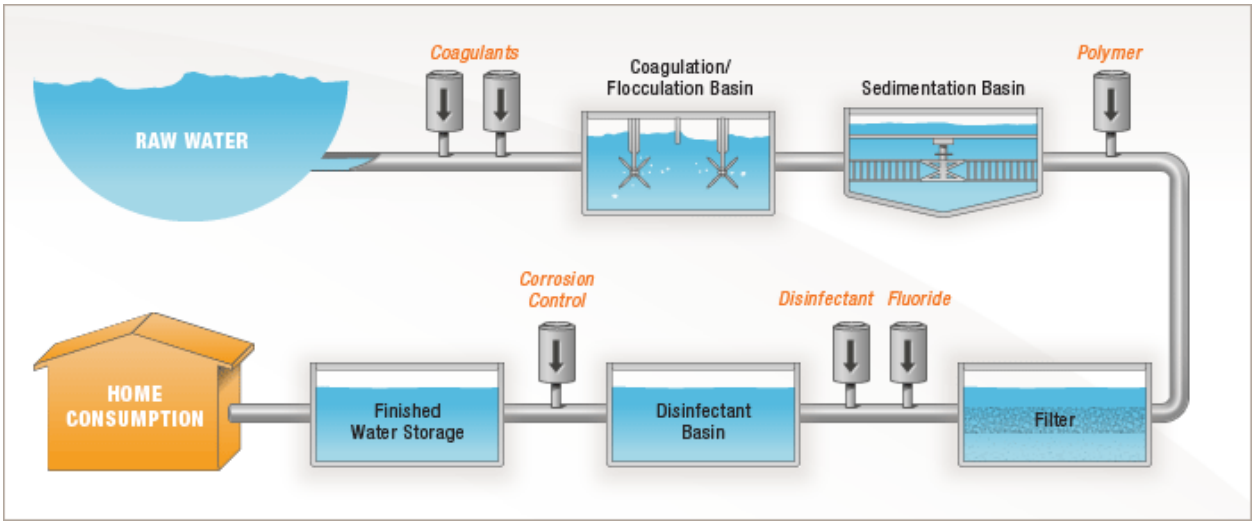


Figure 3-1 Flow Diagram of Typical CEPT system[11].

Paying close attention to the industry allowed me to better design the WetSep System. I noticed that there is less people that willing to engage in the construction industry recently, causing the surge in labour cost. Therefore, the WetSep system employs minimal mechanical and electrical parts that require minimal labour to operate and maintain.

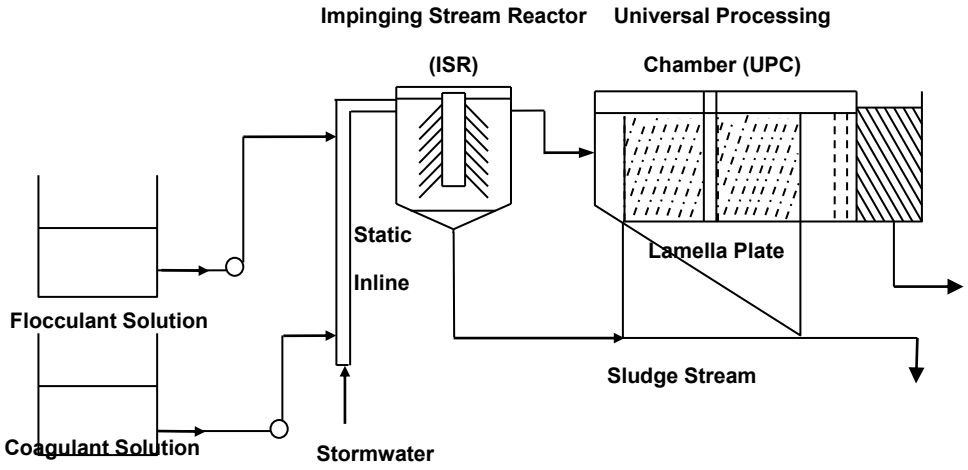


Figure 3-2 Flow diagram of WetSep filtration system.

3.3. Product Development

This section describes the product development stage prior to the product being released to the market. Making a good product does not mean to have a good sale volume if we fail to let customer to understand the merit of the WetSep. It is necessary to acquire solid support to the WetSep before promoting the WetSep into market. Though the general concept of WetSep was generated with the support of theories, the actual performance of the WetSep was still undefined at the product development Stage. Therefore, a series of performance testing was carried out.

The general stages that were undertaken in the development and commercialization of the WetSep product are as follows [12-15]:

- Innovative Design
- Patent Application
- Prototype Development
- Manufacturing
- Marketing/Sales

Innovative Design Stage – This stage involves the development of the idea for the product. I was able to combine my practical experience and knowledge together to develop in concept this design that I felt would be successful in the treatment of wastewater in the construction industry. This stage involved thinking about the major components of the system and coming up with a plan to commercialize the product.

Patent Application – To protect the Intellectual Property (IP) of the new design, a patent application was made for the innovative design. The patent application is a fairly long process that requires both time and financial resources. The patent helps ensures that other parties will not copy this idea and use it to get financial gains improperly.

Prototype Development – A prototype WetSep system was created to try and test the overall concept of the treatment system. The system was used to determine the performance of the treatment process and help set the standards that were used to sell the unit to the marketplace.

Manufacturing – Once the prototype development was successful, a more structured manufacturing process was developed to allow for quality control (i.e. through the use of ISO9000 quality control system) and mass production. The initial portions of this stage was challenging as suppliers for the

components needed to be found and adapted to the system. Constant monitoring of both the manufacturing process and quality of the finished product is necessary to meet the Customer's needs and requirements.

Sales/Marketing – The sales/marketing stage to fully commercialize the product and to grow and operate my business. The marketing and sales aspects have been largely done through my social network and word of mouth from our customers. This is a very important aspect of the business for grow the international sales.

3.3.1. Testing of Removal Efficiency of WetSep

As mentioned in previous section, there is a strict restriction to the turbidity of the water discharge in a construction site. Therefore, the removal efficiency is the most urgent parameter for the WetSep and the equation of removal efficiency is shown as below [16].

$$Removal\ \ efficiency\ \ (\%) = \frac{Influent\ \ turbidity - effluent\ \ turbidity}{Influent\ \ turbidity} \times 100\%$$

Figure 3-3 shows the removal efficiency of WetSep filtration system with different influent turbidities. It is found that the WetSep filtration system will remove greater than ninety nine (99) % of the turbidity for construction site stormwater runoff with a turbidity of less than thousand (1,000) NTU (influent),. For construction site stormwater runoff with a turbidity of less than five thousands (5,000) NTU (influent), a properly engineered and deployed WetSep filtration system can remove greater than 99 % of the turbidity, producing effluent that will consistently meet the state surface water discharge standards.

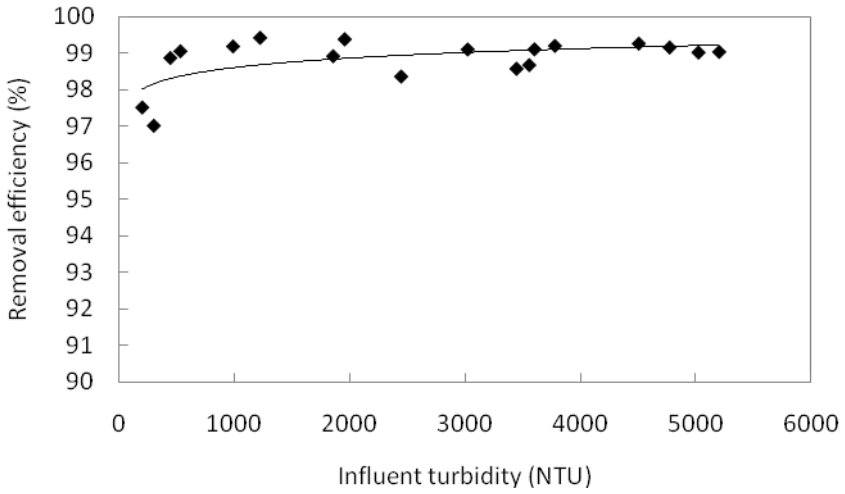


Figure 3-3 Removal efficiency of WetSep filtration system with different influent turbidities.

3.3.2. Costing of the WetSep System

Product cost includes the cost that consumed to create a product. It includes manufacturing overhead, cost of direct labour and materials. Product costing is an extremely important component in evaluating and planning overall business strategies and become critically important to a business survival. The customer would not purchase the product if the price is set too high but the company does not get enough profit to survive if the price is too low.

The first part of the product costing considers the range of factors which affect the price. Some of these are listed below:

- Volume and pumping rate of water being treated – larger clarifier or extra treatment may needed causing the increase in the manufacturing overhead ;
- Turbidity levels of the source water and reduction in turbidity needed;
- Water quality of the influent water; and;
- pH of the construction water.

Usually, the market value of a wastewater treatment with higher capacity (treating large volume of water) is higher than that with lower capacity.

The chemical cost is \$0.137 per m^3 of water treated. Substituting another chemical additive or polymer, such as chitosan, in the same system may increase costs, assuming they have similar performance characteristics. As with the other chemicals, the right chemical at the right dosage must be used for treatment.

The detailed estimation of the running cost in the chemical and electrical consumption is in Appendix B.

3.4. Application Patent

To have the right to practice or use the WetSep, application for a patent worldwide is necessary. Having a patent, I can enjoy the right to exclude others from making, using, selling, offering for sale, or importing the patent invention for the term of the patent.

I firstly targeted on the short-term patent in Hong Kong and I discovered that there is a patent application grant offering from Hong Kong government to assist the local companies and individuals to apply the patents of their own invention. Though the grant, I have successfully apply the short-term patent thought the implementation agent in 1999.

In fact, the benefit of a patent not only allow me to enjoy the exclusion right of using WetSep, but also have the recognition of the claimed technology, which help on the marketing. Therefore, I continue apply the patent in other countries including US, Australia, Japan, China and so on.

3.5. Marketing Strategy

Marketing strategy is defined as an endeavour by a corporation to differentiate itself positively from its competitors, using its relative corporate strengths to better satisfy customer needs in a given environmental setting [17].
There are four strategies in marketing the WetSep system:

1. Discovering the Unique Features from the Competitors
2. Product Portfolio
3. Exploring New Markets
4. Internationalization

Maheshwari & Reddy stated there is a problem for customer to choose the product from group of similar products [18]. Therefore, it is vital to identify the unique features of WetSep and show them to our customer.

Effective portfolio is essential to successful product innovation [19]. The products in portfolio can serve customer needs and they have the tendency to achieve the success in the marketplace [20].

Company always try to explore new markets in order to diminish the risk because the market might shrink due to the environmental change. Exploring

new markets is not limited to the local market. Internationalization is one of the most important path for company growth. Entering a new market, customer bases will be broaden, which would help the growth of a company by increasing the production volume [21]. It has been increasing the importance for all firm, especially those operating in limited domestic markets[22].

3.5.1. Discovering the Unique Features from the Competitors

There are existing wastewater treatment systems used in construction site such as The TotalTreat Continuous Precipitation System (CPS) from Siemens and sand filter. I did the competitor research including search product information from internet, interviewing their customer, and attending the conference to identify the merit and drawback of the potential competitive product. In order to gain the market share, I need to explore the unique advantages than just water treatment. Apart from the high effectiveness in turbidity removal, the following is a list of benefits of the WetSep technology used both the water and wastewater packaged systems:

- Environmental compliance to relevant standards and regulations;
- Simple engineered design;
- Easy installation and setup;
- Localized chemical preparation and storage;
- Equipment can be operated by unskilled labour;
- Low maintenance requirements as there are no mechanical moving parts;
- Small physical footprint of packaged systems;
- Low carbon footprint as very little energy is required to run the entire system (primarily gravity driven system);

3.5.2. Product Portfolio

Different quality and quantity of the construction water produced required different size of the wastewater treatment system. To meet the customer requirement, production diversification is needed.

