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Reshmee Goburdhun

AN APPROACH TO THE DEPOSIT- REFUND SYSTEM OF EMPTY PESTICIDE  
CONTAINERS IN MAURITIUS

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Author Reshmee Goburdhun	
Title An Approach to the Deposit-Refund System of Empty Pesticide Containers in Mauritius  Commissioned by Mauritius Cooperatives Agricultural Federation (MCAF)	
<p>Improper empty pesticide container disposal has been a major challenge in the agriculture sector of Mauritius during the past few years. The aim of this current study is to analyse the feasibility of introducing a deposit-refund system that addresses pesticide containers management issues. This study assumed that the refund scheme can be a system to motivate farmers to recycle. A proper awareness campaign on environmental and economic values can significantly contribute to the appropriate management of pesticide container disposal from farmers.</p> <p>Different types of literature have been reviewed to give the theoretical framework a solid base to complement the purpose and aims of the current research. Data was collected through interviews and questionnaires. A qualitative approach study design using content analysis was used to analyse the data obtained. Further, this study examines the empirical results of previous practices implemented in the pilot Pesticides Container Management Project and the outcome of the pilot project.</p> <p>This study reveals that farmers are resistant to change towards traditional methods of using pesticides. Secondly, the study found that sustainable container management can be achieved in Mauritius provided there is good planning, effective legislation and resources, as well as cooperation between farmers, government and recycling companies. Furthermore, crop insurance is recommended for farmers as it acts as a substitute for farmers to reduce the use of pesticides.</p>	
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## **ABBREVIATIONS**

CRM	Customer Relationship Management
CSR	Corporate Social Responsibility
DRS	Deposit – Refund System
EPA	Environment Protection Act
EPC	Empty Pesticide Containers
FAREI	Food Agricultural Research Extension Institute
GDP	Gross Domestic Product
PCM	Pesticides Container Management
PET	Polyethylene Terephthalate
PPC	Pollution Prevention and Control
SMEs	Small and Medium Enterprises
SFWF	Small Farmers Welfare Fund
ZWS	Zero Waste Scotland

# 1 INTRODUCTION

Plastic containers pollute the oceans; that negatively affects marine life and human health (Andrews 2012). These need to be recycled and disposed properly in order to diminish the dangerous impact it can have on the environment. Recently, some countries have replaced plastic items including plastic bags, spoons, straws and cups with other eco-friendly substitutes. The plastic disposal management in Mauritius is literally non-existent because people dump their waste in a non-environmentally friendly way. Additionally, like most other developing countries, Mauritius still uses plastic items extensively, which is problematic especially in the agricultural sector. In this sector, used pesticide plastic containers are still incorrectly disposed, despite several recent awareness campaigns and guidelines (Huici 2017). To impede this phenomenon, some countries such as Finland, Norway, Canada and Germany have implemented a deposit-refund system (Cordle et al.2019). A deposit-refund system is a system where customers get a rebate on their next purchase when recycling PET bottles and cans. Previous projects showed that the deposit-refund system is a successful approach (Cordle et al.2019). One example is Finland, where the deposit refund system dates since1950. It works by providing incentives to customers to return the product package after use through lower tax rate. It is also known as a money- back system or rebate scheme. The deposit refund system can be adopted in the pesticide industry where this money-back system is an incentive given to people to do the right thing (Ettlinger 2016).

The purpose of this study is to assess the feasibility of the deposit-refund system for managing the recycling of used pesticide plastic containers in the agricultural sector of Mauritius. This study focuses on the project of Container Management System where data is collected from farmers and the marketing manager which is then analysed. Additionally, the research concentrates on sustainable environmental development, the process of recycling and its benefits, analysing business environment of Mauritius, lower environmental risk and promoting recycling through international marketing system.

### **1.1 Aim of the study**

The aim of the study was to analyse the feasibility of introducing a deposit-refund system that addresses pesticide containers management issues. The purpose was to encourage Mauritian farmers in the northern part of the island to recycle their empty pesticides containers. According to Biala and Aregbeyen (2018) and to our present knowledge, no previous study has been conducted in developing countries that identified and examined deposit-refund scheme in the pesticide/fertilizer industry - this highlights the importance of the current study. This study was guided with the following research questions:

1. How the deposit-refund system is applicable in recycling empty pesticide containers in Mauritius?
2. How marketing strategies can be used to encourage the recycling of pesticides containers?

### **1.2 Thesis Structure**

The study aims to provide in-depth analysis of the pesticides industry and the recycling process of empty pesticide containers (EPC) in Mauritius. The content consists of the whole waste management process. Firstly, we investigated the business environment of Mauritius. Secondly, a description of sustainable waste management plan of EPC and the determination of deposit refund system in Mauritius is examined. Thirdly, the author proposed environmental marketing and strategy for adopting this system. Data was collected from farmers (n=50) in the Northern area of Mauritius through interviews and self-reporting questionnaires. Data analysis was performed using abductive content analysis. The results of the study are presented and is a major section in the thesis. Finally, a comprehensive conclusion and recommendation for the implementation of the recycling system is suggested.

## 2 THEORETICAL FRAMEWORK

### 2.1 Mauritius As A Business Environment

The economic and political life in Mauritius has a big impact on its high consumerism society. Mauritian politics are based on a representative democracy. In the Republic of Mauritius, the parliament plays a crucial role in the political environment of the country, and the political risk is moderate (Indexmundi 2018). The total Gross Domestic Product (GDP) of Mauritius in 2017 was €11.71 billion (Trading Economics 2019), where the share of the agricultural sector was 3.09% of the total GDP (The Global Economy 2019). Additionally, the importance of environmental progress is highlighted through the publication of the Environment Outlook Report by the Government of Mauritius. Environmental issues have been recognised as a crucial part in sustainable development (MEO 2010, 3-4).

In Mauritius, the materials that are being recycled include paper, plastic, glass, textile, metals and some hazardous wastes. Plastic waste is harming the environment “from rivers to oceans and forests to city streets”, and Frangoul (2018) revealed that around 70% of waste was not recycled. Consequently, Mauritius has implemented some policies on hazardous wastes management, by minimising hazardous waste generation, encouraging on-site recycling and treatment of hazardous wastes (Beerachee 2012). Recently, the government attempted to reduce pollution with the elimination of plastic bags, plastic straws and plastic cups usage. This has led to new business opportunities horizons for SMEs to replace plastic usage by substitute materials that are environmentally friendly (Hamuth 2016).

The government is also encouraging the use of sophisticated disposal technologies to prevent incineration. According to Foolmaun et al. (2011), recycling and composting are believed to be still in their infancy stage due to no segregation of wastes. Subsequently, there is an urgency to improve the current waste disposal system in the country (Foolmaun et al. 2011). Figure 1 shows the trend in per capita of waste generated by various sectors such as construction, agriculture and industry in Mauritius. Waste has not only increased due to population growth and economic development but also because of social development such as changes in living standards and consumption patterns, production



and marketing (MEO 2010, 73). The trend shows a gradual increase in waste generation per capita in 2009 compared to the past eight years.

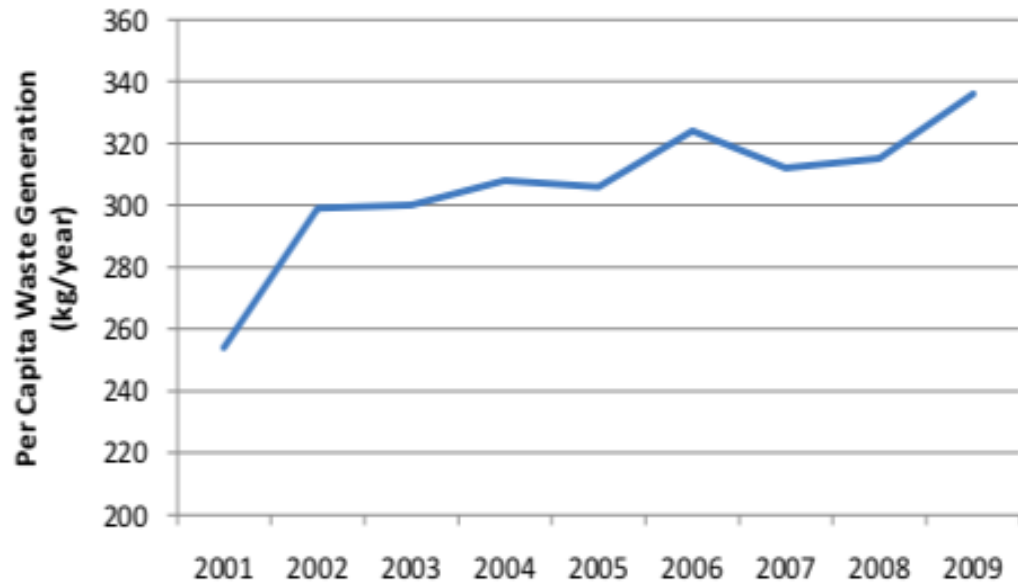


Figure 1: Trend in the annual per capita waste generation (MEO 2010, 73).

