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# From Waste to Resource: Solid Waste Management in the districts of Sardinal and Tamarindo, Costa Rica

by

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Solid waste management has become a large challenge worldwide as the generation of waste continues to increase. Deficient linear solid waste management practices have significant impacts on the environment, health and economy and there is a need for more sustainable systems and processes. Especially developing countries experience limitations on solid waste management. This study explores the districts of Sardinal and Tamarindo, two rapidly developed tourist localities in Costa Rica, on solid waste management. A comparative analysis is conducted between the two districts and the main aim is to create a better understanding of the SWM in the districts by identifying the largest challenges, impacts of tourism and the aspects of the Integrated Sustainable Waste Management framework. A qualitative case study approach is conducted with interviews with different key actors on the topic. The findings of the study suggest that the districts of Sardinal and Tamarindo have similar socio-demographic qualities and the districts experience several challenges that hinder with the current SWM processes, especially with existing regulations, level of education and financial matters. The study further highlights the need for more recycling within communities and tourism establishments and the need for additional resources on solid waste management.

*Keywords: solid waste management, Costa Rica, tourism, recycling, Integrated Sustainable Waste Management*

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# 1 Introduction

Solid waste management (SWM) is a global matter, and it affects everyone in the world. The waste generation rates are increasing and expected to continue similarly in the upcoming decades (Kaza et al., 2018). SWM has become a large challenge worldwide and inadequate management of waste has an enormous impact on the environment, health and economy (Hoorweg & Bhada-Tata, 2012; Tiseo, 2022).

Currently it is estimated that more than two billion people are lacking access to regular waste collection and nearly three billion people do not have access to controlled disposal services. (Rodić & Wilson, 2017; UNEP, 2015). SWM is a cross cutting issue that can be associated with 12 of the Sustainable Development Goals from the United Nations (Rodić & Wilson, 2017). The increasing amount of solid waste is also important in the context of climate change as solid waste creates greenhouse gas emissions, especially through landfill methane emissions (UNEP, 2010). Hence, the present linear ‘throwaway culture’ that leads waste to landfills need more sustainable systems and processes that can decrease the impact of the current SWM around the world (Kaza et al., 2018).

Approximately two billion tonnes of solid waste are generated annually, and the amount is expected to increase to 3.4 billion tonnes by 2050 (Kaza et al., 2018; The World Bank, 2022). The amount of solid waste is increasing mostly due to population expansion, economic growth and urbanisation (Guerrero Abarca, Maas & Hogland, 2013; Tiseo, 2022; Yukalang, Clarke & Ross, 2017). As the amount of solid waste is rising, the need for adequate services for waste treatment and disposal have become more crucial (Tiseo, 2022). Currently, the majority of the waste in the world ends up in landfills and less than 20 percent of solid waste is recycled each year (Kaza et al., 2018; Tiseo, 2022).

Solid waste management is a challenge for developed and developing countries but particularly many developing countries have more challenges and limitations (Popkin, 2021; The World Bank, 2022). In developing countries, the common solution for waste is open dumps and landfills with little regulation and this can cause environmental, safety and health consequences (Popkin, 2021; The World Bank, 2022). Furthermore, effective waste management has high costs, but it is essential in order to create sustainable, clean and liveable cities (Nepal et al., 2022; The World Bank, 2022).

Tourism is a factor that contributes largely to the annual generated solid waste and United Nations' Environment Programme (UNEP) has estimated that during 2011, approximately 4.8 million tons of solid waste was generated from international tourism (Chaabane, 2019; Kaza et al., 2018). This represents about 14% of total solid waste generated annually. Moreover, tourism establishments use extensive quantities of single-use packaging that seldom will be recycled correctly (Muñoz & Navia, 2015). In this study, when referring to tourism establishments it covers restaurants, bars, accommodation for tourists and among other establishments tourists use.

## 1.1 Research Problem

The issue of SWM is most prevalent in developing and transition countries where inadequate and unsustainable management of solid waste is more common, and hence more attention should be given to these countries (Ferronato & Torretta, 2019). When countries develop from low-income to middle- and high-income countries, the waste management systems and processes develop simultaneously (Kaza et al., 2018). Thus, it is crucial that local authorities that are in charge of SWM, allocate sufficient funding for waste management to accommodate larger population centres, ensure collection of all waste and plan adequate treatment and disposal locations (Kaza et al., 2018). The effect of poor waste management is extensive and commonly falls disproportionately on the poor and rural population (Kaza et al., 2018; Ogawa, n.d.).