Four capacities of WetSep filtration systems (1st Generation) are provided for treating different volume of construction runoff. The treatment capacity of WetSep WS10, WS20, WS60 and WS100 are 10, 20, 60, 100 m^3/h (20-40, 70-90, 220-260 and 350-440 gallons per minute) respectively. The sizing chart for various models of WetSep is listed in Table 3-1. In general, WS 10, WS 20

and WS 40 are used for road work (40 GPM), building project (100 GPM) and site formation (250 GPM) respectively.

Table 3-1 WetSep filtration system sizing table.

WetSep Model	ISR Diameter (m)	Water Inlet (m)	Water Outlet (m)	Water Quality Treatment Flow (m^3/h)
WS10	1.6	0.08	0.08	10
WS20	2.2	0.08	0.08	20
WS60	2.4	0.08	0.10	60

3.5.3. Exploring New Markets

Though the WetSep System is firstly targeted on wastewater from construction site, the potential use of the WetSep is kept exploring. The WetSep Filtration System has different configuration to cater the site conditions.

In the remote area, the supply of electricity is insufficient. As mentioned, the electricity requirement for the WetSep system is very low, using simple M&E equipment that allows the WetSep to be run by solar energy. The flow rate start from five (5) to sixty (60) m^3/h and all can be set up within four (4) hours. One of the examples of the WetSep using in remote location – Tai O is summarized in Appendix A – A5.

Figure 3-4 Solar WetSep filtration system.

The environmental restriction is stricter that the use of strong acid in wastewater treatment such as sulphuric acid is inhibited for adjusting the pH of

the influent solution. The WetSep Wastewater Filtration System is able to modify to use CO_2 neutralization, a more environmental-friendly method.

3.5.4.Internationalization

The WetSep System is a patented product providing a turn-key solution for water and wastewater treatment. In 2000 it had been adopted by Gammon Skanska during construction of a HK$500 million ($64 million) sewage tunnel in Hong Kong. It has also been applied for contaminated soil treatment project and achieved 25 ppb in removal of Total Petroleum Hydrocarbon (TPH) from a retired Bus Depot. Apart from Hong Kong, WetSep was also applied in overseas such as United States, Taiwan, Sweden and Australia. In Taiwan Pinglin tunnel project, the system treated wastewater of 300 m^3/h underground at 250 m below the surface before discharging to the nearest reservoir. More than 150 installations have been installed around the world to date. Figure 3-5 shows the WetSep filtration system in New Jersey, U.S. The field test and case study of the WetSep filtration system are shown in Appendix A.

Figure 3-5 WetSep filtration system in Harrison, Middlesex Street, New Jersey, U.S.

3.6. Impacts

Throughout the development of WetSep system there have impacts to my professional career, my company and personal life. There have been both challenges and successes that I have gained as a result of the development of this product.

The WetSep system has had an overall positive effect on my professional career. Over the years as more and more WetSep units have been sold, my social network of professionals have increased allow for further business growth. The knowledge and experiences gained from the development, manufacture and sale of the product has increased my technical skill set that has allowed me to apply these experiences onto other environmental projects. Therefore, not only had the WetSep unit produced a financial gain but also increased the number of different projects I have been able to undertake over the years.

At first, the WetSep system did not comprise a large portion of the overall business, approximately 25% in the first few years. However, last year in 2011, the WetSep system comprised of approximately 45% of the overall business. Additionally, the international export of the WetSep system has increased from 0% since the start to approximately 10% last year. The growth of the WetSep system has been a positive growth revenue stream for my company. The constant development and refinement of the WetSep product has also allowed my staff to learn new technical skills and allowed the workforce to become more skilled that contribute positively to the overall company.

Finally, the development of the WetSep system has had an impact on my personal life as well. Without the support of my family and staff at the company, I would have not been able to realize the success of this process. My family has been a strong supporter in the development of this product even though a lot of my time has been spent overseas to market and sell the product and look for new suppliers. Through the course of the development I have understood how important a family is to support my endeavours and how lucky I have been to have their support.

Table 3-1 summarize the achievement and recognition of WET since 1999 and Appendix D shows the certificate.

Table 3-2 Achievement and Recognition of WET

Year	Achievement and Recognition
2012	One of the 40 Companies in the Hong Kong SME Business Sustainability Index 2012
2009	Participation in The Hong Kong Carbon Reduction Campaign 2009-2010
2007	Certificate of Excellence of HSBC Living Business
2007-2009	Caring Company awarded by The Hong Kong Councilor Social Service
2006	Notable Mention Mobile Lavatory System in 1999 Eco-Production Award
2005, 2008-2009	Certificate of Merit of HSBC Living Business
2004-2006	Organization Member of Hong Kong Waste Management Assoication
2004	Graduate from Incu-Tech Programme of Hong Kong Science & Technology Parks Corporation
2004	Finalist of The World Technology Awards San Francisco, USA
2004	2004 Hong Kong Award for Industry: Machinery and Equipment Design Certificate of Merit for Eco-Toilet
2003	Approval to WET for Environmental Engineering Engineering Graduate Training Scheme “A”
2003	Silver Award of 6th Asian Innovation Awards Global Entrepolis in Singapore 2003
2003	2003 Hong Kong Award for Industry: Machinery and Equipment Design Certificate of Merit for Water Treatment System by Solar Power for Remote Area
2002	Environmental Price for Waste Water Filtration System in SALON INTERNATIONAL DES INVENTIONS
2002	2002 Hong Kong Award for Industry: Machinery and Equipment Design Certificate of Merit for Advanced Composite Material
2001	Certificate of Appreciation for providing workplace attachment training under the Youth Pre employment Training Programme
2000	Silver Award of International Invention EXPO2000 – Hong

	Kong
2000	Winner if New SME Silver Award
1999	Notable Mention for WetDust Dust Suppression System in 1999 Eco-Production Award
1999	1999 Hong Kong Award for Industry: Machinery and Equipment Design Certificate of Merit for WetSep Construction Effluent Treatment System

4. Development of Innovative product – WetSep System (2nd Generation)

4.1. Continuous Improvement

The first generation WetSep system was initially designed nearly fourteen (14) years ago in 1998. As with any product, various research and development refinements have been made over the last decade to refine and improve the WetSep system. Some of these refinements have been successful and other refinements have not been as successful to improve performance.

The main factors for the continuous research and development to improve the WetSep system are as follows:

a) Client Driven: Clients are a main driver to make improvements to the WetSep system as they are essentially the end user for the product. The end user is generally concerned with the operational and maintenance aspect of WetSep system as this is the most impacted area for them. This area will incur the most cost over the operational life of the system. There have been improvements to reduce the operational costs and reduce maintenance requirements by introducing new methods and technology such as simplified electrical controls for easy operation.

b) Government Regulations: From time to time, government regulations are modified or added to require different discharge requirements that have required modifications to the process and/or machinery to be compliant. Different jurisdictions require different standards. For example, to acquire approval for the State of Washington, only chitosan can be used for the chemical treatment because of the residual effects of the chemicals (chitosan is bio-degradable) being discharged into the surrounding environment.

c) Integration of New Technologies: Since the initial introduction of the WetSep system in 1998, there have been new technology and upgrading of existing technology to have more efficient designs and/or improved functions. For example, the WetSep has been recently installed with an updated Programmable Logic Controller (PLC) to

allow a more streamlined control for the system. The previous system relied on a relay control panel system that required more manual input.

d) Cost Implications: Technology and manufacturing processes have improved over time making them either more efficient and/or lower production costs. The WetSep system has incorporated the upgraded components at lower costs to overall improve and lower WetSep's manufacturing costs. This has allowed the WetSep to remain competitive in the marketplace.

e) Market Share/Competition: Due to local and international competition and maintaining current market share, constant monitoring of competitor's designs is necessary to ensure that the WetSep system offers equivalent and/or superior options and functions to meet the Client's needs.

f) Innovation: Based on observations and field tests of the performance of the system, improvements to the design and process have been made recently and are described in general in Section 5.2. The new innovations will be incorporated into new patents for the second generation WetSep.

4.2. Modular WetSep Design

Based on the factors described in Session 4.1, the second generation WetSep (modular design) has been designed to meet the requirements of Clients and new and existing discharge standards while providing a flexible platform for water and wastewater treatment.

The WetSep system (2nd Generation) is an innovative design concept that combines the Impinging Stream Reactor (ISR) which is the Master Unit and a flexible modular secondary treatment Slave Unit (typically a lamella gravity settler) that effectively removes suspended particles at a much smaller footprint than the first (1st) Generation WetSep system which the standard WetSep 60 was based on a standard six (6) m (20') shipping container frame for easy transportation and shipping. The improved WetSep system further addresses the confined space constraints that commonly exists in construction sites by separating the unit into two (2) three (3) m (10') offshore container modules. This modular system is a flexible and versatile design that allows much freedom to how it can be assembled using coupling parts.

Due to the intense urbanization in Hong Kong, space limitation makes delivery of the six (6) m (20') container cargo impractical on some construction sites. This concern is especially true in Oceania where development in the Pacific islands require small, mobile units that can be easily transported from one location to another. The modular design is ideal for this purpose as it eliminates the need to allocate a large area for a construction wastewater system.

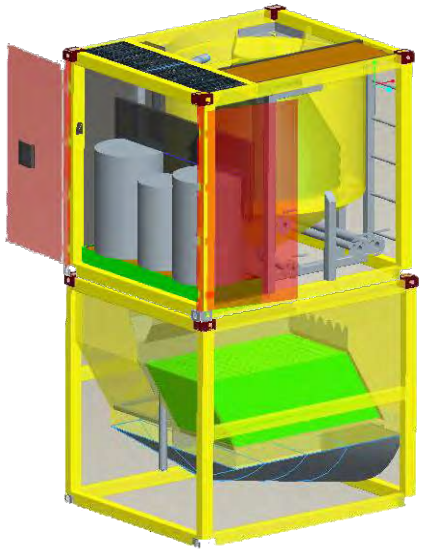


Figure 4-1 Stackable Modular Configuration

Figure 4-1 shows the 2nd Generation WetSep System with the new 10-ft container modules, each WetSep component can be arranged in stacks or in other geometric shapes that satisfy both space constraints and Client's needs.

Depending on the influent characteristics and effluent requirements, the WetSep system may be as simple as one master ISR module or as a collection of slave modules after the master. The influent wastewater first enters the ISR through a series of in-line mixers dosed with coagulant and flocculant additions to facilitate bonding of suspended particles. The influent then enters the ISR through a nozzle. The mixture then spirals down the ISR where the heavier flocs will settle to the bottom and the clarified water will travel up the center of the ISR through a stacked, perforated cones by its hydraulic differential. The lamellar structure of the cones encourages further settling of the finer particles in the water before entering the central column and back up to the effluent outlet at the top of the ISR. The ISR does not require a motor for mixing as its

turbulent vortex provides sufficient momentum for particles to flocculate and settle.

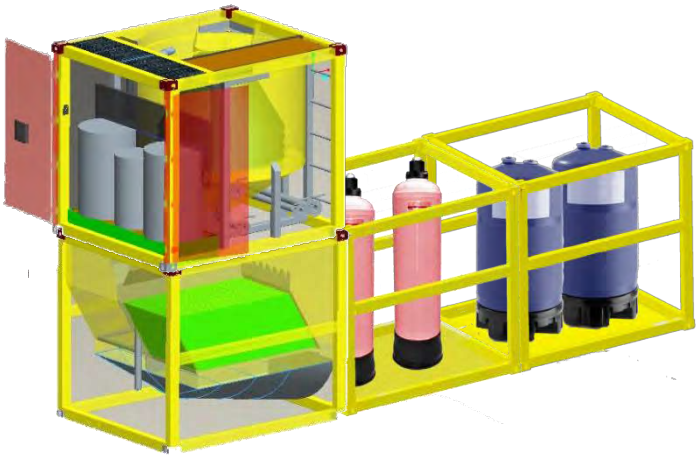


Figure 4-2 Typical WetSep System Configuration

The effluent from the ISR Master module can then enter various Slave Modules depending on the purpose of the effluent. For example, if the effluent is to be discharged into open water, a secondary lamellar settler shall be employed to further reduce the level of suspended solids in the water to meet discharge requirements. Alternatively, a combination of rapid sand filter, activated carbon filter and a disinfection unit can be used to remove heavy metals contaminants in the effluent to meet potable water standards. Furthermore, a work office/laboratory module can be added for on-site monitoring and testing if needed.