## 2.2 Farmers are resistant to change

Farmers do not readily accept new agricultural practices and technologies because of reluctant cooperative attitudes (Lucas 2010). Anastasiadis (2012) found out that adoption is a constant decision where farmers find new practice less threatening in the long-run. The gap time from introducing the new practice to finally adopting it gives farmers a high chance to learn, train and prepare for the change. Dury et al. (2010) mentioned the three main reasons for farmers being less resistant to change. They are: (1) to maximise profits, (2) to have a secure income, (3) and to reduce their workload. Adequate information and exposure must be provided to farmers to influence their adoption behaviour (Aldosari et al. 2019). A discourse analysis is helpful to support educating farmers on environmental concerns and ease farmers' behavioural change. A discourse analysis refers to the specific ways of using language in particular circumstances. (Fleming and Vanclay 2010.) A framework must be built on the perception of farmers about embracing a new agricultural practice. As agriculture is more likely to face climate-change related problems, the

agricultural community is willing to change their practices. Support awareness campaigns are crucial to determine farmers' decisions on mitigating their EPC disposal activities.

### **2.3 Motivational factors for recycling among farmers**

The rapid growth that occurred in terms of imported quantities and the low levels of knowledge of farmers regarding the use and responsible management of pesticides means that a new recycling system is needed. Farmers are particularly at high risk of pesticide exposure due to occupational exposures (Öztaş 2018). Awareness campaigns and training should be organised so as to educate farmers on the importance of recycling. This may reduce negative environmental impacts. Anastasiadis (2012, 5) stated, "farming is a business", pesticide companies providing incentives to farmers that boost their efficiency and encourage them to adopt new practices and technologies in their current activities. As an alternative to using the triple rinsing technique and collection cages for safe disposal, a performance reward scheme can motivate farmers more effectively. (Company X 2010.) Farmers' recycling behaviour can be influenced through positive environmental impact sensitisation, providing intrinsic rewards and creating personal satisfaction through helping society out of altruism (Vining et al.1992).

### **2.4 Impact of agricultural waste and waste disposal**

Silva and Chan (2014, 6) describe pesticide as "any substance or mixture of substances of chemical or biological ingredients intended for repelling, destroying or controlling any pest, or regulating plant growth". Pesticides used in Mauritius are a matter of concern because the heavy use of pesticides leads to high production costs and low food safety and quality. Farmers rely strongly on pesticides and chemical fertilizers causing harm to the environment, human health, and instability of the agro-system (see Table 1).

Table 1: The importation of agricultural inputs in year 2017 for Mauritius (Suet 2018, 147)

Year 2017 - Quantity in tons; Value in Mauritian Rupees (Rs)		
COMMODITIES	QUANTITY	VALUE Rs (000)
Fertilizers	44,405	486,916
Insecticides	697	96,189
Fungicides	205	48,389
Weed killers	1,269	227,475

The value of imported pesticides has increased over time (Suet 2018). Although awareness campaigns have been carried out by the agricultural authorities, the misuse of pesticides still exist among farmers (Boodhoo 2010). According to Loehr (1974), environmental problems occur because agricultural operations rely heavily on waste management techniques instead of the amount of waste involved. Unsafe disposal of pesticide waste can have negative consequences on the environment and human health (Bondori et al. 2019). Ineffective management of pesticide waste can lead to water and land pollution. The inefficient combustion of empty containers in open fields produce harmful gaseous pollutants.

Pesticide wastes are not usually discharged on a regular basis. When performing the triple rinsing process, the little amount of effluent left in the pesticide containers is hazardous for the environment and for farmers' health. This may lead to an increase in morbidity

and mortality. Loehr (1974) endorse the importance of educating farmers on the impacts of agricultural operations, thus minimising environmental concerns.

## **2.5 Sustainable Management plan for empty pesticide containers**

Hurtig et al. (2010) recognised many risk issues related to the use of pesticides, including washing pesticide equipment in the same water that is being used by humans, carelessly disposing EPC, consuming foods and drinks when applying pesticides and without using enough protective clothing. The training of farmers and educational campaigns should be encouraged for this cohort, along with recommendations for alternative methods of pest control or empty containers disposal (Hurtig et al. 2010). The government must implement comprehensive intervention measures such as training farmers on pesticide applications and opening agricultural research on pest control (Jallow et al. 2017). Boolell (2018) highlighted the imposition of levies on the importation of pesticides in Mauritius as a means of restraining farmers from using pesticides.

## **2.6 Deposit Refund System Process (DRS)**

Walls (2011, 11) defined DRS as a combination of “tax on product consumption with a rebate when the product or its packaging is returned for recycling”. The deposit-refund system has been a successful approach in some countries, such as Finland, Germany and Canada. A deposit refund system can control pollution efficiently in the same way as Pigouvian tax, which is applied on negative externalities (Walls 2011). This recycling system is more ecological and economical than current systems (Anty 2016). Hansen (1999) discussed the implementation of non-point nitrogen emissions from agriculture which has however not yet been introduced in the pesticides industry. Walls (2011) concluded that the empirical results on DRS is narrowed because of the lack of research. The notion of implementing the DRS scheme can be costly as it demands big financial investments in the set-up and creating space for empty containers collection (Schmidt 2000). Zero Waste Scotland (ZWS) argued that DRS requires cost-benefit analysis and the consultation of resellers, the Scottish Government and waste management companies so as to avoid an adverse supply chain (Scott 2019).

### 2.6.1 How the deposit refund system works in Finland?

In Finland, DRS is a useful recycling system for “returnable bottles, aluminium cans and plastic bottles”, and has high return rates. In 2015 the return rate registered for aluminium cans, plastic bottles and glass bottles were 95%, 92% and 88%, respectively. (Palpa 2015). According to Helsinki Times (2016), the Palpa company estimated that nearly “17,000 tons of aluminium, 13,000 tons of PET bottles and 50,000 tons of recyclable glass” will be produced annually through recycled bottles and cans. Consequently, this mechanism has been implemented with success in reducing wastes in Finland. This is a common recycling system at the European level and supports an environmentally friendly society. This study concentrates on small channels such as community-supported agriculture, farm sales and cooperatives.