The implementation of solid waste management is a challenging process and oftentimes best addresses on a national or local level to create the most suitable methods in an appropriate context for the best outcomes (Plueddemann, 1994; Topic & Biedermann, 2015). Each country and even each county have unique resources that affect how SWM systems and processes would best function (Topic & Biedermann, 2015). Lozano Lazo and Gasparatos (2019) highlight that there is lack of research on SWM transitions in developing countries, especially in Latin America and that better understanding is required on a county level.

The study focuses on Costa Rica and more specifically on districts of Sardinal and Tamarindo in the province of Guanacaste. Costa Rica is renowned for its rich biodiversity and natural parks that has resulted in the ecotourism industry (Buchanan et al., 2010). An increase in tourism in the country has resulted in rapid economic development and urbanisation, which has contributed to the problem of waste management as the infrastructure in Costa Rica has not improved respectively (Buchanan et al., 2010; Little, 2017).

The generation of solid waste in the past few decades has increased substantially in Costa Rica and in 2018 it was estimated that Costa Rican inhabitants produce approximately 0.8 kilograms of waste per day per person (Ministerio de Salud, 2016). Majority of the waste ends up in landfills and the waste recovery rate in the country is low (Fernández Vicente, 2020). In addition, tourism creates an additional burden for the current SWM (Honey, Vargas & Durham, 2010). This indicates that the country's SWM system works currently in a linear way and improved SWM systems and processes are needed to accommodate increasing amounts of waste and to improve recycling.

## 1.2 Aim, Scope and Research Questions

Currently SWM in Costa Rica faces multiple challenges, but in recent years more focus has been placed on the topic to start improving the existing system and processes, but work remains to be done. On a national level, SWM has been taken into account by implementing new law for waste management and issuing solid waste plans and strategies to promote proper SWM and waste separation and valorisation (Huisman, Keesman & Breukers, 2021). Different associations, non-governmental organisations (NGOs) and initiatives have started to take initiative on the local level to improve the SWM (Rudin Vega, 2020b). Furthermore, more studies are being done on the topic in Costa Rica. For example, research and identification is being done on stakeholders, value chain, legislation, different types of waste, such as plastic and organic waste (Fernández Vicente, 2020; Rudin Vega, 2020b; Soto Córdoba, 2019).

This study examines solid waste management in the districts of Sardinal and Tamarindo in Costa Rica. The study takes three main aims to look into the topic; 1) the largest challenges on SWM in the districts, 2) integrated sustainable waste management framework's six aspects to identify how the six aspects are considered in the districts and their importance and 3) impact of tourism for SWM in the districts. Moreover, the aim is to create an understanding of the commonalities and differences between the two districts on the topics.

The districts of Sardinal and Tamarindo offer an interesting case to study as each of the districts attract tourism as Sardinal has Playas del Coco and Tamarindo has Playa Tamarindo, which both are amongst the most popular beaches in Costa Rica. Therefore, the localities have undergone rapid development in the past decades and experience an increased amount of tourism that both create challenges in the districts. Furthermore, SWM is viewed as an obstacle in both districts and improvements are needed to improve the current SWM systems and processes.

The majority of the research focus on the topic in Costa Rica has been given to the Greater Metropolitan Area and less focus has been allocated to other regions and provinces (Buchanan et al., 2010). There are not existing studies on the districts or on the impact of tourism for SWM, hence this study attempts to investigate the districts of Sardinal and Tamarindo in Guanacaste to create a comprehension by taking a closer look how the two central localities with high amount of tourism are attempting to improve SWM systems and processes to become more sustainable. The study is conducted with qualitative methods and based on fieldwork in the districts in Costa Rica.

The study aims to contribute to the existing literature of SWM in Costa Rica by creating a better understanding of the challenges in touristic localities for SWM and can give insights to the local authorities on how to strengthen the current methods and processes of the existing SWM systems. Hence, the following research questions have been formed for the study to support creating a better understanding of the aims of the study:

*RQ1: What are the largest challenges for solid waste management in the Sardinal and Tamarindo districts in Costa Rica?*

*RQ2: How are the aspects of Integrated Sustainable Waste Management considered in the solid waste management in the districts of Sardinal and Tamarindo?*

*RQ3: What impact tourism has on the solid waste management and its handling in the districts of Sardinal and Tamarindo?*

### 1.3 Outline of the Thesis

The introduction is followed by literature review in Section 2 that covers the SWM in general terms and in the context of Costa Rica to give background for the topic as well as the used theoretical framework is discussed. Section 3 describes the qualitative research method and case study approach along with motivation and data collection method. The findings for the study are analysed and discussed in Section 4. Finally, Section 5 provides a summary of the main findings and suggestions for future research.