Aside from its functional versatility, the modular design can also operate with an even smaller footprint by harnessing gravity as its driving force. By placing the master module at the location with the highest gravitational potential means that intermediate booster pumps are no longer necessary; instead, water will flow downwards by gravity thus reducing energy consumption. Moreover, renewable energy elements can be integrated into the modular design such as wind turbine and solar films, making the WetSep system completely self-sustaining. This renewable energy adopted WetSep system is not only environmentally friendly, but also applicable in the remote area where resources such as labour electricity are limited. Coupling with the advantage of small size, the WetSep can be used in the developing area such as Pacific Islands.

5. Conclusion

The WetSep system was designed to meet a need in the construction industry for wastewater treatment. The system has been successfully used in many applications around the world but predominately here in the local Hong Kong market.

The development and commercialization of WetSep system from innovative idea, design, prototype, patent application, marketing and sales has been a personal challenge that has been overall very successful. The process of commercialization of the product has both been challenging and satisfying for my professional career and has resulted in a positive financial return for my business. Though a lot of time and financial resources have been used to develop this product, I have felt that it has had a positive impact on my career, personal life and for my company.

Since the first generation of WetSep (1998), there have been many small and major improvements to enhance the performance of the WetSep system or to incorporate new features for customers. Recently a modular WetSep system (2^{nd}) Generation has been developed to enhance the flexibility of the system to meet a wider range of applications.

It is this second generation WetSep unit that is the focus of my company's growth in the international market. The goal of my DProf study is to produce a structured business model and marketing strategy to increase the sale of the WetSep overseas.

Reference:

1. Morgan, R.P.C., *Soil erosion and conservation*. 2nd ed. 1995, Harlow: Longman. x, 198 p.
2. USEPA. [cited 2012; Available from: http://water.epa.gov/scitech/wastetech/guide/construction/index.cfm.
3. Bratby, J., *Coagulation and flocculation in water and wastewater treatment*. 2006, London: IWA Publ.
4. Kolarik, L.O. and A.J. Priestley, *Modern techniques in water and wastewater treatment*. 1995, East Melbourne, Vic., Australia: CSIRO.
5. Kalibbala, H.M. and m. Tekniska högskolan i Stockholm. Institutionen för anläggning och, *Application of indigenous materials in drinking water treatment*. 2007, Mark- och vattenteknik Land and Water Resource Engineering, Kungliga Tekniska högskolan: Stockholm.
6. Census and Statistics Department, *Hong Kong Annual Digest of Statisitics 2011 Edition*. 2011, Hong Kong Government Printer: Hong Kong.
7. BARRETT, M.E., et al., *A REVIEW AND EVALUATION OF LITERATURE PERTAINING TO THE QUANTITY AND CONTROL OF POLLUTION FROM HIGHWAY RUNOFF AND CONSTRUCTION*. 1995, The University of Texas at Austin.
8. Mridha, M. and K.D.P. Nigam, *Coiled flow inverter as an inline mixer.* Chemical Engineering Science, 2008. **63**(6): p. 1724-1732.
9. Daligault, A., et al., *Stormwater and lamella settlers: Efficiency and reality.* Water Science and Technology, 1999. **39**(2): p. 93-101.
10. Hogg, R., *Flocculation and dewatering.* International Journal of Mineral Processing, 2000. **58**(1–4): p. 223-236.
11. [cited 2012; Available from: http://www.denverwater.org/WaterQuality/TreatmentProcess/.
12. Roy, R., *Case studies of creativity in innovative product development.* Design Studies, 1993. **14**(4): p. 423-443.
13. Trott, P., *Innovation management and new product development*. 5th ed. 2011, Harlow: Financial Times Prentice Hall.
14. Yen, H., *Design innovation and marketing strategy in successful product competition.* The Journal of Business & Industrial Marketing, 2011. **26**(4): p. 223-236.
15. Rogers, D.S., D.M. Lambert, and A.M. Knemeyer, *The Product Development and Commercialization Process.* International Journal of Logistics Management, 2004. **15**(1): p. 43-56.

16. Ni'am, M.F., et al., *Removal of COD and Turbidity to improve wastewater quality using electrocoagulation technique.* The Malaysian Journal of Analytical Sciences, 2007. **11**(1): p. 198-205.
17. JAIN, S.C., *Marketing planning & strategy*. 2000, Cincinnati, Ohio: South-Western College Pub. .
18. Maheshwari, S. and P.K. Reddy, *Discovering special product features for improving the process of product selection in E-commerce environment.* 2009: p. 47.
19. Cooper, R.G., S.J. Edgett, and E.J. Kleinschmidt, *New Product Portfolio Management: Practices and Performance.* Journal of Product Innovation Management, 1999. **16**(4): p. 333-351.
20. Rothaermel, F.T., M.A. Hitt, and L.A. Jobe, *Balancing vertical integration and strategic outsourcing: effects on product portfolio, product success, and firm performance.* Strategic Management Journal, 2006. **27**(11): p. 1033-1056.
21. Lin, K.-H. and I. Chaney, *The Influence of Domestic Interfirm Networks on the Internationalization Process of Taiwanese SMEs.* Asia Pacific Business Review, 2007. **13**(4): p. 565-583.
22. Ruzzier, M. and B. Antoncic, *Social capital and SME internationalization: An empirical examination.* Transformations in Business & Economics, 2007. **6**(1): p. 122-138.

Appendix

Appendix A. Field and Case Study of WetSep Filtration System

A1 Field Test Study 1 in South Caboolture, Queensland, Australia

A WetSep WS40 unit was trialed in Australia at the South Caboolture Wastewater Treatment Plant in Queensland to assess its capabilities in both the polishing of on raw sewage. A report on the results obtained was prepared by the Council's Scientific Services section which indicated raw sewage flow rate of 1.7 L/sec and an alum dose of 166 mg/L a Wet Sep 40 produced reductions of 97% of SS, 80% in BOD, 76% in COD, 86% in total phosphorus and 67% in organic nitrogen (Table A-1).

Table A-1Performance 1 of WetSep WS40 in field test study 1

Testing parameters		Inlet	Outlet	Removal efficiency (%)
SS	mg/L	628	18	97.1
BOD	mg/L	202	39	80.7
COD	mg/L	468	112	76.1
TP	mg/L	13.4	1.9	85.8
TKN	mg/L	52.8	34.8	34.1
NO_x N	mg/L	<0.02	0.61	N.A.
Ammonia N	mg/L	23	24.8	N.A.
TOC	mg/L	47.1	27.8	41.0

A2 Field Test Study 2 in Hong Kong

A WetSep WS40 unit was used in a construction work for rail extensions in Hong Kong in 2003-2004. The WetSep has been provided for treating waste water generated and was found to be an effective measure. The total suspended solid were analyzed by a HOKLAS accredited laboratory (Table A-2). Under proper operation, the treated construction runoff fully complied with the specific condition as stipulated in the approved license.

Table A-2 Performance of WetSep WS60 in field test study 2

	Suspended solids (mg/L)		
Date	Intake	Discharge	Flowrate (GPM)
13/12/2003	877.0	10.7	221
15/12/2003	697.5	10.1	177
30/12/2003	541.2	7.2	281
6/1/2004	497.2	7.9	262
8/1/2004	500.7	8.1	232

A3 Field Test Study 3 in Lai Chi Kok (Hong Kong)

A WetSep unit with activated carbon packed in the universal processing chamber and advanced oxidation was installed at Lai Chi Kok Bus Depot for treating wastewater containing high concentration of suspended solid, heavy metal and oil/diesel. Samples are obtained between June and July 2004. The total suspended solid were analyzed by a HOKLAS accredited laboratory. Table A-3 shows the performance of the WetSep filtration system.

Table A-3 Performance of WetSep with advanced oxidation process and activated carbon adsorption in field test study 3

Parameters	Influent	Effluent	Hong Kong EPD standards
pH	11.4	8.6	6-9
Suspended Solids	112 mg/L	<2 mg/L	30 mg/L

COD	16 mg/L	4 mg/L	80 mg/L
Iron	3.14 mg/L	0.07 mg/L	10 mg/L
Boron	65 ug/L	25 ug/L	4 mg/L
Barium	83 ug/L	25 ug/L	4 mg/L
Chromium	18 ug/L	6 ug/L	1 mg/L
Mercury	<0.5 ug/L	<0.5 ug/L	0.001 mg/L
Cadmium	0.3 ug/L	<0.2 ug/L	0.001 mg/L
Copper	7 ug/L	1 ug/L	1 mg/L
Nickel	7 ug/L	2 ug/L	1 mg/L
Lead	18 ug/L	<1 ug/L	1 mg/L

A4 Field Test Study 4 - Slope Stabilisation Work in Shatin

This project involved a major slope stabilization works at Lai Ping Road, Kau To, Shatin, New Territories, Hong Kong. It is used as a case study by Hong Kong Environmental Protection Department (HKEPD).Muddy wastewater generated from the construction activities was of major concern. Substandard wastewater if discharged would lead to the Tolo Harbour via the Kau To Hang and adversely affected the water quality of both the river & the harbour. Therefore wastewater generated from the construction works was pumped to WetSep filtration system for removal of the suspended solids, before discharging to the nearby streams and the harbour. The results showed that there was significant improvement in the effluent quality after the installation of wastewater treatment facility. The stream water was turned clear following the installation of the wastewater treatment system. For more details, please reference to:
http://www.epd.gov.hk/epd/misc/popup/greenexample/W_TN_C4/w_tn_c4.html

Figure A-1 Extensive site coverage of the slope stabilization project at Kau To.

Figure A-2 Installation of WetSep Filtration System for effluent quality control

Figure A-3 Downstream of Kau To Hang before and after installation of WetSep

Figure A-4 Outfall at Tolo Harbour before and after installation of WetSep

A5 Field Test Study 5 in Tai O (Hong Kong)

The WetSep in this application was used to treat domestic sewage temporarily prior to discharge to the sea when an existing Imhoff Cone Treatment System was undergoing maintenance work. The WetSep was connected to by-pass the Imhoff Cone to allow the maintenance work to proceed.

The challenge in this project was that the installation was located in a remote area. Taking the advantage of portable size, the WetSep was transported to the site by means of barge. With little infrastructure required, the WetSep can be deployed easily to hard to reach places.

The capacity of this system was approximately one hundred (100) m^3/h. The incoming suspended solids of the domestic sewage was approximately three hundreds (300) mg/L and was treated to a concentration less than fifty (50) mg/L (more than eighty (80) % of the suspended solids were removed by the WetSep system).

Figure A-5 Transportation of the WetSep by Barge

Figure A-6 The WETSEP in Tai O

A6 Field Test Study 6 in U.S.A.

This project was operated by one of the top construction companies in the U.S., JE Dunn Construction. The WetSep system was successfully used at the construction site of a new government building at the U.S. Port of Entry to Canada in Blaine, Washington. Approximately 130,000 m^3 (170,000 $yards^3$) of earth was excavated. Due to the close proximity to Semiahmoo Bay and the consistent wet climate of Western Washington, construction wastewater treatment was an essential part in managing the environmental concerns. A WetSep 40 was used to treat and discharge construction wastewater from the site. The system performed well and was able to achieve lower turbidity levels than the background measurements from the City of Blaine's stormwater pipes.

There were two (2) separate operations that created significant amounts of wastewater. The first was the construction excavation. The WetSep was setup at the top rim of the excavation and temporary wastewater ponds were constructed nearby. The wastewater was pumped into the WetSep system for treatment from the temporary ponds. At some locations, buried PVC pipes were used in conjunction with flexible piping. At full production, the system treated approximately fifteen (15) – nineteen (19) m^3/h (4,000 – 5,000 gallons/h) of wastewater.