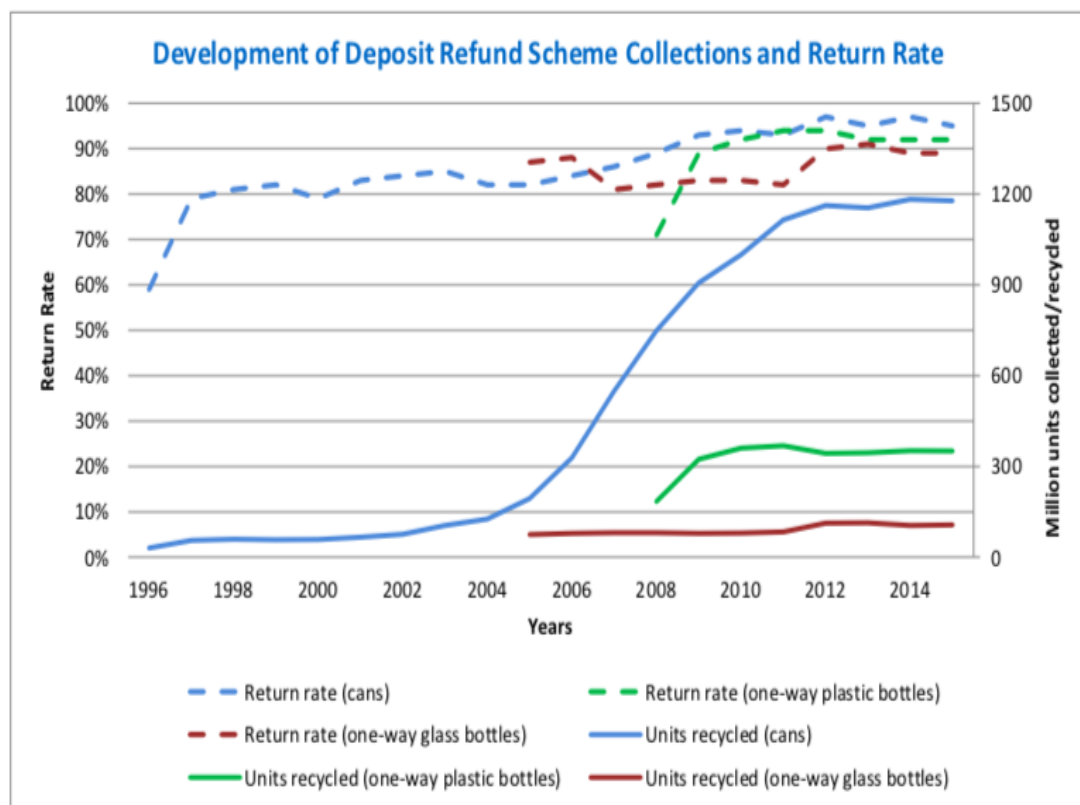


Figure 2: Development of deposit refund system (Ettliger 2016, 3)

As shown in Figure 2, the return rate was already at 59% in the initial year where Palpa was first introduced and in 2008, one-way plastic bottles were introduced with a return rate of over 70%. By 2012, the recycling rates for cans, plastic and glass were above 90%. Therefore, the environmental effect of the deposit refund shows that high frequency of

use of the deposit system was promoted by the interaction between the packaging tax and DRS in Finland (Ettlinger 2016).

### **2.6.2 Determination of Deposit Refund system in Mauritius**

The general recycling systems in Mauritius are ineffective as compared to Finland. To create a sustainable society, the Pollution Prevention and Control (PPC) Division preserves compliance to environmental legislation and standards under the Environment Protection Act (EPA). The PPC records environmental complaints and addresses to emergencies by taking appropriate actions as listed in the Environment Protection Act (PPC 2019).

As explained by Hamuth (2016), although the Mauritian industrial landscape has many recycling factories of plastic and paper, there is a lack of planned network for the collection of used plastic and paper. These factories encounter impediments in acquiring the critical amount of recyclable inputs to function at optimum capacity (Hamuth 2016). In Mauritius, consumers can only return empty beverages glass bottles to customer service in the supermarket and customer service prints out the credit note as rebate on their purchase. This has been identified as a trait of DRS (Seebaluck and Koussa 2009). However, no cans and plastic bottles are accepted.

### **2.6.3 Deposit Refund System for recycling empty pesticide containers**

Recycling is a potential way out. A SWOT analysis is implemented to analyse the DRS for empty container management in Figure 3 (Appendix 4). With the current container waste management system, 1.8 tons of EPC have been collected from the fields, and 75% of triple-rinsed containers have been disposed of (Company X 2017, 11). Hence, when exploring the applicability of DRS, it is believed that the number collected might double. As stated by Biala and Aregbeyen (2018), the refund amount, recovery period and perceived effectiveness of DRS influenced the farmers' compliance with DRS. Thus, local authorities should apply DRS and set up recycling cages and plants and motivate private recycling companies, so as to accommodate EPC. (Biala and Aregbeyen 2018.)

To reinforce safe disposals, sufficient collection cages will be made accessible in all collection stations. The collection cages are made from recycle plastic which facilitate

farmers to throw their EPC. Once the cages are filled, they are collected by the recycling company Surfrider Ltd (Company X 2017, 24). The collection points need to be located near the reseller outlets for the field officers to check whether triple rinsing is practiced before ending in cages.

## **2.7 Environmental Marketing**

Consumers are changing their behaviour to assimilate environmental considerations. Ethical considerations should be integrated into environmentalism so as to form ethical environmental marketing claims where two aspects of ethical theory are considered: moral style and normative behaviour (Davis 1992). Moral style means to take particular construction to demonstrate its vital relation with moral decisions (Axinn 1990), and normative behaviour is referred to conformity where the standard of acceptability respects the rules of society (Reference 2019). Environmentalism has become a framework where businesses accept concepts like ‘ecological management and waste minimisation’ (Polonsky 1994). Green marketing, also known as environmental marketing, ensures that the welfare of the retailers and farmers are protected with less detrimental effects on the environment. This mode of marketing is often used by organisations for having ethical obligations to become more socially responsible.

### **2.7.1 International marketing system for recycling**

To create a green economy, awareness creation and behavioural change communication are required to improve farmers’ attitudes towards disposal of pesticide waste along with training to optimise pesticides use (Bondori et al. 2019). Not all farmers in Mauritius are aware that EPC can be managed, as the deposit return scheme is not well-known. Therefore, the most effective ways to disseminate information is to invest in widespread marketing efforts and stimulate participation from farmers (GlobalData Consumer 2018). Posters and flyers played a significant part in spreading information on triple rinsing (Appendix 5). In order to change sustainably the mindset of farmers, it is crucial to involve key stakeholders including agricultural programs, farmers, the government bodies and local authorities through cause-related marketing. Applying cause-related marketing can create opportunities to have a wider reach to the prospects and improve public relations by creating good images of the recycling system in the farmers’ eyes.

Promoting communications and marketing for the recycling system are the main drivers for an effective campaign where an understanding of the need for action is recognised. This type of understanding can generate movements for the collection of tons of EPC within the environment and offer a solution to a final disposal through the reuse of the containers (Huici 2017).

### **2.7.2 Blue Ocean Strategy**

In the modern society, competition exists in every organisation whether the company is providing a product, pesticide or the company is providing a service such as recycling. Kim and Mauborgne (2015) argued that competition should not merely concentrate on benchmarking as the key strategic thinking but rather on how to bridge the value gap. The authors further defined two types of frameworks derived by the business universe: red ocean and blue ocean. The red ocean refers to fierce competition that exists in all industries. Contrarily, the blue ocean strategy is defined as the formation of an 'uncontested market space' by a company with no competition (Financial Times 2019). It is possible to be successful pursuing a blue ocean strategy, but this strategy demands a substantial amount of business experience. Kampa et al. (2012) identified five differences between the red and blue oceans (Appendix 6) that act as an important strategy. The blue ocean is a market that is yet to be discovered by a wide audience; therefore, it is not considered to be a monopoly (KeepSolid 2018). The blue ocean strategy is applicable for marketing purposes, which help to locate the problems and challenges end-users are facing and hence provide solutions. Companies exerting this strategy can create a marketing system that goes beyond any rivals and sells their products/services in the simplest way by caring for the needs of the potential users. (Origano 2007.)

According to Kim and Mauborgne (2017), applying the blue ocean strategy can bring remarkable success in the recycling industry only when aligning the three essential propositions to the strategy, namely value proposition, profit proposition and people proposition. The term 'value innovation' is used in the value proposition concept where waste management companies can create and capture their own blue oceans (Kim and Mauborgne 2017). As quoted by Kaplan and Norton (2008), a perception of a new value proposition is the key of a distinct strategy. The profit proposition ensures the economic progression where profitability and competitive advantage are evaluated through a traditional analysis taking into consideration elements related to sustainable development.



Finally, the people proposition creates a broad system where society is involved in the social interest of preserving the environment and from a young age, children are taught how to recycle in schools. (Asselineau et al. 2013.)

The blue ocean strategy approach can acquire the aim of reducing waste, while concurrently improving the results. The blue ocean framework can provide a plan for ecological development where the quantity and quality of EPC recycling can be improved (Mudd 2017). SMEs are often more flexible than big companies as they can spread their message more swiftly. Small companies can better move towards the needs and wants of their customers through effective marketing and communication where good CRM is required to gain positive outcomes from this strategy. (Origano 2007.) Although the blue ocean strategy adoption is challenging, the roadmap planner in Figure 4 shows the high percentage acquired in profit (61%). However, the red ocean has proved to acquire a high percentage in income and in the number of companies. The roadmap hence illustrates that the profit in the blue ocean is 1.5 times higher than in the red ocean. (KeepSolid 2018).