## 2 Literature Review

This section gives an overview of the literature on solid waste management and the chosen theoretical framework. First, discussion of solid waste management is covered to give the reader an introduction of the field and ideas of previous research. Next, the section focuses on the theoretical framework of Integrate Sustainable Waste Management that serves as a guiding tool in this thesis. The chapter concludes with a discussion on solid waste management in the context of Costa Rica and the districts of Sardinal and Tamarindo.

### 2.1 Solid Waste Management

SWM is the process of collecting, treating, and disposing of solid waste that is no longer used and the waste can be categorised based on its material, such as plastic, glass and organic waste. Solid waste should be managed systematically to ensure best practices regardless of the origin or content of the waste (LeBlanc, 2020). When considering SWM it is crucial to think how solid waste can be adapted and used as a valuable resource instead of just thinking it as a waste that needs to be disposed of (EEA, 2014).

SWM is a complex issue that affects both developed and developing countries. Developed countries generally face fewer issues with SWM as they have more advanced and standardised waste management and value chains as well as better methods for treatment and reuse, such as composting (Kumar, 2011; Tiseo, 2022). Furthermore, Lozano Lazo and Gasparatos (2019) state that developed countries have focused on the transition from ‘waste’ to ‘resource’ management with the emergence of a circular economy paradigm. SWM in developing countries is often a larger problem where solid waste mismanagement has become an extensive concern (Shukla & Khan, 2022). The larger amount of waste causes several problems for the population and for the environment (The World Bank, 2022). The SWM systems in developing countries are considered to be insufficient as they often lack proper administrative and financial structures, suitable regulations, infrastructure and adequate human resources (Botello-Álvarez et al., 2018).

Commonly in developing countries, SWM is the responsibility of cities and municipalities. Many developing countries are experiencing rapidly urbanising cities, population growth and rapid economic growth that not only accelerate consumption rate but also increase the

generation of solid waste (Yukalang, Clarke & Ross, 2017). With increasing solid waste, the cities and municipalities experience challenges to provide an effective and efficient system for the population (Guerrero Abarca, Maas & Hogland, 2013).

Based on the current research, the largest obstacle in SWM is the high costs of waste management (Guerrero Abarca, Maas & Hogland, 2013; Kaza et al., 2018; Lozano Lazo & Gasparatos, 2019). The World Bank (2022) estimates that waste management comprises 20-50% of municipal budgets as it would need to cover at least operating, environmental and social costs. The amount varies between countries, but nevertheless it is a big portion of the total municipal budget. The understanding of solid waste needs to be holistic from all the factors affecting it to the handling system and value chain (Abdel-Shafy & Mansour, 2018). Managing solid waste is also an intensive service as municipalities need capacities in procurement, contract management, labour management as well as social contract between municipality and community (Hoornweg & Bhada-Tata, 2012). Moreover, additional challenges that municipalities and cities are facing with solid waste are technical, social and environmental, such as deficient infrastructure, inadequate service coverage and insufficient technologies (Guerrero Abarca, Maas & Hogland, 2013; Zurbrügg & Schertenleib, 1998). Such concerns and preconditions need to be considered and applied by municipal services to ensure more sustainable waste management systems to its inhabitants (Hoornweg & Bhada-Tata, 2012).

Inadequate SWM processes can lead to several negative impacts for human health and the environment. Such impacts for human health can be infection transmissions, non-communicable diseases and physical injury (Yukalang, Clarke & Ross, 2017). Furthermore, deficient management of landfills can increase the risk for humans in the form of higher risk of cancer, disorders and respiratory distress (Vinti et al., 2021; Yukalang, Clarke & Ross, 2017). Impacts for the environment can be air pollution, water and soil contamination or even loss of biodiversity (Ejaz et al., 2010; UNEP, 2017). Negative environmental impacts are especially caused when the waste is disposed of in unregulated dumps or openly burned (The World Bank, 2022).