The second significant amount of construction water was from the bridge pier operations. A steel sleeve was placed into the ground and the earth excavated out from the middle of the sleeve. Reinforcement was placed in the hole and then filled to the top with water prior to pumping in concrete. The water pressure assured an even distribution of concrete in and around the reinforcement cage. The water that was pumped out (as the concrete was pumped in) was placed into three (3) large steel holding tanks. The wastewater in the tanks was adjusted for pH before being pumped into the WetSep system for suspended solids removal.

Figure A-7 Construction site in Blaine, WA, USA at the Canada/USA border.

A7 Field Test Study 7 in Sweden

The WetSep system is currently in operation in Sweden to treat construction wastewater produced from tunneling work and excavation for a Hydro-Electric Power Station. Two (2) out of the four (4) generators at the Hydro-Electric Power Station will be replaced. New tunnels are being blasted and the excavated material removed. The effluent quality of the treated wastewater is below twenty five (25) mg/L of suspended solids.

Cold weather in Sweden is a big issue in wastewater treatment as the water will freeze in low temperature, causing blocking and cracking of the water pipe. To solve this, a heating system can be adopted in the WetSep to prevent the freezing of the water.

Package system design allows the WetSep to be transported easily to Sweden.

Figure A-8 Construction site in Sweden

Appendix B. Detail Estimation of the running cost

B1 Estimation of Chemical Consumption Costs for WetSep Filtration System (WS60)

The chemical costs depend on dosage rate of flocculant and coagulant. The costs for the WetSep filtration system at a flow capacity of sixty (60) m^3/h are shown as follows:

Cost for Coagulant Agent (PACl)

Dosing Rate	= 30 g/m^3
Flow Capacity	= 60 m^3/h
Consumption for 1 Day	= 30 g/m^3 x 60 m^3/h x 8 h/day
(8 hours a day)	= 14,400 g/day
Consumption for 1 yr	= 14,400 g/day x 20 day/mouth x 12 mouth/yr
(20 days a month)	= 3,456,000g /yr
	= 3456 kg/yr
Estimated Price	= 3,456 kg/yr x US $2.3/kg
	= US$ 7,949 /yr

Cost for Flocculant Agent (Polymer-anionic PAM)

Dosing rate	= 4 g/m^3
Flow capacity	= 60 m^3/h
Consumption for 1 day	= 4 g/m^3 x 60 m^3/h x 8 h/day
(8 hours a day)	= 1,920 g/day
Consumption for 1 yr	= 1,920 g/day x 20 day/mouth x 12 mouth/yr
(20 days a month)	= 460800 g/yr
	= 460.8 kg/yr
Estimated Price	= 460.8 kg/yr x US $17/kg
	= US$ 7,834 /yr

Cost for Coagulant Agent/Flocculant agent (Chitosan)

Dosing Rate	= 10.0 g/m^3
Flow Capacity	= 60 m^3/h
Consumption for 1 day	= 10.0 g/m^3 x 60 m^3/h x 8 h/day
(8 hours a day)	= 4,800 g/day
Consumption for 1 yr	= 4,800 g/day x 20 day/mouth x 12 mouth/yr
(20 days a month)	= 1,152,000 g

= 1,150 kg

Estimated Price = 1,150 kg/yr x US $200/kg
= US $230,400 /yr

Annual amount of construction runoff treated by the WetSep WS60
= 60 m^3/h x 8 h/day x 20 day/mouth x 12 mouth/yr
= 115,200 m^3/yr

Treatment cost per cubic meter of wastewater using PAC followed by PAM
= (US$ 7,949 /yr + US$ 7,834/yr) ÷ US$ 7,834/yr
= US $ 0.137/m^3

Treatment cost per cubic meter of wastewater using Chitosan
= US $230,400 /yr ÷ US$ 7,834/yr
= US $ 2/m^3

However, the above cost should only be used as examples as the costs vary based on region, manufacturer and the water quality of the construction runoff. The comparative costs for treating 1 M gallons of the construction runoff are estimated in Figure B-1.

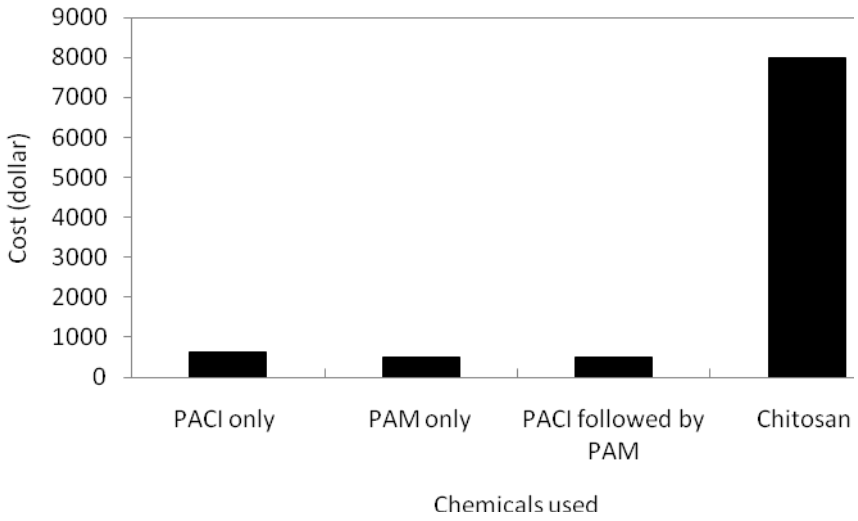


Figure B-1 Chemical costs for the coagulation/flocculation for treating 1M gallons of construction runoff.

B2 Estimation of Electricity Consumption of WetSep Filtration System (WS60)

Electrical units of WetSep filtration system include coagulant dosing pump, flocculant dosing pump, mixer for coagulant and flocculant solution preparation, acid dosing pump for pH adjustment, actuator, transformer and signal light. Under normal operation, the actuator and mixer will only operate temporarily. The detailed electricity consumption of WetSep filtration system is listed in Table B-1. As the system only has limited electrical parts, the electric cost is significant reduced.

Table B-1 Electricity Consumption of WetSep WS60 System.

Equipment	Max dosage rate	Consumption (W)	Quantity
Coagulant Dosing Pump	0.061 m^3/h	42	1
Flocculant Dosing Pump	0.042 m^3/h	40	1
Mixer (operate only during preparation of coagulant and flocculant solution)	N.A.	150	2
pH Dosing Pump	0.061 m^3/h	42	1
Others (transformer/signal light)	N.A.	50	1
Actuator	N.A.	120	2
Max Power Consumption		714	
Normal Operation		174	

Appendix C. Detail technical information detailed technical information

This section describes the first generation of the WetSep system in its initial configuration. Since the first generation WetSep was developed continuous improvements have been made based on client feedback and new innovative designs. The new designs are currently under the process to apply for further patents.

The WetSep system employed vertical inner mixing, coagulation, flocculation, impinging streams, conical tank and circular incline plate and lamella plates for treating construction stormwater. The WetSep System consists of patented technologies: ISR. The ISR is the first stage of the filtration process, separating the influent into its element at this Primary Treatment Unit. The schematic diagram of the Impinging Stream Reactor (ISR) is shown in Figure C-1. The ISR consists of an influent vertical pipe with two chemical injection points, an elbow joint for turbulent mixing, a circular reactor tank with one shaped hopper at the bottom, a central inverted filter cone with separation plates and outlet pipes. No mechanical driven parts was required to achieve the mixing and separation.

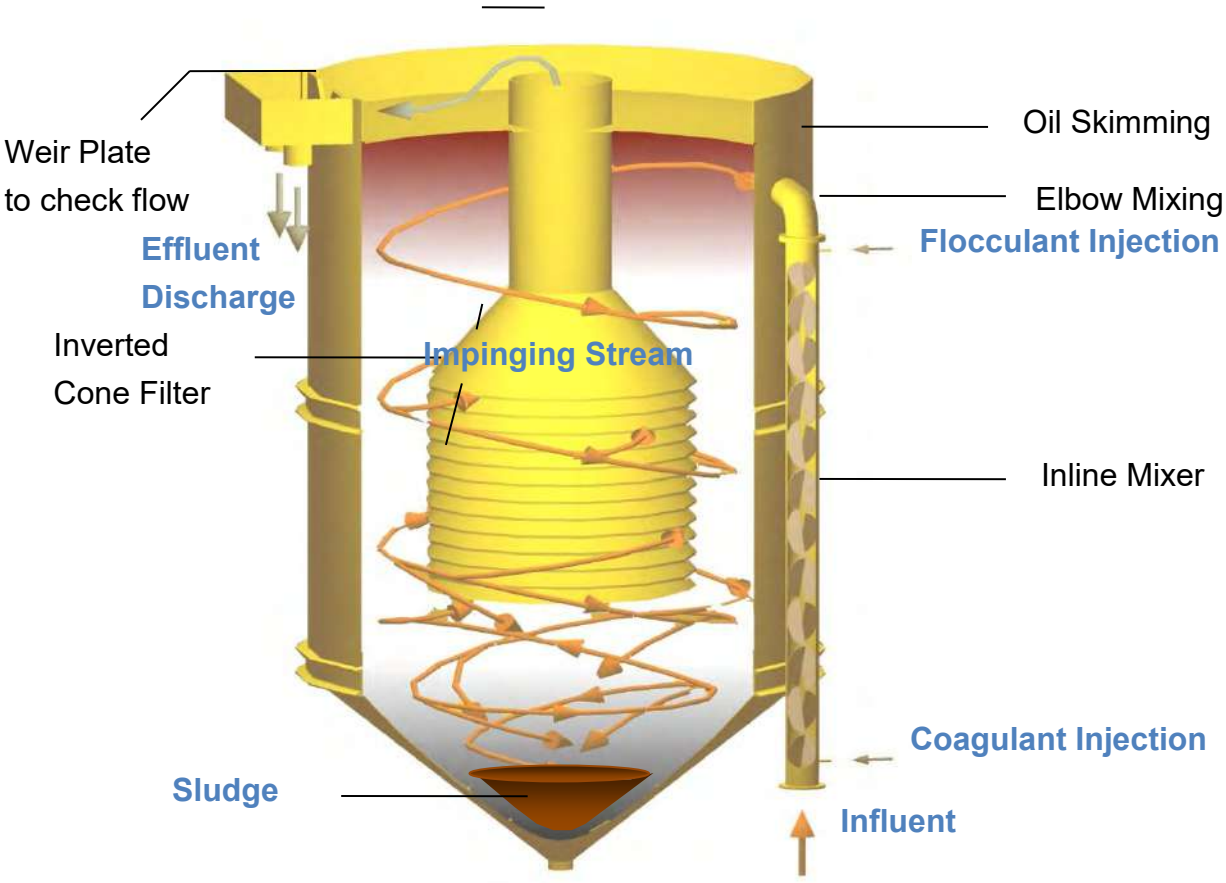


Figure C-1 Schematic Diagram of WetSep (Impinging Stream Reactor)

C1 Vertical Inline Static Mixer (Coagulation)

The influent is pumped to the system and chemicals are injected for coagulation and flocculation. Coagulation is the first stages for treating the water. Chemical coagulants were added to combine insoluble particle and/or dissolved organic matter into large aggregates, thereby facilitating the removal in subsequent separation step. However, the dispersion of coagulants in the water is always one of the most important problems for the reaction. The insufficient mixing would lead to incomplete coagulation and instability of aggregates and hence affect the quality of the treated water. The problem becomes more significant at high concentration of suspended solids. The mixing of chemicals with the influent stream is achieved in a vertical inline static mixer without any mechanical stirring. The vertical position of the inline mixer would minimize the buildup of materials to avoid blockage. Inline static mixer contains vanes that bring about sudden changes in velocity patterns as well as momentum reversals. Figure C-2 shows the inline static mixer used for rapid mixing. It has been found that the installation of inline mixer without any

mechanical stirring can significantly enhance the mixing and allows five (5) – thirty (30) seconds for the reaction of coagulation rapidly.