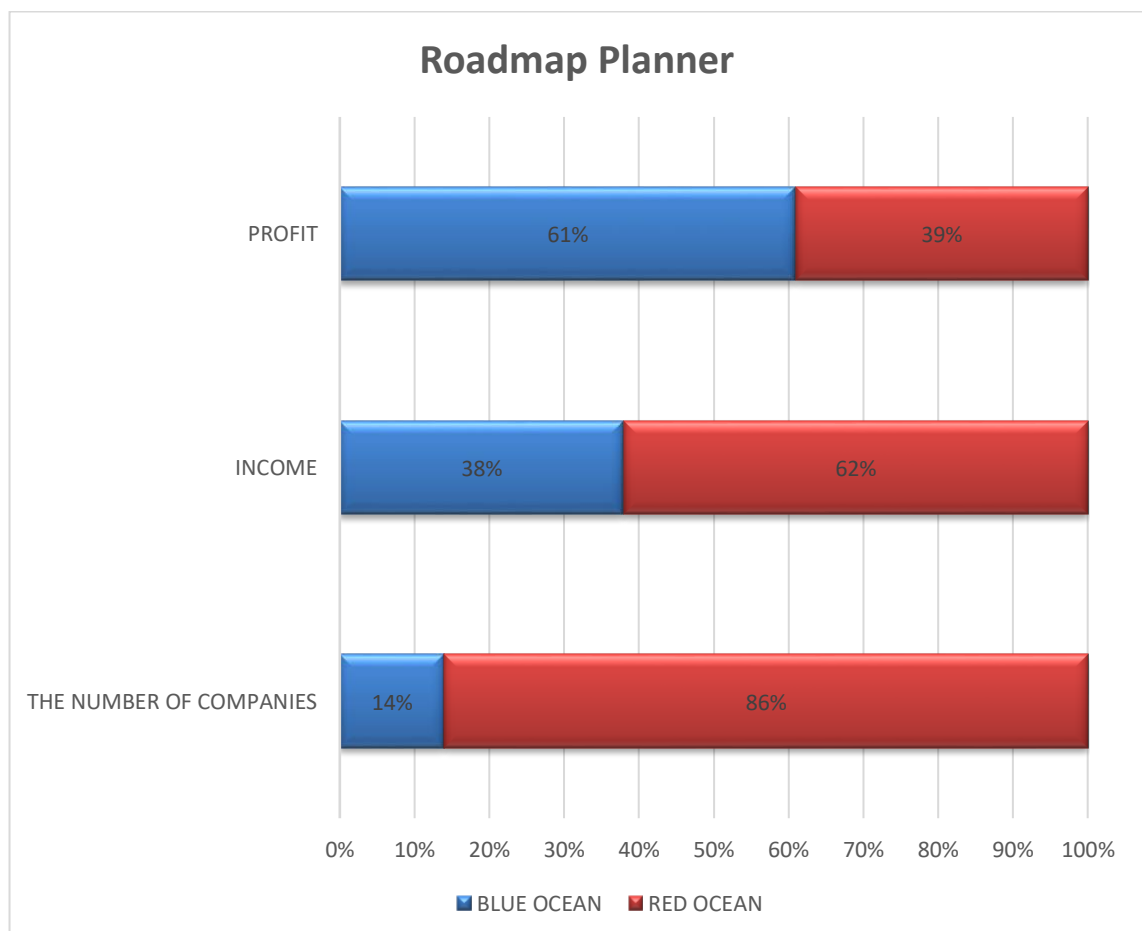


Figure 4: Roadmap Planner (KeepSolid 2018)

However, the blue ocean strategy is quite risky and difficult to perform. As the blue ocean strategy needs further procedures to be fully implemented into companies developing products/services, it is essential to review the chances to create new products/services, involving differentiation and low cost concomitantly. (Kampa et al. 2012.) Origano (2007) examined the possibilities of big companies' failures because it is harder to change and operate a new strategy in the whole organisation in a short period of time.

### **3 RESEARCH METHODOLOGY**

#### **3.1 Study design and justification**

Previous literature from reliable online sources, articles, existing studies, and primary data were collected and analysed. The study is carried out using qualitative methods due to the research content. The qualitative research is conducted as it can help to shed light on this specific matter. Usually, qualitative research concentrates on a small number of participants, and in this situation, the research will focus only on farmers who live in the northern region of the island. This study will adopt a practical and feasible approach on the case company by analysing the previous waste management measures that were taken. The study analyses the problem by looking at it in a much broader perspective. Choosing a research methodology is a vital part as the author finds the abductive approach to be useful where the author can go back and forth to assess the results between the empirical data and theoretical framework. As cited by Eriksson and Kovalainen (2008, 15), "the abductive research starts with a research question and adopts theories to generate empirical results".

#### **3.2 Selection criteria**

Qualitative research involves the collection, analysis, and interpretation of data. The empirical data is collected by interviewing farmers and the marketing manager. The data is then analysed deeply to derive the codes and themes for this study. Issues such as anonymity and confidentiality are considered when presenting findings (Anderson 2010).

Therefore, to ensure anonymity, the case company and the interviewee real names will not be used. The case company will be addressed as Company X and the interviewee will be addressed as Mr. S in this study. The alliance company of Company X that is chosen, is an importer of pesticides products. The company is well-known and successful in the agricultural sector which has a great hand in the Container Management Project. Therefore, the alliance company will be named Company Y in this study.

### **3.3 Data Collection Method**

The data collection was conducted through interviews and by searching for relevant articles, journals, online sources and primary data. The researcher prepared two sets of interview questions which were for Mr. S. The first set of interview questions was for interview one (Appendix 1). The second set of interview questions was for interview two (Appendix 2). Further, a questionnaire was prepared for data collection from the farmers. The questionnaire was a self-reporting questionnaire consisting of closed-ended questions (Appendix 3).

Mr. S was interviewed two times; the first interview was held on 11 February for around an hour, and the second interview was conducted on 2 April for two hours. On the first interview, Mr. S talked about the company where he works and the project that he is a part of. When a clear overview of Company X is gained from the first interview, Mr. S was interviewed on a second time with open-ended questions derived from the theoretical framework.

Data was collected from 50 farmers on 16 February 2019 at a pesticide reseller outlet in a city called Goodlands. The researcher waited at the pesticide reseller outlet for two hours. As farmers were coming to the outlet, the researcher handed out the questionnaire and asked them to fill it. Participation was voluntary. After collecting 50 completed self-reported questionnaire, it was deemed that the number of respondents was enough.

Also, an in-depth interview was carried out by interviewing Mr. S, who is the project and marketing manager of Company Y (Appendix 2) as the personnel of Company X was not available. This study will use the abductive method for analysing the results. An abductive approach refers to the combination of both deductive and inductive approaches where the research process is analysed from the start to build up the theoretical parts. The author

can merge both numerical and cognitive reasoning when using the abductive approach (Saunders et al. 2000, 145-150). The interviewee was informed about the interview process and the aim of the study. With the interviewee's permission, the interview was recorded, which was then transcribed.

### **3.4 Analysis**

For the interview and questionnaire, discourse analysis was used where the actual words used during the interview were examined. For the interview analysis, three basic procedures were used: (1) observing concepts, (2) collecting examples of the concepts and (3) analysing these concepts in order to find the commonalities (Ayres et al. 2003). These principles allow new ideas and themes to emerge and the purpose is to elicit information from the data collection. Vivo coding is adopted. This refers to giving great importance to the actual spoken words of the interviewee. When going through the interview data, vivo coding helps in labelling sections of the data where a three-word summary is quoted: "Ecological Management Process" (Manning 2017). The codes and themes are derived from the interview. Coding can be defined as identifying interesting features of the data which helps in developing a theme. A narrative is constructed from the theme to portray the main contents, sub themes to foster these contents and codes from the interview to support the data (Ryan and Bernard 2003). Multiple codes can be extracted from the same segment of text where they are sorted into groups and combined to form an overarching theme. With this analysis, the objective is to focus on creating a sustainable recycling approach. (Flick 2014.)

### **3.5 Sampling, Validity and reliability**

In this qualitative study, sampling, validity and reliability measures were assessed. On one hand, a non-probability sample has been used where the convenience sampling method is adopted. Convenience sampling is where the participants selected are convenient sources of data (Lavrakas 2008). The validity of this analysis is measured in terms of internal validity. Validity is the extent to which the data and the interpretation of data are credible. Additionally, internal validity is necessary to consider because the study focuses on the "cause-and-effect correlation". (Slack and Draugalis 2001, 2173). Since a case-study method is being used, the author follows the literature of Yin (2003, 33-39),

who suggested that researchers must have more than one source of evidence which lead to the chain of verification. The validity of this study is assessed based on the interviews and questionnaire conducted and the outcome achieved from the data collected. Therefore, this study aims to analyse the results through empirical data from multiple sources such as the case company and its pilot project on container management.