Several studies have been conducted for SWM in different countries around the world. Many studies have focused on quantitative methods to investigate characterization and gas emissions among others and most commonly focusing on a single or several countries or regions (see Kamarehie et al., 2020; Singh, Kumar & Roy, 2018; Wu et al., 2015; Zhao et al., 2009). Various qualitative studies also exist on the topic covering different aspects, such as case studies, SWOT analysis, drivers and barriers and transition studies (see Etea, Girma & Mamo, 2021; Jamshidi, Taghizadeh & Ata, 2011; Lozano Lazo & Gasparatos, 2019; Mwanza & Mbohwa, 2017; Srivastava et al., 2005; Yukalang, Clarke & Ross, 2017). Many of the studies have been conducted in China, India and in several African countries. Recently, more

studies have focused on sustainable transitions, circular economy paradigm and integrated sustainable waste management model (see Cobo, Dominguez-Ramos & Irabien, 2018; Geissdoerfer et al., 2017; Lozano Lazo & Gasparatos, 2019; Shukla & Khan, 2022; Silva et al., 2017; Wieczorek, 2018; Wilson, Velis & Rodic, 2013). This indicates that there is interest and development towards more sustainable and circular SWM in the world that can support increasing the number of materials being reused and recycled.

### 2.1.1 Waste Hierarchy

One of the problems with SWM is that it still operates in a linear way and the majority of waste ends up in landfills or open dumps that demonstrates that there is room for improvement when it comes to more sustainable practices and handling of waste (Kaza et al., 2018). An order has been created which would be the most suitable and ideal way to handle waste in order to create fewer negative impacts. Waste hierarchy has been created for this purpose to minimise the amount of waste, improve resource efficiency and to prolong the life cycle of products and materials (European Commission, n.d.; Manshoven et al., 2019).



*Figure 1: The Waste Hierarchy (European Commission, n.d., n.p.)*

A waste hierarchy pyramid, seen in Figure 1, is commonly referred to describe the prioritisation order of how waste should be handled, and it has been adopted internationally. Generally, the waste hierarchy pyramid is divided into five steps that characterises the ideal order from highest priority to lowest in terms of preference for managing and disposing waste. The waste hierarchy steps, from highest priority, are prevention, preparing for reuse, recycling, recovery and disposal (European Commission, n.d.). The waste hierarchy is replacing the more traditional waste management approach of ‘three R’s’ (reduce, recycle and

reuse) and expands the steps for a more comprehensive model that allows other concepts, such as circular economy, to build upon the waste hierarchy (McRobert, 2016; The World Bank, 2020).

The goal of the waste hierarchy is to decrease the amount of waste ending up disposed of and to increase options for prevention, reuse and recycling. When looking at the waste hierarchy pyramid's highest step, prevention, can be considered to be non-waste as the step includes to use less materials in design and manufacturing and additionally keeping products in use for a longer period of time (DEFRA, 2011). The prevention of waste can refer to any phase of the life cycle and also to prevent harm, such as using less hazardous materials (Corvellec & Czarniawska, 2014). The remaining four steps are considered waste, but they consist of different methods. Preparing for reuse concerns refurbishing, repairing and cleaning products or parts that has a goal to extend the life cycle of products (DEFRA, 2011). When waste cannot be prevented, as many materials and products should be recovered either by reforming it into a new material or product, i.e., recycling or the value of the resources can be reused through energy recovery where waste is turned into usable heat, energy or fuel (EPA, 2015). The least preferred method of the waste hierarchy pyramid is disposal that is most commonly executed either by landfilling or incinerating without energy recovery and it should be only used when waste cannot be reused or recycled, such in the case of hazardous waste (DEFRA, 2011; EPA, 2015).

The above discussed waste hierarchy has been the guiding principle for managing solid waste internationally for the past few decades and different governments have been adopting the approach to finding ways to start transitioning from the linear model to the circular economy (EPD, n.d.; Kelleher, 2010). The waste hierarchy framework has helped authorities to find new solutions to prolong the life cycle of materials and products and therefore lessen the environmental impact. It has been proven that following waste hierarchy steps moves the process into the direction of more sustainable and less straining outcomes (Plueddemann, 1994). However, there is still a lot to improve and to develop as the amount of solid waste is increasing globally and the majority of waste still ends up in landfills.