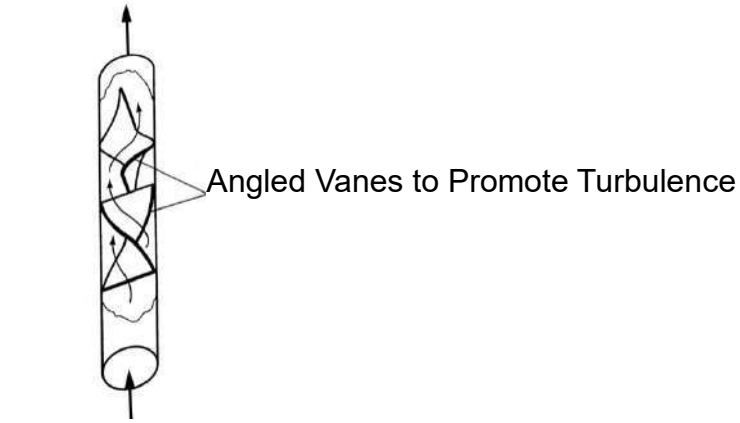


Figure C-2 Inline static mixer used in wastewater treatment for rapid mixing.

C2 Circular Reactor Tank (Flocculation)

The second and most important stage is flocculation and the quality of the treated water is directly affected by the efficiency of flocculation. Chemical flocculants are added to enhance the bonding between the micro-floc particles and form large, denser flakes that are easier to separate. The efficiency of flocculation depends on the collisions between aggregates/micro-floc and flocculants which are affected by the velocity of liquid. Particle can be brought together by inducing velocity gradient (G-values) and low G-values provide the optimum conditions for flocculation. As low G-value can generate sufficient turbulence, the collisions are effective in floc formation without breaking the flocs that have already formed. The impinging stream reactor makes use of turbulence and centrifugal force provided by the spiral path to enhance the collisions between the aggregates/micro-floc particles and flocculants (Wu, 2007). The suspended particles containing the chemicals impinge on the inner surface of the reactor tank tangentially and follow a spiral path down to the bottom (

Figure C-3). The solid-liquid streams impinge against each other at high velocity with the aim of enhancing the transfer between phases. With both the centrifugal and gravitational forces, the heavier particles after flocculation

settle to the bottom while the liquid continues to move upward and enter a central inverted cone filter.

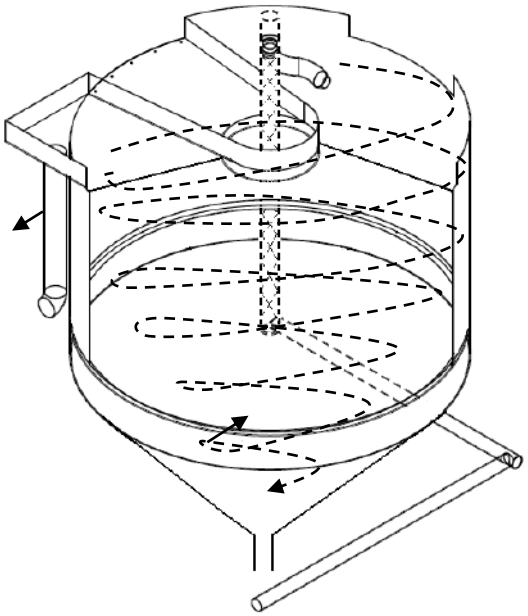


Figure C-3 Inline Spiral path of the suspended solid in the reactor

3.2.3 Lamella Plate in Universal Processing Chamber

Significant amount of suspended solids are removed after entering the inverted cone filter. In order to further polish the stormwater, lamella plates are installed in the Universal Processing Chamber (UPC) to enhance of the settling characteristics of the suspended solids. The separation speed can be increased by tilting the lamella plate compared to conventional clarifier. The theory is based on that settling depends on the settling area rather than detention time. Figure C-4 shows the theory of clarification by the inclined lamella plates. Clarification is achieved in the lamella plate if the upstream velocity is low enough to allow solids to report to the lamella plate. The area above the feed point is used for clarification and the area below the feed point is used for thickening.

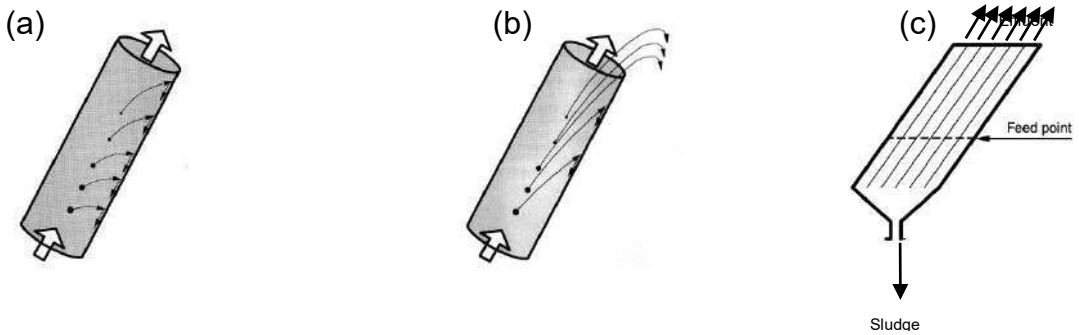


Figure C-4 Sedimentation in the lamella plate (a) Clarification is achieved (b) Clarification is not achieved (c) Flow diagram in lamella plates

The Universal Processing Chamber (UPC) has also been designed to accommodate various means of filter media and absorbents zeolite, silica sand and activated carbon. The dosing of hydrogen peroxide at the inter-connection also extends the application of the WetSep to advanced oxidation process and achieves the tertiary treatment which results in ppb level for removal of total petroleum hydrocarbons (optional).

Appendix D. Achievement and Recognition of WET

The Chinese Manufacturers' Association of Hong Kong

1999 HONG KONG AWARDS FOR INDUSTRY
CMA CERTIFICATE OF MERIT
IN
MACHINERY AND EQUIPMENT
DESIGN

This certificate has been awarded to

WetSep Construction Effluent
Treatment System

of

Waste & Environmental Technologies Ltd

for its outstanding design

1999 香港工業獎
廠商會機器及設備設計優異證書
保然技術有限公司之
保然濕渦污水處理系統
為設計優秀之產品
特予證書以資表彰

會長
評審委員會主席

The Chinese Manufacturers' Association of Hong Kong

2002 HONG KONG AWARDS FOR INDUSTRY
CMA CERTIFICATE OF MERIT
IN
MACHINERY AND EQUIPMENT
DESIGN

This certificate has been awarded to

Advanced Composite Material

of

Waste & Environmental Technologies Ltd.

for its outstanding design

President

Chairman, Panel of Judges

2002 香港工業獎
廠商會機器及設備設計優異證書
保然技術有限公司之
先進複合材料
為設計優秀之產品
特予證書以資表彰

會長
評審委員會主席

2003 HONG KONG AWARD FOR INDUSTRY:
MACHINERY AND EQUIPMENT DESIGN
CERTIFICATE OF MERIT

This certificate has been awarded to

Water Treatment System by Solar Power for Remote Area

of

Waste & Environmental Technologies Ltd.

for its outstanding design

2003 香港工業獎
機器及設備設計優異證書

保然技術有限公司之
太陽能推動之邊遠地區供水處理系統

為設計優秀之產品
特予證書以資表彰

主席 評審委員會 會長 陳永耀

2004 HONG KONG AWARD FOR INDUSTRY:
MACHINERY AND EQUIPMENT DESIGN
CERTIFICATE OF MERIT

This certificate has been awarded to

Eco-Toilet

of

Waste & Environmental Technologies Ltd

for its outstanding design

2004 香港工業獎
機器及設備設計優異證書

保然技術有限公司之
環保廁所

為設計優秀之產品
特予證書以資表彰

主席 評審委員會 會長

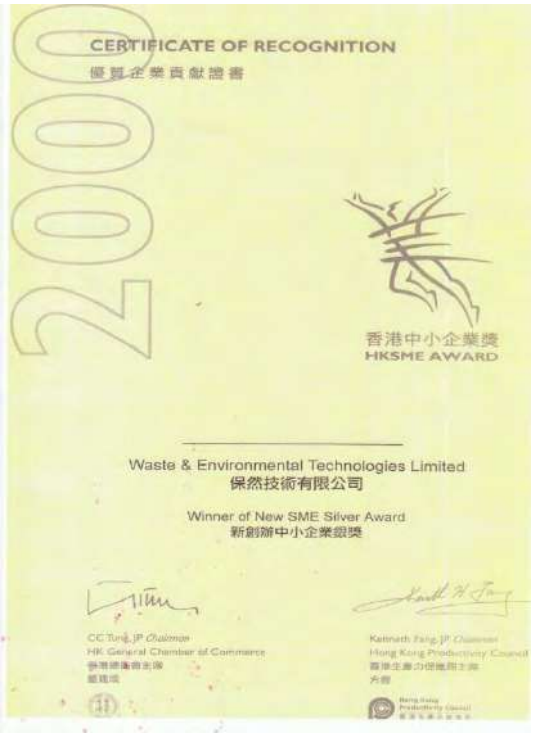

CERTIFICATE OF MERIT
營商新動力
LIVING BUSINESS
Certificate of Merit
優秀表現獎狀
presented to
頒予
Waste & Environmental
Technologies Limited
in recognition of
your meritorious performance in
The SME Living Business Awards 2005
表揚貴公司參與
2005年「中小企營商新動力」獎勵計劃
之優秀表現
HSBC 滙豐


CERTIFICATE OF EXCELLENCE
滙豐營商新動力
HSBC LIVING BUSINESS
2007
Certificate of Excellence
傑出獎狀
presented to
頒予
Waste & Environmental
Technologies Limited
保然技術有限公司
HSBC 滙豐


CERTIFICATE OF MERIT
滙豐營商新動力
HSBC LIVING BUSINESS
2008
Certificate of Merit
優異獎狀
presented to
頒予
Waste & Environmental
Technologies Limited
保然技術有限公司
HSBC 滙豐


CERTIFICATE OF MERIT
滙豐營商新動力
HSBC LIVING BUSINESS
2009
Certificate of Merit
優異獎狀
presented to
頒予
Waste & Environmental
Technologies Limited
保然技術有限公司
HSBC 滙豐


滙豐營商新動力
HSBC LIVING BUSINESS
Certificate of Excellence
傑出獎狀
presented to
頒予
Waste & Environmental
Technologies Ltd
保然技術有限公司
HSBC 滙豐


CERTIFICATE OF RECOGNITION
優異企業貢獻證書
2000
香港中小企業獎
HKSME AWARD
Waste & Environmental Technologies Limited
保然技術有限公司
Winner of New SME Silver Award
新創辦中小企業銀獎


International Invention Expo 2000 - Hong Kong
2000香港國際發明展覽會
獲獎證書
Mr. Leung Wai On
WetSep Wastewater Filtration System in using impinging Stream Reaction
在2000香港國際發明展覽會上榮獲
銀獎
特頒此證予以表彰
二〇〇〇年十一月


展翅計劃
青年職前綜合培訓
Youth Pre-employment Training Programme
感謝狀
Certificate of Appreciation
This Certificate is awarded as a token of appreciation to
保然技術有限公司
Waste & Environmental Technologies Ltd
for providing workplace attachment training under the
Youth Pre-employment Training Programme.
July 2001

DIPLÔME

SALON INTERNATIONAL DES INVENTIONS

GENÈVE

ENVIRONMENTAL PRIZE
MAY 2002

awarded to: Mr. LEUNG Wai-On

for the invention: Waste Water Filtration System

Jean-Luc VINCENT
President-founder of the Exhibition

The Winners 2003 — Asian Innovation Awards

SILVER AWARD

Pure Genius

A Hong Kong entrepreneur invents a solar-powered device with the potential to provide impoverished regions with clean drinking water

By Mei Fung

INSPIRED BY THE WASHING MACHINE

And the Winners are.....