According to Shipman (2014), reliability refers to the consistency in measurements. The reliability of this study is taken into consideration when designing the interview questions. To ensure a reliable study, the researcher focuses on proper record keeping of the collected data and the transcribed data obtained from the recorded interviews. Consequently, the validity of the study is upheld by the embedding information derived from the content (Suter 2012).

### **3.6 Limitations**

Farmers are reluctant to change except if that change gives them some benefits in return. The main person in charge of the case company was not in the country when the interview was conducted. Company Y's representative member was then chosen to interview as he is also part of the project. The interview was done in the native language of Mauritius, which is Mauritian Creole, which was then translated in English by the author for transcribing the interview. The geographical region of the island is an important limitation to consider as farmers in the northern region were interviewed. This provided the study with limited perspectives on the farmers' attitudes. Another difficulty was a language barrier, where the questions of the questionnaire were translated in the mother tongue of the country so as farmers can understand and answer the questions easily. Another methodological limitation of this study is the cross-sectional approach because data was collected at one point only. Additionally, an interview was conducted with one person; this may have limited the result. The 50 farmers that answered the questionnaire were not a random sample. They just happened to visit the outlet at that time. A power analysis was not conducted to estimate the sample size. Consequently, the result of this study should be interpreted with caution as the researcher cannot confirm the generalisability of the result.

## 4 EMPIRICAL RESULTS

### 4.1 Background of The Case Company

Company X is a global network representing the plant science industry. It is an international trade association of agrochemical companies that promotes agricultural technologies such as pesticides and plant biotechnology to support the betterment of agriculture. Company X is a non-profit organisation representing many companies, nearly in 25 countries extending over six regions, namely: North America, South America, Europe, Africa/Middle East, Asia and Japan. It has a branch in Mauritius, part of the Eastern Southern Africa hub. The stewardship approach explained by Company X is shown in Figure 5 (Company X 2010).

“Company X uses the stewardship approach for product management because it is the most ethical way to manage crop protection products from their discovery to development, and to the final disposal of waste” (Mr. S from Company Y, 2019)



Figure 5: Stewardship approach (Company X 2010, 8).

In Mauritius, the company recruits six importers of pesticides namely, The Mauritius Cooperatives Agricultural Federation (MCAF), Blychem Ltd, Suchem Ltd, Agro-oi and ENL Agri. The reason for collaborating with these companies is because they have a

responsibility towards the end-users, the farmers. The company has developed health hazard programs where training sessions are provided to farmers in using pesticides such as the safe use of pesticides, emphasizing the reading of labels on the products and knowledge about the application of pesticides. The company also aims at improving the regulatory standards in the pesticide industry.

“Our vision and mission are to reduce the EPC from the environment through safe disposal of the empties” (Mr. S from Company Y, 2019).

#### **4.2 The Pesticide Container Management Project**

The Pesticides Container Management (PCM) project was developed in 2015 by Company X in Mauritius where the United Nation Development Program (UNDP) agreed to sponsor half of the budget by giving 1 million Mauritian rupees (€ 24,759) (Oanda Corporation exchange rate on 07.04.19) to the project. Company X had sponsored the rest of the budget. Hence, the total budget of this project was around 2.7 million Mauritian rupees which is €66,848 (Oanda Corporation exchange rate on 07.04.19). The organisation provided training which aid farmers to understand the practice of triple-rinsing, installation of collection stations, and the safe disposal of containers.

During the pilot study in the project, collection cages were provided to farmers to collect their EPC. Once these cages were full, a recycling company, Surfrider Ltd, collected them. The cages were distributed in nine farming sites. Field officers were appointed to monitor and control farmers' activities. The Ministry of Environment was also involved to ensure that the cages were durable even in harsh weather.

The goal of having this project is to make farmers aware about their health and safety and ways to tackle any challenges before making it a national project.

**“The project was initially administered in four regions of the island for three categories of farmers, namely sugarcane, herbs and onion farmers. The four areas covered were the central, the east and west regions and some parts in the south region. Unfortunately, the north region was not part of the targeted site due to limited resources available.” Mr. S from Company Y.**

### **4.3 Interaction with north region farmers**

The interaction with farmers of the northern region was done through interviews. The questionnaire is simple and direct by having closed-ended questions (Appendix 3). The data was easily analysed by sorting the interview results in terms of percentages. The purpose of conducting this interview with the farmers was to gain their perspectives on recycling. Out of the sample of 50, 75% keep the EPC outside their house, usually in a store, and 25% keep them inside their house. 45% of the cohort throw the empties on open fields or in normal trash-bins; 40% recycle the empties; 5% burn the containers after use, and 10% bury the empty containers believing that these empties are toxic and should not be recycled. Additionally, 90% of the sample think that they are harmful to both the environment and human health.

Despite Company X providing training to farmers on the triple-rinsing method, not all farmers practice it. In many parts of the island, farmers are unaware of the training provided and hence, they remain unknown of the process. Some farmers mentioned that they do not have enough time to go through the process for all EPC. Moreover, 95% believe that getting incentives for returning and recycling the empties can encourage the disposal of containers. 86% of the sample prefer to receive incentive such as refund on their next pesticide purchase than receiving a token when returning the empty containers. Nearly half of the sample think that DRS can improve the management of empty containers. The analysis of the data therefore shows that this waste management system can motivate farmers to recycle. Figure 6 shows the interview results of the farmers' opinions on recycling and EPC management.



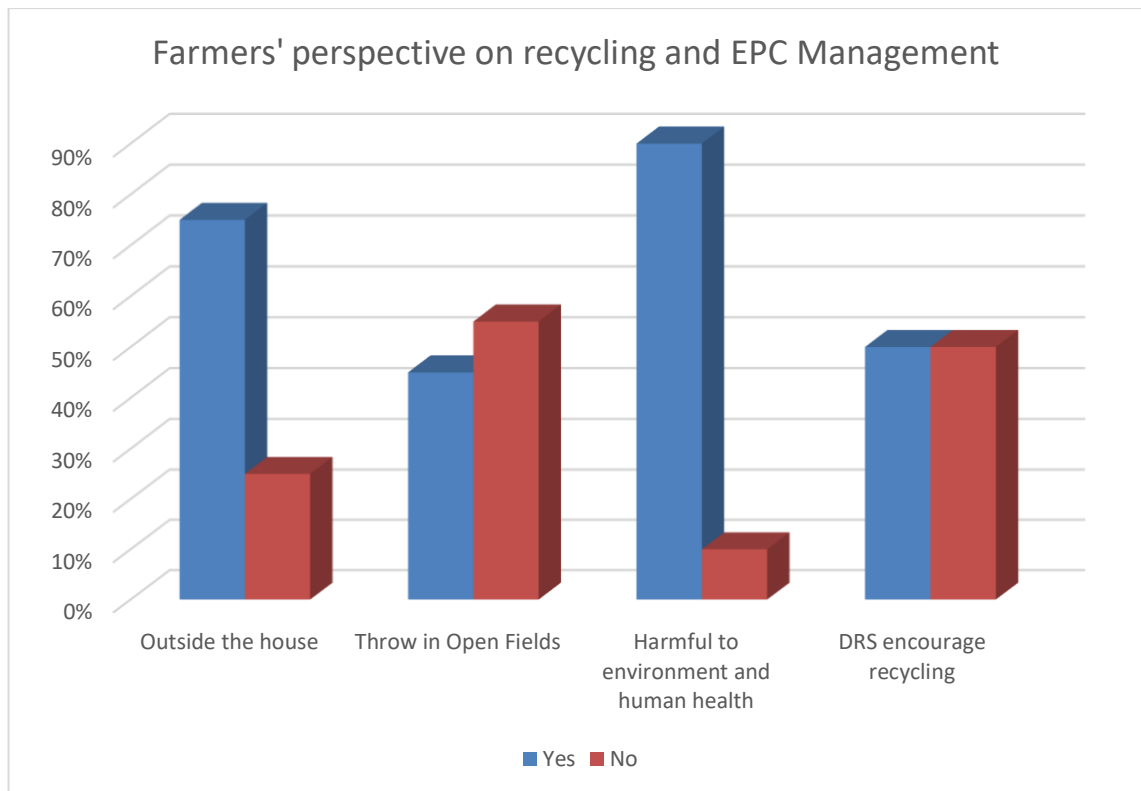


Figure 6: Farmers' perspective on recycling and EPC Management

#### 4.4 Recycling Process in Mauritius

Mr. S talked about two types of recycling; the recycling of plastic products and the recycling of chemical products such as pesticides chemicals and household chemicals. As no action has yet been taken for the recycling of household chemicals, this study focuses on pesticide chemical recycling, where an infrastructure has already been built. Protocols have already been adopted in Mauritius whereby triple-rinsing should be performed. Being a developing country, Mauritius has a slow growth in development and innovations. Agricultural research on pest control is very limited and not popular in Mauritius. Unfortunately, stakeholders are still unaware of the importance of conducting this research, and no adequate resources are provided by the government. Mr. S also cited that only 20% of the country is safeguarding the environment against pesticides. As the farmers are resistant to change, they do not realise the impact of pesticide misuse on the environment.