## 2.2 Waste Management in Developing Countries: Integrated Sustainable Waste Management Concept

Implementing effective and sustainable SWM in developing countries is a challenging process. Existing literature suggests that countries and cities around the world are slowly starting to tackle the issue of linear SWM and making improvements to their processes (Shukla & Khan, 2022; Silva et al., 2017; Topic & Biedermann, 2015; Wilson, Velis &



Rodic, 2013). One of the main obstacles for developing countries and cities is that many of them try to 'copy and paste' developments from developed countries that have more mature SWM systems and processes (Topic & Biedermann, 2015). This practice is not ideal and often does not work as there is no one correct waste management model that can be applied everywhere (Topic & Biedermann, 2015). Plueddemann (1994) emphasises that most waste management efforts and aspects are best addressed at a country or even at a county level to select the most applicable methods and techniques for each area. Hence, developments in SWM should support each country or county to develop individual solutions that are appropriate for its own economy, demography, culture and its unique resources (Topic & Biedermann, 2015).

A concept of Integrated Sustainable Waste Management (ISWM) has been developed to address particular common problems with solid waste management, especially in low- and middle-income countries in the South (van de Klundert & Anschütz, 2001). The ISWM framework was initially developed by WASTE, a Dutch non-governmental organisation (NGO) and its partners, in the 1980s (Anschütz, Ijgosse & Scheinberg, 2004; UN-Habitat, 2010). Since then, the ISWM framework has been further defined and expanded and it has gradually become a dominant paradigm for more sustainable SWM and used especially in the context of developing countries (Lozano Lazo & Gasparatos, 2019; Wilson, Velis & Rodic, 2013). Moreover, the ISWM framework allows studies of complex and multi-dimensional systems and provides new perspectives for further development (Topic & Biedermann, 2015).

The ISWM framework has been applied in several developing countries, such as in Bolivia, Pakistan, Nigeria and Mexico. For example, Lozano Lazo and Gasparatos (2019) discussed the ISWM framework with the focus on dimension of stakeholders by doing a comparative analysis of two cities in Bolivia. A study conducted in Nigeria used ISWM framework with a holistic approach and analysed all three dimensions, concluding the importance governmental commitment and stakeholder involvement are crucial in order to reduce inefficiencies (Christopher et al., 2019). A study done in Mexico looked into the framework and more particularly the dimension of aspects for waste collection system in Aguascalientes with main focus of collection system (Mader, 2011). Most studies using ISWM framework are using qualitative methods approach to gain in-depth insight with interviews to gain an understanding of certain localities.

The ISWM concept's baseline is grounded on four basic principles: equity, effectiveness, efficiency and sustainability (van de Klundert & Anschütz, 2001). Equity signify that the system is designed to serve all citizens with appropriate waste management, while effectiveness mean that the applied waste management model will lead to safe removal of waste (Anschütz, Ijgosse & Scheinberg, 2004; van de Klundert & Anschütz, 2001). Efficiency means that the waste is handled by maximising benefits, minimising the costs and

optimising resources, whereas sustainability implies that the system is suitable to the local conditions and can maintain its operation without risking the future (Anschütz, Ijgosse & Scheinberg, 2004; van de Klundert & Anschütz, 2001).

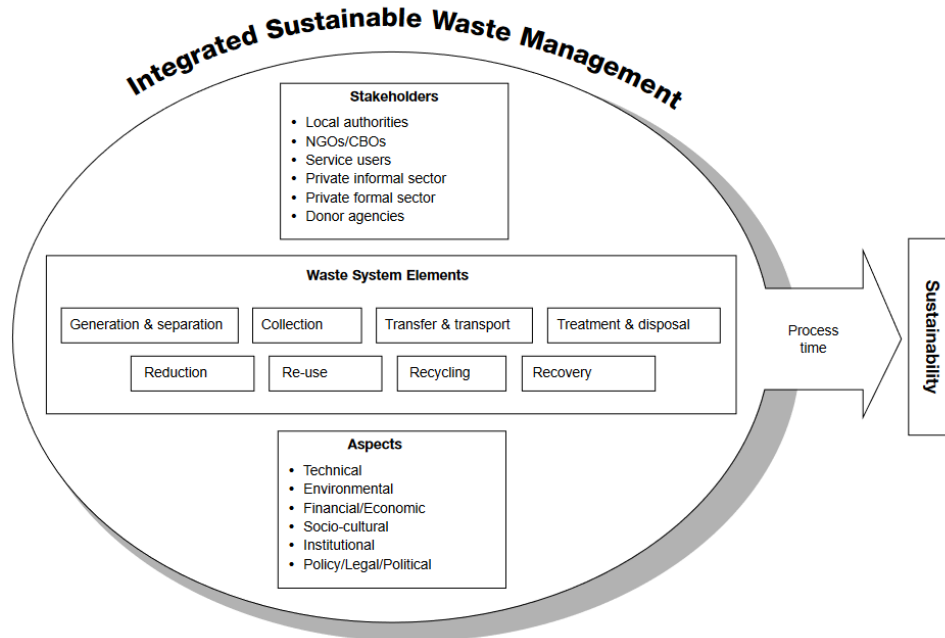


Figure 2: The ISWM framework (van de Klundert & Anschütz, 2001, p.14)