Congratulations to all the Winners of the Asian Innovation Awards 2003

Gold – This winning team invented a simple test for childhood leukemia.
Jinyin Li, Huiping Da, Limpoon Wong, Institute for Infocomm Research, Singapore
Allen Yeoh, National University Hospital, Singapore

Silver – A Hong Kong entrepreneur invented a solar powered device to help clean water.
Leung Wai On, Waste & Environmental Technologies Ltd, Hong Kong

Bronze – This team developed light pipes to bring more natural light into high rise buildings.
Robert Hamzah, Kenneth Yeang, TR Hamzah & Yeang Sdn Bhd, Malaysia
Veronica Garofa Hansen, Ian Edmonds Queensland University of Technology, Australia
Richard Hyde, University of Queensland, Australia

OES Award – The winner developed a super accurate palsteal, non-invasive heart monitor.
USCOM Pty Ltd

Asian Innovation Awards 2003

REVIEW

In association with Global Entrepolis @ Singapore

The Hong Kong Institution of Engineers

香港工程師學會

(Established by Ordinance in December 1975)

This is to certify that

Waste & Environmental Technologies Ltd.

was approved for the

Environmental Engineering

Engineering Graduate Training Scheme "A"

of the Institution for the period

From ***August 2003*** *to* ***August 2006***

President

Secretary

The Hong Kong
Institution of Engineers
香港工程師學會

This is to certify that

Ir LEUNG Wai On

has satisfactorily completed an

Engineering Supervisor Workshop conducted by

The Hong Kong Institution of Engineers for

The Engineering Graduate Training Scheme "A"

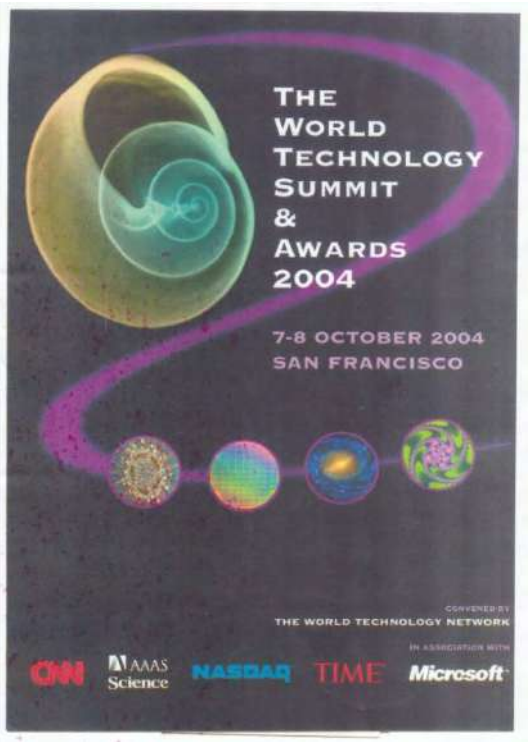
*in **Environmental** Discipline on 7 June 2003*

as part of the requirement for the

Engineering Supervisor Applicants

Manager - Training

Secretary



Certificate of Membership

This is to certify that

Waste & Environmental Technologies Ltd

has been accepted

as an Organisation Member

(Session 2004-2005)

of

Hong Kong Waste Management Association

a professional organisation devoted to promoting advanced technologies, environmentally-sound operation and high standards of solid waste management

Chairperson
HKWMA

Membership Secretary
HKWMA

Date of issue: 23 July 2004

Certificate of Membership

This is to certify that

Waste & Environmental Technologies Ltd

has been accepted

as an Organisation Member

(Session 2005-2006)

of

Hong Kong Waste Management Association

a professional organisation devoted to promoting advanced technologies, environmentally-sound operation and high standards of solid waste management

Chairperson
HKWMA

Membership Secretary
HKWMA

Date of issue: 26 September 2005

Waste & Environmental Technologies Ltd.

保然技術有限公司

商界展關懷
caringcompany 2007/08

Mission

To build a caring community spirit through cultivating corporate citizenship and strategic partnership among the business, public and non-profit organisations.

宗旨

致力建立商界及公共機構的企業公民參與，透過工商、公共及非牟利服務機構的策略伙伴合作，共同建立關懷及互助的精神。

Employing Vulnerable
Caring for the Environment
Mentoring

The Hon Bernard Chan
Chairperson

Ms Christina MS Fang
Chief Executive

Waste & Environmental Technologies Ltd.

保然技術有限公司

商界展關懷
caringcompany 2008/09

Mission

To build a caring community spirit through cultivating corporate citizenship and strategic partnership among the business, public and non-profit organisations.

宗旨

Employing Vulnerable
Caring for the Environment
Mentoring

Mr Bernard Chan
Chairperson

Ms Christina MS Fang
Chief Executive

Waste & Environmental Technologies Ltd.
保然技術有限公司

商界展關懷
caringcompany 2009/10

Mission
To build a cohesive society by promoting strategic partnership among business and social service partners and inspiring corporate social responsibility through caring for the community, employees and the environment.

宗旨
促進商界與社會伙伴合作，啟發企業社會責任，關愛工商及公共機構關懷社群、關心員工及改善環境，攜手建設共融社會。

關懷社區
Caring for the Community

關懷員工
Caring for the Employees

關懷環境
Caring for the Environment

香港社會服務聯會
The Hong Kong Council of Social Service

Mr Bernard Chan
Chairperson
陳有慧 主席

Ms Christine MS Fang
Chief Executive
方敏生 行政總裁

Valid from 1 March 2010 to 28 February 2011
自2010年3月1日至2011年2月28日有效

HK CARBON reduction campaign
香港減碳行動

In appreciation of

Waste & Environmental Technologies Ltd.

for your participation in

The Hong Kong Carbon Reduction Campaign

2009-2010

Edmond Ma, Head of Pearl River Delta Regional Program, The Climate Group

主要贊助 MAJOR SPONSOR
HSBC 滙豐
HSBC Climate Partnership

贊助 SPONSORS

合辦機構 ORGANISER
THE CLIMATE GROUP

Certificate of Recognition
嘉許證書

Waste & Environmental Technologies Ltd.
保然技術有限公司

One of The 40 Companies In The
Hong Kong SME Business Sustainability Index 2012
2012 香港中小企企業可持續發展指數
40 家指數公司之一

21 February 2012
2012年2月21日

Presented to

Waste & Environmental Technologies Limited

By Mrs Anna Sohmen
Chair of the 1999 Eco-Products Award
Steering Committee

To acknowledge a

Notable Mention

from the Judging Panel in the
Eco-Design Category

for their

WetDust Dust
Suppression System

Business Environment Council

Hong Kong Eco-Products Award 2006

Notable Mention

is hereby granted to

Mobile Lavatory System

Waste & Environmental Technologies Limited

20 July, 2006

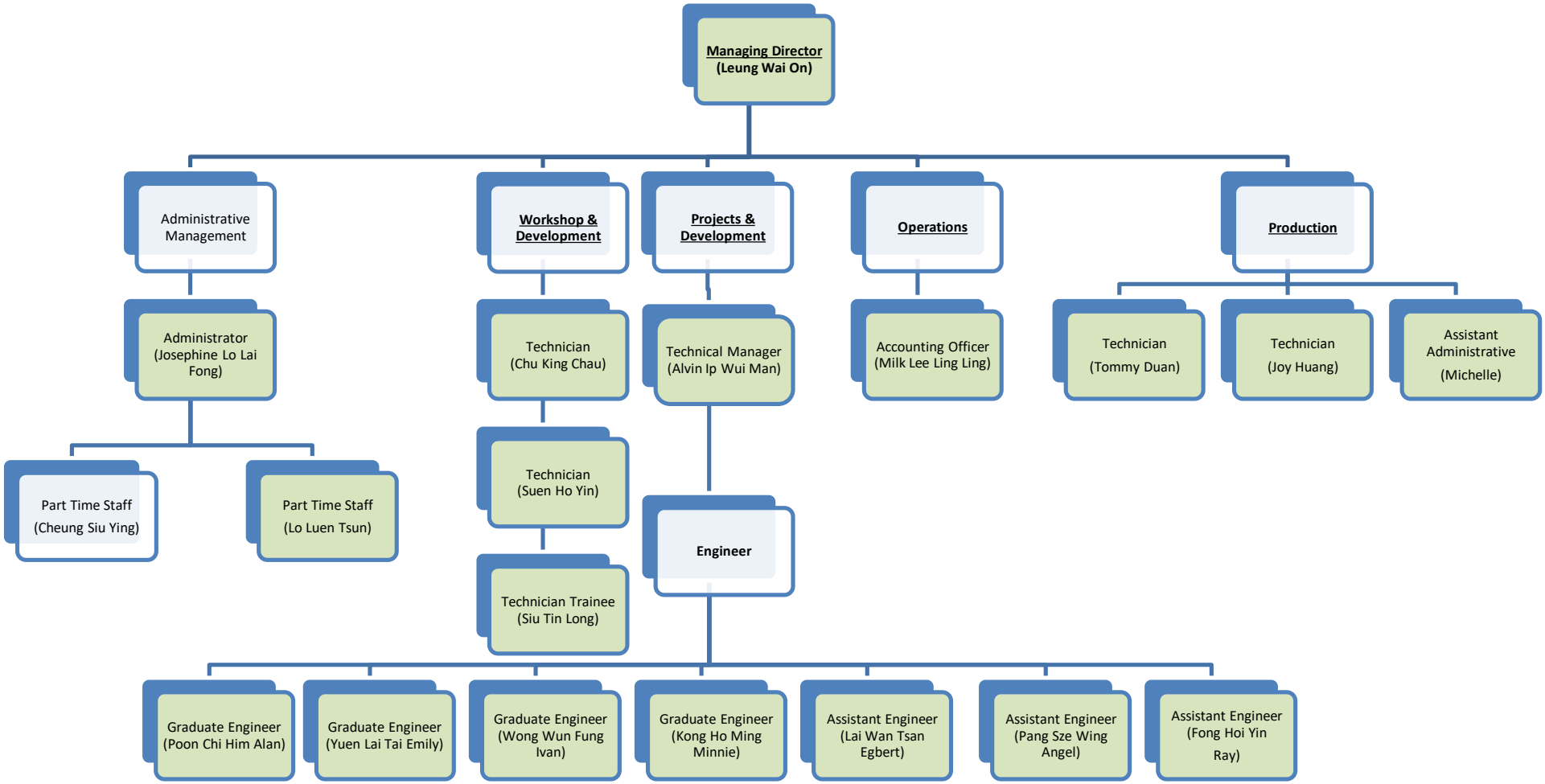
Mr Stephen Fong
Chairman

Appendix II

Organisation Chart

Waste & Environmental Technologies Ltd.

Organizational Chart



Appendix III

Interview Transcript by

Miss Brenda Lee

Confidential

Waste Environmental Technologies - Interview Transcript

A: Lawrence Lee & Alvin Yip
Q: Brenda Lee

Q : Thanks to Lawrence and Alvin for accepting my invitation for the interview. Should we start with the first question ? At WET, how do you define CSR ?

Question 1

A : I guess we don't have a formal definition on CSR, but we generally look at CRS as a way to give back to the community, and also looking at a more continuous development program to make sure that whatever happened in the community, we have the proper expertise and proper skills to help them with. What we also look at, is not only giving back to the community, but like everything we mean for business. We also look at business component for that, and a good example of that is, we generally hire interns, either both from IVE and universities, locally and abroad, to have that practical skills, and here working at the company, and they are also contributing to the company as well. We also look at, I think, in terms of what we do environmentally speaking, we like to do something that is more educational, and that's what drives, a lot of our, I guess that's what you call CSR. There is a big misunderstanding that there is a lot of information flowing around regarding the environment in general and we try to do a little bit in general to educate, because we feel that education is one of the largest pillars in terms of moving the society forward.

Q: OK, thanks for that. Well, at WET, is it a single owner company, or is like partnership, or something else ?

A : We have shareholders, but generally it is run by a couple of board members, managers and managing director.

Q : I have noticed from your name card that you have operations all over, so basically they are being owned by the same group of shareholders, a small group of shareholders. And the two of you are senior, founding members, CEO or shareholders?

A : Not shareholders.

Q : Senior management.

A : Middle management.

Q : Would you think that the definition of CSR you just shared with us has anything to do with the personal values of your shareholders ?

A : I think everything they do personally as shareholders, and our managing director has a big heart and a soft spot for a lot of these charity programs just based on what he feel as part of a professional. We have an engineering background, and at this company, in terms of how I feel as a professional engineer, public safety and public health is number one with anything we do. And as a professional we have an ethical code and a professional responsibility to take care not only our projects, but also look at the impacts of our projects can affect the society in general. That is also a values shared by the managing director, and it is part of the social responsibilities how to help others and how to help them understand what we do as a profession, and under the engineering profession and under this broader environmental sector.