#### 4.5 Motivational Factors

It is fundamental to educate farmers about the advanced methods in agriculture. Mr. S mentioned that his aim is mainly to create competition between farmers by encouraging them to perform the triple-rinsing method. The pesticides importers and the farmers have developed good business relationship by keeping close-contacts, providing credit facilities and discounts.

“Old farmers are resisting change and they prefer to use their traditional methods. The pesticides importers that are associated in the project, have volunteered to sponsor bio products, sprayers and other tokens to farmers to promote EPC recycling.” (Mr. S from Company Y, 2019).

Mr. S suggested that the resellers should sell their products at competitive prices to win farmers’ trust. Mr. S conducted a pilot project where every farmer was given a container collection bag with his/her name printed on it. The objective of the pilot project was to collect maximum containers from farmers by providing them with rewards based on the number of containers collected. However, Mr. S revealed that due to peer pressure, young farmers became reluctant to recycle as they were not satisfied with the rewards provided. The pilot project can be extended into a national project if they get financial aid from the government.

#### **4.6 Managing Waste and Disposal**

Company X ensures triple rinsing is practiced by testing some containers randomly from the farmers who are collecting containers to gain rewards. Mr. S however admitted that it is difficult to control whether triple rinsing is practiced in all the empty containers. When providing trainings in batches, the biggest challenge faced by Company X is time consumption. In practice, farmers do not apply the triple-rinsing the same way as shown in the training as many of them believe that it is a waste of time. Mr. S emphasized that the residue thrown by farmers could have been used later in the same sprayer.

“I believe that focusing on the quantity of waste is not that important but looking at the waste management techniques should be the main focus for the EPC to be disposed” (Mr. S from Company Y, 2019).

Mr. S suggested that the government should intervene in controlling the unsafe disposal of pesticides. The government has to provide adequate resources with the help of a distribution network that includes companies that are importing and selling pesticides (Appendix 2).

#### **4.7 Adopting DRS**

Mr. S found the application of Pigouvian tax to be a good procedure in controlling pesticide recycling. This tax system can be very effective in the agricultural sector as farmers will not bear the burden of the tax in terms of high prices by getting a rebate as compensation on high price. Company X considers DRS to be an advocacy support for recycling by providing a win-win-win situation for farmers, resellers and the society as a whole. The implementation of DRS can thus be financed by the imposition of a levy. Moreover, adequate space is needed to set up the cages at the resellers' points.

#### **4.8 Triple Rinsing Method**

Company X is a non-profit organisation with the main aim of creating a sustainable environment through safe use of pesticides instead of making profits. Farmers are trained to adopt the triple-rinsing method with water, which makes empty containers 99.99% safe for recycling.

“Before implementing the container management project, my team carried out a survey to identify the traditional way farmers are disposing their empties” (Mr. S from Company Y, 2019).

The survey result helped Company X to come up with the triple rinsing method for safe disposal and optimised use of pesticides. The leftover residue of the pesticide containers is put in a sprayer and used again by the farmers instead of disposing the EPC in the environment with no triple rinsing being practiced.

#### **4.9 Marketing Strategy**

In the initial stage of the pilot project, the promotional tools used were not reliable as people were throwing all kinds of products in the collection cages. The stickers in the cages make people believe that the cages were for all plastics trash. This matter was considered and afterwards the printed advertising was made eye-catching by focusing only on collecting EPC. Consequently, the posters and flyers have become very effective in spreading information on triple rinsing and creating awareness.

“Our focus is not completely on green marketing to promote the project. As I have mentioned, the awareness campaign target was mainly on four targeted areas, and the pilot project was handed over to the Food Agricultural Research Extension Institute (FAREI), which will implement the project on national basis” (Mr. S from Company Y, 2019).

FAREI will eventually carry out the awareness campaigns in all regions of the island. As no proper marketing strategy was adopted, many farmers are still unaware of the triple-rinsing training's existence. Videos, dubbed in the mother tongue of Mauritius, were also used to illustrate how triple-rinsing is performed. Mr. S added that the blue ocean strategy would have been a substantial option to reach their targets and visions. The blue ocean strategy demotivates competition, and thus retailers can improve their reputation by adopting corporate social responsibility (CSR) to the market.

#### **4.10 Measures and Solutions**

Mr. S explained that the issue of pesticides use can be resolved if farmers apply a reasonable amount of pesticides, read the guidelines on the label and respect the timeframe for cultivating crops. Farmers are informed not to use domestic purpose water for washing the containers or pesticide equipment. The equipment is washed separately usually on fields. Although agricultural research on pest control is conducted, the research is limited and unpopular. The stakeholders are also unaware of the importance of doing research on pest control. Besides, some pesticides companies cannot carry out research due to lack of resources.

An improved future programming is needed to educate farmers to recycle empty containers. As Mr. S believes that the pilot project by Company X is ecological but not

sustainable, more measures should be taken by the project members to encourage more funding sources to make the project sustainable.

#### **4.11 Outcome of the pilot project**

The project was moderately successful in the beginning as farmers were reluctant to recycle. Moreover, issues such as mismanagement of EPC, time consuming for triple-rinsing and recycling were identified. Many farmers prefer to adopt the fastest technique of disposing EPC.

“We provide incentives to farmers by having competition in every region, and whoever has collected the maximum empty containers, performed the triple-rinsing and recycled them, are awarded with the company’s tokens or swags such as a sprayer, a cap or umbrella” (Mr. S from Company Y, 2019).

Providing incentives to farmers have gradually showed some progress, but this rewarding method has encouraged farmers to use more pesticides so as to collect more containers and win the tokens. This method also contradicts the main aim of the pilot project, which is to create a safe environment.

## **5 DISCUSSION**

The study investigates whether the adaptation of DRS in the pesticide industry is the ultimate solution for recycling EPC. Previous literatures and empirical results are evaluated which show that no reliable solutions have been adopted yet for the EPC management. After interviewing the farmers in the north region and Mr. S, the empirical data is analysed through coding. A list of codes is identified which help in deriving the sub-codes. The sub-codes are then grouped together to form a main theme for this study (Table 2). The main theme aids at providing the results.

Table 2: Derivation of Codes, Sub-Themes and Theme

<b>Codes</b>	<b>Sub-Themes</b>	<b>Main Theme</b>
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Resistance to change Good Business relationship Reluctant Time consumption Traditional methods Perspective on recycling	Farmers' attitudes	Deposit Refund Scheme
Incentives Refund Token Rewards Motivate Farmers Competition	Rewarding methods	
Safe use of pesticides Training to farmers Triple-rinsing method Monitor Health and Safety Bio-cultivation Pest control	Management of pesticide use	
Waste disposal Toxic Quantity of waste Waste techniques Burned containers Chemical	Drawbacks of pesticide usage	
Pilot study Agricultural research Limited Resources More Funding sources Mismanagement Distribution network	Stewardship of agriculture	
Government Financial aid Pigouvian tax Levy	Funding methods	

Green marketing Promotional tools Awareness campaigns Blue Ocean Strategy Corporate Social Responsibility (CSR)	Marketing strategies and approaches	
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The farmers' attitudes have aid in understanding their behaviour towards recycling. As Anastasiadis (2012) stated that farmers are resistant to change because they do not aim at performing new activities without any direct personal interest, Mr. S also clarified that one of the reasons for the project being unsuccessful is that farmers are resistant to change their old methods of using pesticides. Although many farmers still want to follow their traditional methods, their perspective on recycling must be considered in adopting triple-rinsing method. Mr. S also suggested that educating the farmers and giving rewards to them can motivate the adoption of a new practice. This study shows that both the literature and empirical data have evaluated the same possible solutions for this obstacle through an exhaustive approach. Loehr (1974) stated that environmental issues can be reduced if the operations of empty containers recycling focus more on the amount of waste disposed rather than on the systems of managing waste. However, the empirical data shows that Mr. S focuses more on the waste management techniques instead on the amount of waste disposed.