Apart from the basic principles of the ISWM framework, it also has three major dimensions: stakeholders, waste systems elements and local context aspects (van de Klundert & Anschütz, 2001). Figure 2 demonstrates the different dimensions of the ISWM framework. Each of the three dimensions need to be addressed when developing a SWM system and they can be linked to a key question (UN-Habitat, 2010).

### Stakeholders – who needs to be involved?

Stakeholder is considered a person or an organisation that has a stake or interest in waste management. The stakeholders depend on the regional area and therefore they need to be identified in the local context (van de Klundert & Anschütz, 2001). Most commonly authorities, varying from national, municipal and local, are included as a stakeholder in the waste management system (Anschütz, Ijgosse & Scheinberg, 2004). Other potential stakeholders can be waste generators (i.e., households, services, institutions), formal or informal waste handlers and NGOs/CBOs (Anschütz, Ijgosse & Scheinberg, 2004; UN-Habitat, 2010). Furthermore, according to van de Klundert and Anschütz (2001) particularly in low- and middle-income countries, many people are involved in reuse and recycling apart from the official authorities. This can include informal sector waste pickers and recycling enterprises as examples. Stakeholders have a significant role in the SWM, but the challenge

lies on how to get them to cooperate for a common purpose as they all have different roles and interests in the waste system (Anschütz, Ijgosse & Scheinberg, 2004).

#### Waste system elements – what needs to be done?

Waste system elements cover the practical and technical components of waste management systems and the ISWM framework demonstrates that the components are part of the overall picture, not the whole picture (UN-Habitat, 2010). The elements are meant to be looked upon being stages in the flow of materials from mining stage towards final treatment and disposal, hence it refers to how solid waste is handled and where it ends up (Anschütz, Ijgosse & Scheinberg, 2004; van de Klundert & Anschütz, 2001). The disposal of waste has environmental implications and due to this it is linked to the waste hierarchy, which is a cornerstone for ISWM framework (Anschütz, Ijgosse & Scheinberg, 2004). If considering Figure 2 and the elements section, the higher row relates to removal and disposal whereas the bottom row relates to valorisation of commodities.

#### Aspects – how to achieve the desired results?

The ISWM framework identifies six aspects through which the existing waste system can be assessed and with which a new system can be planned (Anschütz, Ijgosse & Scheinberg, 2004). These aspects are aimed to ensure that the waste system is sustainable, and they can be used, for example for assessing situations or identifying priorities (UN-Habitat, 2010). The six aspects are defined below that are based on the definitions by van de Klundert and Anschütz, (2001):

1. *Technical aspects* involve the observable practical implementation and maintenance of the waste elements. These include what facilities and equipment are in use and how they are designed for instance.
2. *Environmental aspects* concentrate on the effect on land, water and air for waste management and for pollution control and health concerns.
3. *Financial/economic aspects* concern the budgeting and cost accounting in waste management systems regarding the local, regional, national and international economy. Some particular problems that have been defined are cost reduction, efficiency of SWM systems, income generation and impact of environmental services on economic activities.
4. *Socio-cultural aspects* contain the influence of culture on generation of waste and managing waste in the households and institutions. Additionally, the aspect includes the community and its involvement in waste management as well as their relations.
5. *Institutional aspects* focus on the political and social structures that control and implement waste management, the organisational structures and the available institutional capacities. Principal activity for this aspect can be regarded to be planning.

6. *Policy/legal/political aspects* indicate the boundary conditions in which the waste management system exists, sets goals and priorities, basic decision-making processes and the existing legal and regulatory framework.