Question 2

Q : I see, that is wonderful. I hope more companies are like your, that is really professional and ethnical, that's so important nowadays. Very good, let's move on to the second question, which is more straight-forward. Who are your key internal and external stakeholders ?

A : I think the internal one would probably be our managing director. He tends to drive things that happened in this company. And in terms of everybody else, I think the key internal ones would be everybody in this company. I think everyone in this company shares that social responsibility, and shares the vision that besides coming to work here but we are doing something good for society. In our cases it is easy to make connection with the environment and society. We are in the business at the same time. I think all of us collectively feel that we are making some kinds of positive contribution to people both inside and outside of the company.

Q : Good, OK, actually this question on the stakeholders, I think you can take WET as a company when talking about your company as a business, who are your stakeholders, so internally I would assume that like many other companies your shareholders, and also your particularly managing director being the driver, and your staff, employees would be your key stakeholders internally. What about your key external stakeholders ?

A : Obviously our external key stakeholders would be our clients and potential clients. In terms of potential clients we do a lot of networking, so the Government is part of key stakeholders. It is because in the environmental sector, Government is the only body that drives investment. Let's put it this way, wherever you go in this world, the Government will drive the environmental policy.

Q : It makes sense because that they should be taking that role.

A : So in a wider scope, and obviously we deal with some low impact development and construction. When you are building a structure you are working at a construction site, we do want to affect the surrounding environment whether it be discharging waste water into the river or into the ocean. We don't want to be having excessive noise and water. That means HK is such an urbanized environment that you need to take consideration of your neighbors when you are doing constructions or finally finishing your structures. So these are the kind of principles that we also believe in.

Q : Thanks. I can get at how you categorize your stakeholders.

A : They are the ones who intend to engage with CSR but they don't have professional knowledge. They can seek our input and we are eager to help. As we are an environmental protection company, we could provide our expertise and opinion or to jointly organize activities to promote CSR. Basically we are sharing our resources.

Q : As we have defined the CSR, the remaining questions will gear towards different stakeholders. How do you manage and communicate your CSR practices, and so on. You input is very useful, Alvin.

Question 3

Q. Question no.3, there are two parts of this question, how does your company (A) manage and (B) communicate CSR practices here ?

A : As far as management framework, since we are a small company with limited resources, like what Alvin was saying earlier, when the opportunity arises to do charitable work, or when we try to incorporate CSR aspects within our business, we will then approach it project by project. In terms of how we develop it, as coming from our managing director of a small firm, he provides the focus and the direction how we handle each project. And in terms of how we do it, we will look into areas in in terms of staff and time. To answer

your question, we don't have an official management framework. It's more unofficial and on case-by-case basis.

Q : Anything you want to add, Alvin ?

Alvin: Not really. We normally do it on project basis. We are always approached by other organizations to help.

Q : On top of your charity work, I am interested to look at people caring in your company. How do you care about people in your company?

A : I take a step back to look at this.....low impact construction is something we look at. We look at the appropriate technology, I guess in our aspect of CSR is to incorporate it into our products as we sell. Things like appropriate technology is to develop a solution for a particular issue for example waste water treatment system. We want to make sure that there were very little moving parts, easy to maintain.....it is mobile and multi-functional.....it is modular and flexible, etc. I don't know if you have heard of the terms "KISS" (keep it simple & stupid). It is probably a down to earth appropriate technology because you don't want to develop something overcomplicated for the general public to use and to understand. We want to make it easy, functional and to actually solve with a solution..... and to make sure for a particular product the environmental impact isn't detrimental to wherever it needs to go. Our managing director has a lot of connections in the South Pacific. Some of those areas are less developed than other parts of the world in Asia. So the skillset and educational level may not be there to tackle a complicated system. All our systems and everything we do locally here in HK are developed as easy to operate and maintain, with very little environment impact. So stepping back, that's how we communicate and incorporate CSR within the company.

Q : What about the staff here, in terms of the turnover and the length of services, how many years has WET been started up ?

A : The company was set up in 1998. In terms of turnover it is high by my standard coming from North America. In terms of HK, the situation is pretty normal. We tend to have a younger staff here and a lot of people are fresh from universities, and for engineers it is pretty typical. For our tradesmen, skilled workers.....they tend to be more stable. In terms of engineers, they are all university graduates.....following HK standard.

Q : Normally how many years ?

A : Two to three years.

Q : Actually it is not too bad.

A : We employed a lot of fresh graduates. In terms of HK standard it is pretty normal.

Q : OK, can you talk a little bit about is there any special or outstanding working environment or attractive benefits that you are offering to attract and retain these people, or training opportunities and so on ?

A : We are very flexible. If there is anything that comes up and if we have budget we will definitely send them to training, for example, if there is opportunity to go overseas, for business, exhibitions for new technology, and so on.....etc.

Q : Better exposure.

A : We also offer training programs under scheme A for HK Institute of Engineers, to help them to become accredited to become engineers. We are one of few companies that offer the apprenticeship scheme in Hong Kong. Presently, we have two apprentices as electricians.

Q : There is not much apprenticeship in HK. Would you be giving some sort of subsidy to your staff to encourage them to get accredited as engineers, or they should be responsible for themselves.

A : It is not a monetary subsidy. It's a knowledge-based subsidy. It is more on training and development. As you know, it is impossible to build engineers overnight. You need three to four years of experience and examination to become accredited. We will give them some time for the training and examination. And as part of CSR we want to see more professional engineers in the profession, to keep the line going. It is our responsibility to encourage more professional engineers, and like Alvin is saying. Our timing here is very flexible. An attitude that we like to have here is you are going to be a professional engineer, I will treat you as a professional engineer, and we will let you allocate your own time as necessary.

Q : So there is a trust, a high level of trust, can I say that ?

A : Yes, if you are going to be a professional, we will treat you as a professional until you get your accreditation. That is how I was trained and that is how we've tried to set a structure here and people will know their responsibilities and liabilities and how they impact in what they do.

Q : Can you share with me is there any particular environmental protection measures as far as this little office is concerned ? For example, in reducing carbon footprint……..

A : We have a big water filtration system. It is a packaged system generally we used for construction management especially when you are doing tunneling, you will have water then we will treat it before discharge, and our system use very little energy like solar energy, so we want to make it a low impact construction to the people and community around you, and all that it is a package that helps environmental protection.

Q : That is the products and services you offered to the clients, so what are the environmental protection and the green measures that you have adopted for your office ?

Alvin : It is (environmental programs in the office) quite general, such as recycling and reuse double size of papers, use of IT technology, etc.

Q : Have you ever replaced and installed new T5 lighting system ?

A : It is difficult as it is standardized here. We grow a lot of plants though. We maintain create a green environment.

Q : Do you have a chance to monitor the electricity bill and water bill to make sure that all these are being ….

A : Not to my knowledge.

Q : So that is the management part of CSR practices, If you would like to talk a little bit about communication which embraces internal and external ones. May be we can talk about a bit on the internal communication ?

A : I think we discuss about everything on a daily basis. (Brenda : face to face, direct.) We are such a small company and we are used to gather everybody in the board room and have a discussion. CSR always comes up or even in the training sessions.....we always look at the impact such as cost, etc. When it comes down to maintainability and the environmental impact, we will discuss on which solutions work, cost implications, labor required, impact on people, and most importantly, is it safe to the general public.

Q : I can see that your mind is full of projects, 24-hrs a day, as a professional engineer!

A : Realistically speaking if you do it bad you hurt the other end. They will keep calling you and lots of "why" will come up. I have had a lot of that before.

Q : This is a matter of cause and effect.

A : It is something we do on daily basis.

Q : It is part of the management of the operation. OK, so you will have all these staff meeting, face-to-face……..some companies which I talked to used a lot of technology like whatsapp and social media to communicate with their colleagues and customers. Is that common in your company ?

A : We do a little bit of that if we have to send files back and forth. You've seen our website and that's another way how we communicate externally.

One or the other way as Alvin mentioned is that we have seminars free of charge in December for urban wind energy which the university professor will be giving a speech at the HK Science Park. There is obviously a business component in it to network and look for business opportunity. It also gives a platform for people to mingle and talk. We don't support at the back. We don't throw in big money on advertising but we use our existing network and invite people to come to the seminars. There are existing places where we can network and we don't charge a dime. This is a give and take and we get their contact information and network opportunity.

Q : That is often viewed sometimes as marketing. You are also raising awareness on some of these social issues.

A : We will bring everybody to the table. We are working for another seminar for June and we are looking at bringing the financial component and the academic component; as well as the industry and Government together. This will make sure that everybody have a chance to talk to each other. I always find a lot of places again no matter where you go in this world, some parties will not talk to the other parties and somebody has to be the in the middle to hold their hands. It's because they don't like each other for whatever reasons.....we give them an opportunity to express their different views.

Q : So you provide the platform and the opportunity.

A : That's correct.

Question 4

Q : OK, very good. So we now move to question no. 4, we will first discuss the motivation part, is there anything you want to add about the motivation in engaging in CSR practices ? I think we have covered most of it. What about the barriers, are there any difficulties and barriers ?

A : Barriers are always there. The biggest one is monetary and time resources. When our company gets busy with heavy workload, it makes it very difficult to allocate some time to do these CSR-related things. However, as we discussed earlier we will handle it on case by case basis, and take on project which makes us easier to handle. You know, we are a small company and unlike the big organization which has a PR department to handle all the stuffs.....

Q : Alvin, do you have anything to add ?

Alvin : It is always the resources issues as we are a small company. We can have manpower but on investment side it is difficult. For large programs we can find some sponsorship. Our basic direction is not to be a host, but just someone who assists and to provide input, with manpower and equipment.

Q : Actually I find that is most common in companies like yours. They called it skill-based volunteers. So I viewed it as skill-based CSR practices, and that is part of your jobs anyway, and you are definitely expert in that particular area that we can tap on, that's not new to you. I think we also covered the strategy as well, do you have a strategy? or the approach you are adopting.

A : You know, I don't think it is anything official, anything planned. It may seem fragmented. But anything we do with CSR is on long-term basis. Like education itself it takes twenty years for a child to see the world. This kind of business connection and network takes time. Do we have a short-term strategy, not likely. Do we have a long term strategy? I would say yes. The more we do these things, the more we are planting these things in other people's heads. Like Alvin has said, we don't go out looking for people, they come looking for us. Every time we conduct the exhibition, we include the education elements.

Alvin : There are two main rationales for organizing the seminars and exhibitions. Firstly, it is for business promotion and the other important part is educational on environmental protection particularly green energy. These events are very popular among students.

Question 5

Q : Question no. 5, do you have a system to measure the outcome of CSR practices ?

A : Not really. We don't do too much follow up on this area. We don't have much concern on the outcome.

Q : There are companies in HK that have launched some incentive programs for the staff and they would like to see if there is any impact on staff turnover as a performance indicator. Probably your energy is geared towards serving your customers and how best you can offer your services. As far as your customers are concerned, would you be conducting regular customer surveys or to collect the feedback ?

A : We do minimal surveys. I guess a lot of cases we will directly talk with the customers. We go to seminars, exhibitions and conferences that's when we got a chance to re-engage our clients and look for potential clients. In terms of measurement standards, we don't really have it because we feel that it is a commitment. It is an ongoing commitment by the firm.

Q : May be that is already built in as part of your project. Meaning that you have certain standards you need to meet anyway, but it is a matter of, say for example HSBC project, if I quote as an example, condensation water of the HSBC living roof. After this project, what is the follow up actions that you would do, would you be also sending people to ask customers, every six months, how satisfied they are, or to see if they have any complaints.

A : We do initially have an one year warranty period and within one year we will check with them and see how things are going. If they have any problems, they will call us. In some locations where we have ongoing maintenance contract, we will have their feedback but we find generally speaking in environmental sector it is relatively small and if people are looking for very specific things, they know we have been around. Things are changing..... I mean now with IT we are slowly developing our own system a little bit more engaging the public in general. We have kind of step back in general recently but I think we are starting to develop more structural plans to re-engage.