Company X has shown great concern on the way EPC are being disposed. Although Hurtig et al. (2010) mentioned that bio-fertilizer can be used as a substitute of pesticide to reduce environmental problems, Mr. S pointed out that using of bio-fertilizer will cause a slow growth in cultivation compared to the application of pesticides in crops. Research on pest control would have been beneficial in this case but because of limited resources provided by the government, the research is not performed in Mauritius. Due to lack of promotion and marketing practiced by Company X, many farmers of different regions of the island are unaware of the training provided and the triple-rinsing practice. Mr. S added that embracing green marketing and the blue ocean strategy could have enable Company X to reach their goals when implementing the pilot project.

Eventually, the adaptation of DRS in the pesticide industry for EPC management can be addressed based on relevant experiences which are almost homogeneous to the socio-economic of Mauritius. This study can practically be developed if the limitations and additional suggestions are incorporated. Through the previous literatures and empirical data analysis, a position map is illustrated to indicate the perception of both the PCM and the DRS for recycling EPC in the pesticides industry. Figure 7 illustrates the value proposition for adopting an EPC recycling system where the Mauritian farmers adhere to change their way of disposing EPC.

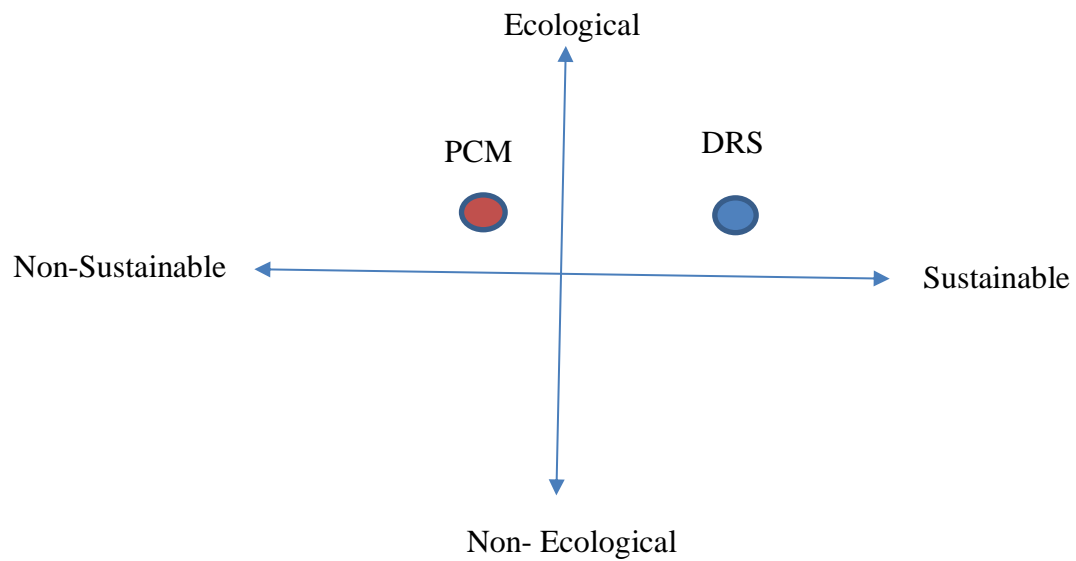


Figure 7: A position map for EPC management system

## 6 CONCLUSION AND RECOMMENDATIONS

The purpose of this current study was to analyse the feasibility of introducing a deposit-refund system that addresses pesticide containers management issues. For decades, Mauritius has been overlooking the safety of the environment where no actions have been taken concerning the recycling of solid wastes. Being a small country, Mauritius believes that it cannot create big impacts in the world on being an environmentally friendly country. Like Mauritius, Singapore is also a small country, but it is committed to waste minimisation and recycling and has adopted a zero-waste campaign where “the



government has targeted attaining 70% national recycling and 30% domestic recycling by 2030” (Zero Waste Singapore 2010).

To reduce the EPC waste footprint, a coherent and sustained EPC recycling approach is requisite for Mauritius with an awareness campaign on pesticide risks. This study has analysed the feasible approach to DRS for this problem. The literature gap of the ways of managing EPC is mostly filled from the qualitative data and information that tries to answer the research questions. The research questions of this study are answered by focusing on the EPC management and the adoption of DRS. Effective marketing approaches that encourage recycling are: (1) green marketing, (2) awareness campaigns and (3) the blue ocean strategy.

It is important for farmers to understand the drawbacks of pesticides usage on the environment. Small Farmers Welfare Fund (SFWF) is a crop insurance for farmers in Mauritius that promotes environmental safety attitudes to cultivate. Previous studies have shown that many farmers intend to adopt opportunistic behaviour of using less pesticides in order to benefit the insured money. Therefore, crop insurance has proved to be an effective way of encouraging less use of pesticides. Encouraging farmers through meetings and field visits by qualified personnel can be very useful as they can farmers to practice this recycling activity. This helps to ensure the link between planters and recyclers for smooth running of the EPC recycling operation. For DRS promotion, radio programmes as a media coverage can be produced over a period of one week, and a video dubbed in the Mauritian language could demonstrate the triple-rinsing technique and the new recycling system for EPC. Additionally, printed advertising such as poster and flyers can be eye-catching and effective in spreading information on triple rinsing.

Many challenges need to be addressed, including the introduction of a specific legislation and the initiation of a pesticide container management strategy with recycling targets. Ineffective EPC management is a notable problem that needs to be addressed in Mauritius. The zero-waste Singapore campaign is a good example for Mauritius to follow, as the local government and parastatal bodies must take urgent actions to ensure proper solid waste management. The government must also plan to create new incentives and financing schemes for the agricultural sector. A thorough approach is required to evaluate the driving forces and missing voids that have been identified through the study. As the

stakeholders show a reactive tendency towards the EPC management plan, the solutions mentioned in the study can be considerably legitimate for this hindrance.

For future agricultural research, a survey on the effectiveness of EPC management can be conducted through quantitative study so as to gather more detailed data. Legislation on regulating the disposal of EPC and ways to encourage financial resources from stakeholders should be considered as suggestions for improving the disposal of EPC. If a future researcher is doing a study on EPC management in Mauritius, it is recommended to create a self-reporting questionnaire with farmers in all regions of the country. Indeed, a zero-waste campaign for EPC in the pesticide industry can also be set up with the help of extensive advertising.

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## **APPENDICES**

### **Appendix 1**

#### **First Interview Questions**

Interview: 11<sup>th</sup> Feb 2019 at 10am

Interviewee: Mr. S, Project and Marketing Manager of Company Y. (BSC in Natural Resource Management and MSC in Project Management)

1. What is Company X Company?
2. How big is Company X company?
3. The purpose of implementing the Container Management Project?
4. The total budget for this project?
5. How was the project implemented?
6. The outcome of this project?
7. Any marketing or promotional activities such as posters, brochures were carried out for this project?
8. What is the % of farmers receiving training on recycling empty pesticides containers and the number of containers being collected after practicing triple rinsing?
9. Any other ways of implementing a responsible management plan for empty pesticide containers other than DRS?
10. What could have been done to make this project successful? — any critical and active approach to the problem?



## **Second Interview Questions**

Interview: 2<sup>nd</sup> April 2019 at 11:30am

Interviewee: Mr. S, Project and Marketing Manager of Company Y. (BSC in Natural Resource Management and MSC in Project Management)

### **RECYCLING PROCESS IN MAURITIUS**

1. What stage of recycling and compositing are believed to be in Mauritius?
2. Where do you categorise Mauritius in terms of safeguarding the environment against pesticides?