The aspects for ISWM gives authorities a set of tools on how to perceive, analyse and balance priorities and create measures to give the needed result in a specific context (van de Klundert & Anschütz, 2001). It needs to be taken into account that developing and planning SWM systems are long-term issues that need time to mature and occur (van de Klundert & Anschütz, 2001). This needs to be considered by stakeholders when making decisions for SMW that the change will happen over a longer period of time. In the context of Costa Rica, ISWM framework could serve as a useful tool for improving the current SWM systems and processes. Especially, the dimension of aspects is not looked into in Costa Rica so far and hence it could offer insight into how to achieve better processes for SWM. The dimensions of stakeholders and waste system elements are already better identified in Costa Rica and have existing literature (see Buchenan et al., 2010; Rudin Vega, 2020a; Rudin Vega, 2020b). Hence, this study will look into the aspects dimension more specifically to create a better understanding of them in the context of Costa Rica.

## 2.3 Solid Waste Management in Costa Rica

SWM is considered by the Costa Rican Ministry of Health as one of the main environmental problems in the country (Ministerio de Salud, 2016). This is particularly worrisome considering that Costa Rica is aiming to achieve net-zero greenhouse gas (GHG) emissions by 2050 and currently the waste sector produces 15.7% of the GHG emissions in the country, which is the third highest sector (Government of Costa Rica, 2019; MINAE, 2018). This indicates that there is improvement needed for the sector.

According to the Ministry of Health (2016), the generation of solid waste between 1991 and 2006 has increased 2.7 times. In 2018 it was estimated that approximately 1.45 million tons of solid waste was created, which equals to 0.81 kilograms per day per citizen (Fernández Vicente, 2020; Huisman, Keesman & Breukers, 2021). The waste collection system in Costa Rica recovers only about 77% of the solid waste and 23% is discharged into the environment by burying, burning, or thrown to the river banks or the sea (Ministerio de Salud, 2019).

The waste management system in Costa Rica has been rather outdated and until 2008 it was not clearly defined who is the governmental entity in charge of the SWM (Ministerio de Salud, 2010). Furthermore, there have been problems with municipalities as they have been providing inadequate services, lacking support and there is lack of cooperation between

different municipalities and additionally there have been little control and monitoring of waste strategies (Ministerio de Salud, 2010).

Costa Rica passed a law for Integrated Management of Waste (Law 8839) in 2010 with a goal to address the current waste management problems in the country (Buchanan et al., 2010; Soto Córdoba, 2019). The law is considered the most important law applying to SWM in Costa Rica and it defines the role municipalities have on the value chain. Law 8839 established that municipalities are responsible for SWM in their cantons and hence they have responsibility for several actions, such as collection service, regulations and educational campaigns (CIJ, n.d.).

The value chain in Costa Rica comprises three main points: collection, management and transformation. Collection includes the actors and routes involved through which the solid waste is collected and transported (Rudin Vega, 2020a). The waste collection is handled by municipalities and often the waste is collected and transported by municipalities or collection management companies (Rudin Vega, 2020a). The management of the solid waste is where the waste is taken after collection and sorted before final disposal. The management of the waste includes sorting, compressing, packaging and storage of the waste (Rudin Vega, 2020a). The transformation includes the process of transforming the collected waste materials. This covers different processes, such as use in industrial processes, transformation to new or same products (Rudin Vega, 2020a). Some of these transformation processes can happen directly in Costa Rica but some will be exported outside and the materials that cannot be transformed will be directed to landfills (Rudin Vega, 2020a).

The majority of the responsibility of the SWM value chain is with municipalities and they have been criticised that most waste ends up in landfills as a high amount of the waste is collected together and not separately based on the type of waste (Buchanan et al., 2010; Rudin Vega, 2020a). The municipalities are not the only actors in the value chain of waste management, there are also private actors, service users, NGOs and local actors that impact the value chain (Anschütz, Ijgosse & Scheinberg, 2004). In Costa Rica, the value chain and the actors for SWM has been identified and existing research exists, hence the understanding of the two are satisfactory (Buchanan et al., 2010; Rudin Vega, 2020b; Soto Córdoba, 2019). According to Rudin Vega (2020b) the actors of the value chain could benefit from more communication as currently it is lacking.

Little (2017) states that SWM in Costa Rica is impacted negatively by tourism as the current SWM systems are inadequate to accommodate additional waste created by tourists. As Costa Rica receives more than two million tourists each year, tourism contributes to the amount of generated waste (Honey, Vargas & Durham, 2010). The impact of tourism on SWM as a topic is relevant but there are only few existing studies considering the matter (see Honey, Vargas

& Durham, 2010; Little, 201). Hence, more research on the topic would be needed to create a better understanding of the impact tourism has on different localities in Costa Rica.