Q : Because for this question no.5, we want to drive or really to look at, would you be establishing sort of dialogue and also how to collect firstly the performance indicators and secondly are you measuring the impact of some of these responsibilities to your customers, and other stakeholders.

May be your business is a little different than others that you have this warranty period…….you would anyway be communicating with your customers on a regular basis.

A : A little bit of both.

Q : And also the maintenance contract where you are bound to communicate with them on a regular basis.

A : We would provide information upon request by customers, as most of the case they want to make referrals to other companies, we are eager to help them and provide poster and even presentation as long as they make the request.

Q : But are you having a system to collect customer feedback?

A : We have the ISO system, we have done a little bit, but not a large system and specific to the product.

Q : I understand, so that is built in anyway rather than an add-on.

Question 6

OK, Question no. 6, very quickly, do you see any benefits being an CSR-awarded winning company over the years ?

A : I think it shows the capability of what you called CSR-awarded company. We may be small to medium but we also can place resources to help the community to have some social responsibilities. It's kind of showing to the community it doesn't matter how big and how small you are. It's that you are still able to contribute in your own personal way..... I mean every little bit helps if everybody pitches in. So that's what I can certainly say is a benefit. And as a professional firm it is a bit of personal satisfaction. It goes back to motivation.....it definitely makes us feel that we are contributing to the community as a whole.

Q : That is the internal side, internal benefit to the staff and so on. What about your business, do you think that your customers or that brings some, obviously it is still intangible that you really can't measure but would that help in terms of your branding and image and so on ?

A : I certainly think that.

Q : Although it is not your initial intention.

A : I don't think it can hurt our image, and as Alvin has said, people know what we do in the community, or over the industry and we let that be our driver. You know we are practical and professional company, so we like to do the best we can and if they like that then they will come back. So it is a lot of word-of-mouth and interactions. It comes to a lot of personal connections.

Q : And these people call you. Do they have better impression on your company after knowing that you have won the award?

A : It's hard to say, there's lots of proposal and reviews that are done. In terms of our contractors, there is no effect at all to our core business.

Q : Any further comments?

A : For some consultants it may be, but for other major customers who are usually contractors, there is no effect. They will focus on technical things and the price.

Question 7

Q : For projects, the consultant may have more concern. The next question no. 7, I want to look at the communication means that you are using, both internally and externally. Internally we talked about face to face meetings, and so on.

A : Externally we have our brochures, we will go out to the construction sites and speak with the clients, and the websites as well.

Q : Do you have the newsletters that you will send out to represent the industry ?

A : No, we don't have the resources at this point, we don't have a very large marketing department, we do what we can.

Q : What about social media? How far have you been using social media on your communication with your internal and external stakeholders?

A : Not much. We concentrate more on word of mouth at this point, and as Alvin said we try to change and be more proactive and aggressive.

Q : Do you have Facebook ?

A : We have just started. We have a Facebook account. In terms of our business, we have a lot of order generation letters, the purchasing manager and the construction managers they are not gonna look at twitter and Facebook, and ask the customer have you seen our product before. It is a more personal connection. We still have it, we have the website and other stuffs. But it goes down to handshakes and personal meetings and that drives our business.

Q : I suspect in less than ten years I think the mode of communication would change dramatically.

A : I think social media have some impact but in technical I don't think that would replace the handshake.

Q : Probably they would also look at other dimensions as well.

A : In engineering field it is difficult we have to take a look on site before we move on, and we cannot just rely on phone calls. We can post a sketch through Facebook. It requires interpersonal interactions, when both are on site we can talk it through. As a young engineer, my old boss used to say – never ever send an email as your first point of contact when you are dealing with a problem because email is very insensitive, you are not quite sure how they are going to receive it. It is always better to pick up the phone and call somebody or set up a meeting.

Question 8 & 9

Q : Question no. 8 & 9 are always interesting questions for us to reflect on ourselves, are there any difficulties and challenges in communicating CSR, which refers to responsibilities on your employees, suppliers, customers and everybody else ?

A : I think there are always challenges when it comes to communication. I find the largest challenge in my dealings in life is the generation gap. It is a very big concern, it seems to be disconnected between the older and younger generation where some of the values that you may call conservative tend to be more overlooked, that drives the charitable work of the CSR versus the younger generation, with the advent of IT there is a need for instant gratification if, you known Fuji film, you can look at it instantly over the internet the company history, instantaneously access to the information, and it's the instantaneous gratification that you need, and in terms of the younger generation, there is a common bond you both want to do something good for the overall community as a whole, the older generation tends to thin more conservatively in the long term. The younger generation tends to be, you know, getting to the solution fast. Like everything else a good compromise is to make both sides happy. Our challenge is to make sure that everything driven from the top is understood and we are playing on the same platform.

There are a lot of great challenges working with NGOs because the deliverables could be different, we would be more practical while the NGOs may look for something more on the image. A large part of the NGO's work is fund-raising, and they are driven by the fund-raising figures and they will lose of what is happening around us. So it is different perspectives.

Q : Alvin, do you have anything to add ?

Alvin : Problems are mostly on cooperation, with different expectations on the deliverables.

Q : So it needs more communication to resolve the cultural difference and understand the different needs of the various parties in the community.

Question 10

Question no. 10, is always easy for you guys, how do you see your company moving forward with CSR in the future ?

A : I think we are looking at, in terms of CSR, not just the local market, but also more at the international experience, and our product, technology, and knowledge can be deployed to other places as well to see if it is useful, as a part of that far-reaching with low-impact development and construction. CSR is a continuous improvement project, you can nail it down at any given time, and the societal expectation we will be adapting along, and it is the reason why we keep young staff here.

Q : What's the average age of staff here ?

A : Twenty six or twenty seven.

Q : Very young.

A : That brings new ideas here as we are doing research and development.

Q : What about your HR policy? Would you have plans to upgrade it or to offer out of box package and benefits to your staff to make the environment even more friendly ?

A : That you have to talk to our managing director. In terms of what we are doing I shall say non-monitoring, to give more opportunity to go on site and learn more. And for younger people they are eager to learn. Their mind can be shaped and they are willing to take on a lot of different things all at once, we keep throwing different things to them, to give them challenges. Because in my experience the biggest killer of the job is boredom.

Q : OK, because when we talk about out-of-the-box, it doesn't necessarily mean monitoring. We talked about benefits which could refer to both intrinsic and extrinsic benefits.

A : We try to cultivate an environment where we treat everybody with respect and professionalism. In a mutual and open door policy.

Q : What about your community projects ?

A : We have a seminar for June, coming up, on low impact development.

Q : Good. Thank you. That's the end of the interview. Many thanks to you both.

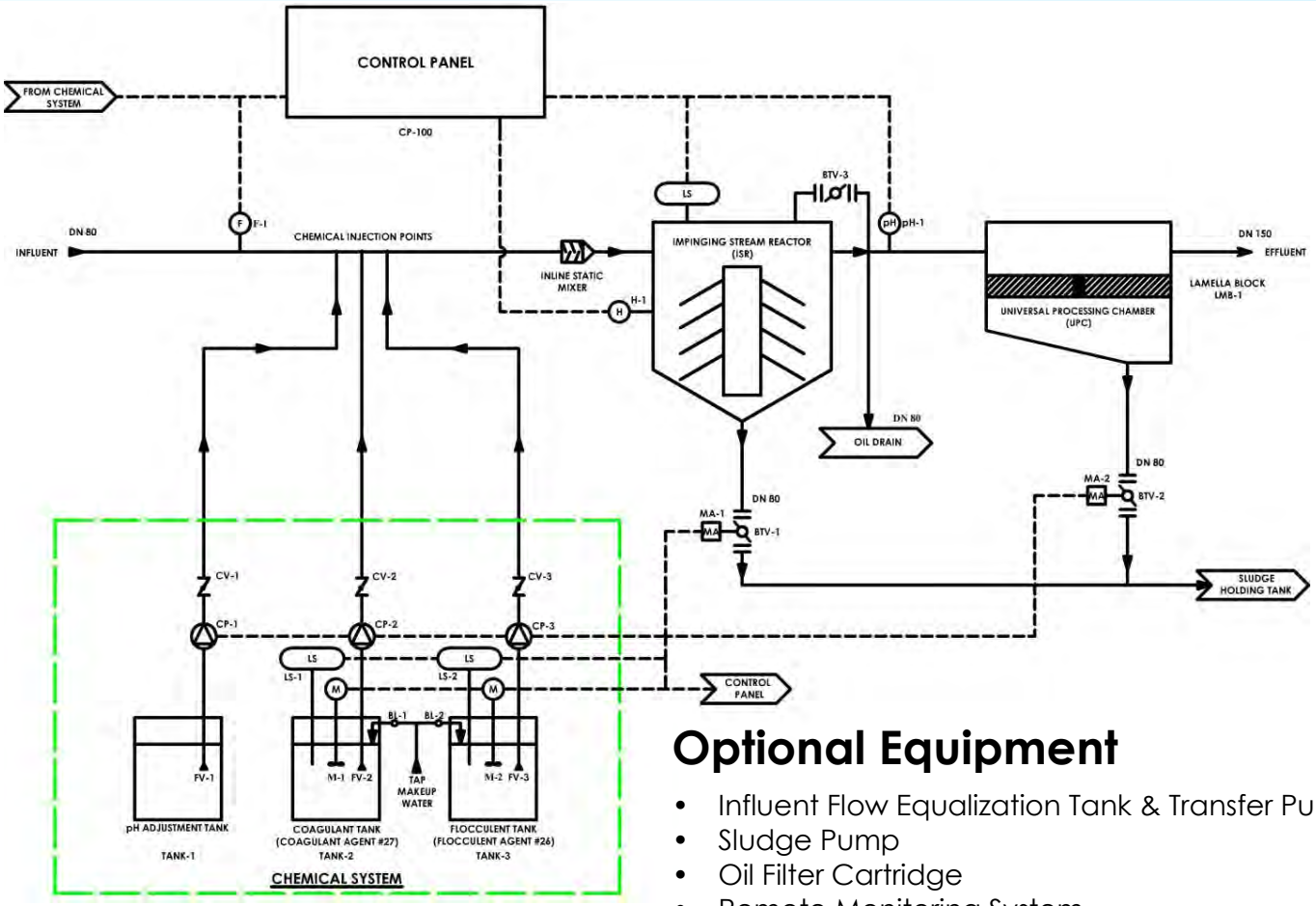
A : You are welcome. Thanks, Brenda.

END

Appendix IV

Detailed Description of

WetSep Filtration System



* WetSep 60E model is shown

Optional Equipment

- Influent Flow Equalization Tank & Transfer Pump
- Sludge Pump
- Oil Filter Cartridge
- Remote Monitoring System
- Stainless Steel Body Frame
- Renewable Energy Sources (Solar, Wind)

Process Description

Chemical Enhanced Primary Treatment (CEPT) is recommended by the World Bank as the most effective and energy efficient method of water and wastewater treatment due to the high treatment efficiency.

The WetSep system uses the concept of CEPT. The first stage of treatment is the Impinging Stream Reactor (ISR) which does not require any driven motors. Thus, it reduces the energy requirement and simplifies the entire system. It combines the process of coagulation, flocculation and sedimentation in one system. By precise engineering of the flow path, flow rate, pressure differential and empirical data, the treatment can be completed in one single vessel.

Using Computational Fluid Dynamics (CFD) modelling, the performance of the WetSep system has been optimised to meet the needs of a wide range of influent water quality.

The influent water first passes into the ISR for the first stage of treatment. The ISR removes 80-85% of suspended solids (SS), oil and grease from the influent water.

The second stage of treatment is the Universal Processing Chamber (UPC). It is designed to be a modular unit that allows different treatment systems to be installed, such as lamella plates, coalescing plates, membrane or rapid sand filter, to treat various types of wastewater. The choice of module depends on the requirements of the treatment which varies from project to project.

Effluent from the ISR and UPC treatment processes has suspended solid removal efficiency more than 99.5%.