### **MOTIVATIONAL FACTORS**

1. How is the business relationship with the farmers and any competitive advantage in the pesticide industry?
2. Farmers are at high risk of pesticide exposure? What policies are your project adopting in helping farmers to reduce that risk?
3. How are you conducting the training of triple-rinsing method?
4. After conducting a questionnaire, I figured out that the majority of farmers were not aware of neither the triple rinsing procedure nor the training being provided to mitigate their activities. Can you explain how the awareness campaign was performed for the farmers? How do you monitor that?
5. Any rewards provided by farmers to encourage them for triple-rinsing method?
6. How do you ensure that personal satisfaction exist for farmers in order they help the society?

### **MANAGING WASTE AND DISPOSAL**

1. How do you monitor farmers which are still misusing pesticides?
2. Have you ever faced any conflicts/challenges when training or communicating with farmers concerning the triple rinsing and recycling of EPC?
3. What is your focus on managing the waste techniques and on managing the amount of waste?
4. Any other future plans to control unsafe disposal of pesticides?

**ADOPTING DRS**

1. What is your opinion on using Pigouvian tax which is applied on negative externalities?
2. Do you have any plan to adopt DRS in Mauritius?
3. How is your project sponsored? If you intend to implement DRS, what is your sources of Finance?
4. Is there any adequate space at the resellers points where collection cages can be set up and triple rinsing being verified before accepting the containers for recycling?

**TRIPLE RINSING METHOD**

1. Do you prepare a cost-benefit analysis for the triple-rinsing method?
2. What are the reasons for performing the triple-rinsing method?

**MARKETING STRATEGY**

1. Was green marketing carried out when implementing this container management project?
2. If yes, was green marketing used as a marketing tool and did the farmers or retailers acknowledge that Company X is a very environmentally committed organisation?
3. How effective were the posters and flyers in spreading information on triple rinsing?
4. How well and reliable were the communications and marketing being promoted for the recycling system with the aim of an effective campaign?
5. Based on your experience, do you think that the blue ocean strategy can reduce EPC waste while influencing farmers to recycle at the same time?
6. Could you please describe the value and social propositions being provided to the stakeholders (farmers, retailers, society) when the container management project was adopted?

**MEASURES AND SOLUTIONS**

1. What measures are you taking to ensure that farmers are not washing their pesticides equipment in same water human is using?
2. What is your opinion on opening an agricultural research on pest control?

3. Based on your experience in the pesticide industry, do you think that the container management system was an ecological management of EPC?

### Appendix 3

## Questionnaire for Farmers

Table 3: Questionnaire for farmers

*Practices and knowledge regarding empty pesticide containers and the Deposit Refund System being used as a waste management system in the agricultural sector*

	YES	NO
<b>Place of the empty pesticide containers</b>		
Inside the house		
Outside the house		
<b>What do you do with your empty pesticide containers</b>		
Throw in open fields		
Burn		
Bury		
Keep for own use		
Recycle		
<b>Knowledge about empty pesticide containers</b>		
Think that empty pesticide containers can cause harm to the environment		
Think that empty pesticide containers can cause harm to the human health		
Perform the triple-rinse (know the steps of triple-rinse)		
Know the purpose of triple-rinse		
<b>Implementation of Deposit Refund System for empty pesticide containers</b>		
Will you want some incentives to be given if you return the empties for recycling?		
Prefer to receive incentives like a refund on your next pesticide purchase than a token when returning the empties		
Think that DRS can change the way empty pesticide containers are managed		

## SWOT Analysis

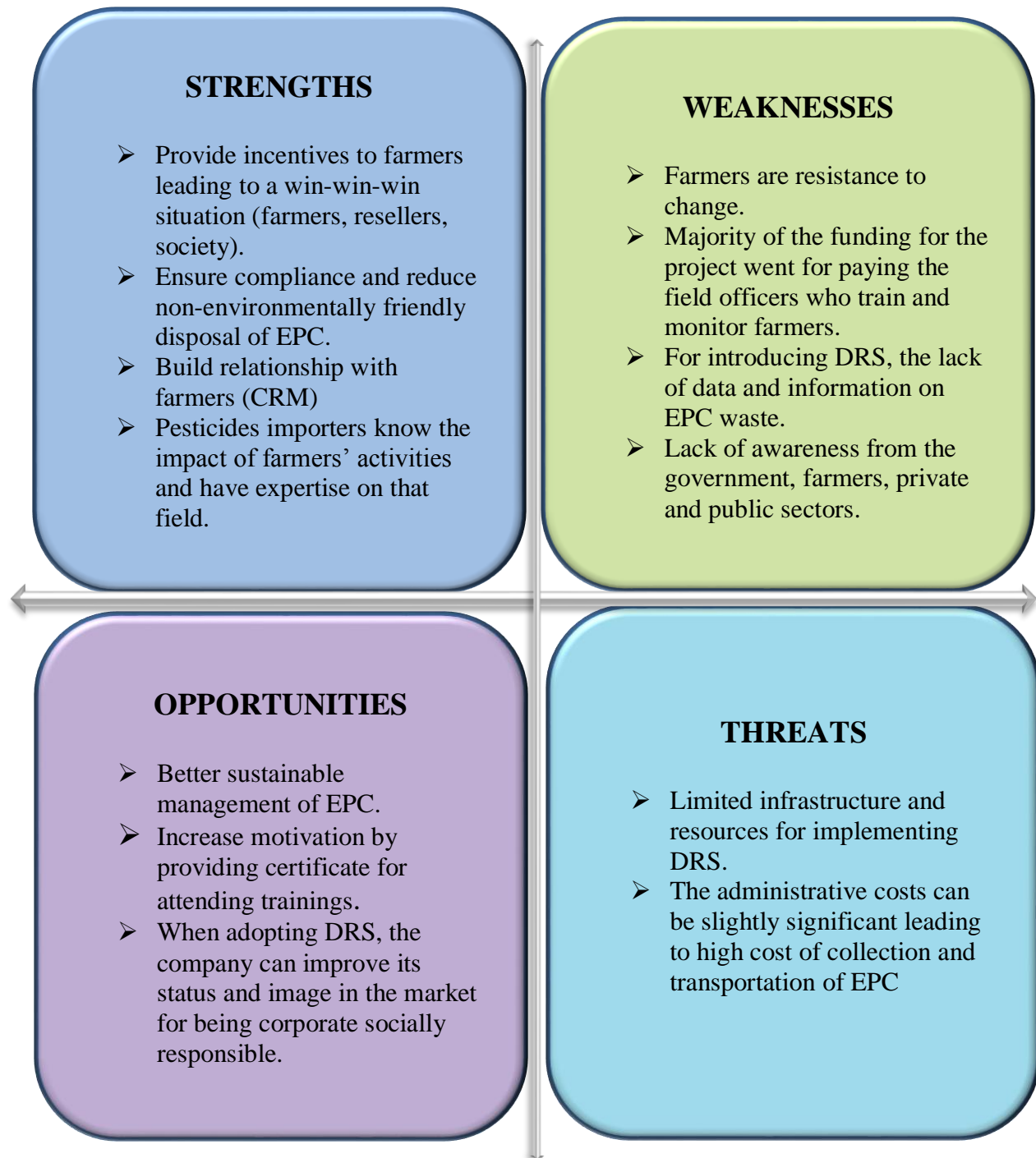


Figure 3: SWOT Analysis for DRS

## Triple Rinsing Poster



Picture 1: Triple-rinsing poster (Company X International 2010)

## Red Ocean Strategy v/s Blue Ocean Strategy

Table 4: Main differences between Red Ocean Strategy versus Blue Ocean Strategy (Kampa et al. 2012)

Red Ocean Strategy	Blue Ocean Strategy
<ul style="list-style-type: none"> <li>➤ Compete in existing market space.</li> <li>➤ Beat the competition.</li> <li>➤ Exploit existing demand.</li> <li>➤ Exercise the cost-benefit trade-off.</li> <li>➤ Align the whole system of the company's activities with its strategic choice for either differentiation or low cost.</li> </ul>	<ul style="list-style-type: none"> <li>➤ Create uncontested market spaces.</li> <li>➤ Making the competition irrelevant.</li> <li>➤ Create and capture new demand.</li> <li>➤ Break the cost-benefit trade-off.</li> <li>➤ Align the whole system of the company's activities in pursuit of both differentiation and low cost.</li> </ul>

## EPC Recycling



Picture 2: Pesticide Containers (Pesticide Environmental Stewardship 2019)



Picture 3: Collection Cages (Alberta Agriculture and Forestry 2015)





Picture 4: Recycling of EPC (South Dakota Department of Agriculture 2012)