For a long while, the government in Costa Rica has not been willing to consider more sustainable solutions for its waste management regardless of the visions that the citizens have had (ZWE, 2015). Costa Rica having had the experience of viewing the waste management sector as a burden, the country has now finally started to understand the reality of the sector and is now working on increasing functionality of the sector and making investments to improve the current systems and processes of the SWM. For example, the Ministry of Health together with the Ministry of Energy and Environment are currently developing a NAMA (Nationally Appropriate Mitigation Action) for waste (CACC, 2021). This indicates that the waste management sector is starting to experience a paradigm change from waste being a problem to waste being a resource that can be taken advantage of.

## 3 Methodology

In this section, the methods applied to the study are described along with data collection and analysis methods. Further, limitations and ethical considerations are discussed. A qualitative research method has been chosen for the study with case study approach. The study is based on a fieldwork that was conducted in Guanacaste province in Costa Rica over a period of three months in collaboration with Lund University and Universidad Nacional de Costa Rica.

### 3.1 Research Approach and Design

The focus of this study is to examine solid waste management in the districts of Sardinal and Tamarindo in Guanacaste province, Costa Rica. The aim of the study is to investigate the largest challenges the districts are experiencing with SWM and how different aspects of Integrated Sustainable Waste Management framework are considered. Another aim is to assess how tourism affects the SWM in the districts of Sardinal and Tamarindo. A qualitative research design has been chosen for the study with a case study approach. The research was conducted in Guanacaste province in Costa Rica between February and April 2022 in the form of fieldwork in partnership between Lund University and Universidad Nacional de Costa Rica (UNA) and Centro Internacional de Política Económica para el Desarrollo Sostenible (CINPE).

Qualitative research design seems most suitable for the study to get a deeper understanding of the topic and to attempt answering the research questions. Creswell (2014) determines that qualitative research design is the most fitting when the aim is to understand a particular social situation, role, group or interaction and to comprehend a real-life social phenomenon. Moreover, qualitative research design commonly intends to provide in-depth understanding and learning people's experiences and perspectives (Creswell, 2014; Ritchie & Lewis, 2003). Hence, often the results from qualitative research cannot be generalised and it is not necessarily the objective of it, but instead to focus in-depth to a specific phenomenon in a unique setting (Ritchie & Lewis, 2003).

Case study approach is generally linked with qualitative research. Morgan (2012) emphasises that the case study approach allows research done in a 'real-life' context that creates a comprehensive understanding and engagement with the chosen topic and it is commonly a

complex issue. The case study design frequently uses interviews and observations to gain a better and more in-depth understanding to create knowledge of the phenomenon in its specific context (Simons, 2009).

In the case for this study, the province of Guanacaste in Costa Rica and more specifically the districts of Sardinal and Tamarindo are the chosen cases to investigate and create a deeper understanding of the topic of solid waste management in connection to its challenges and linkage to tourism. Solid waste management is a topic in Costa Rica that has been overlooked but recently more focus has been put into it to improve the system and increase the amount of recycling. In Costa Rica more of the waste management and recycling efforts has been focused on the Greater Metropolitan Area and less focus has been on the other provinces and rural areas of the country (Buchenan et al., 2010). Therefore, Guanacaste and the districts of Sardinal and Tamarindo pose as a good locality to investigate and contribute to the literature of SWM in more rural and tourist areas of the country.

In the past few decades, the province of Guanacaste has seen a shift from an agricultural economy to a service economy (Honey, Vargas & Durham, 2010). Guanacaste has become one of the most attractive tourist destinations in the country and due to the shift, the province has experienced urban development (ICT, 2012). Especially beach locations have attracted tourism in the region and the locations have undergone rapid development to accommodate the incoming tourists. In Guanacaste, the most popular beach destinations are located in the districts of Sardinal and Tamarindo (Costa Rica Guides, n.d.). The district of Sardinal has Playas del Coco and Playa Hermosa, which are in close distance to each other. The district of Tamarindo has the largest beach town of the same name in Guanacaste. Both districts are popular amongst tourists and are considered areas that are growing fast in terms of tourism and consequently the towns have developed rapidly (Costa Rica Guides, n.d.). Such rapid development can cause problems for the waste management systems as the town might not necessarily have improved enough infrastructure to accommodate the growing quantities of generated waste (Little, 2017). Hence, these two districts have been chosen as the focus areas for the study as they provide an interesting case to investigate with regards to SWM.

## 3.2 Data Sampling and Collection

Case study approach commonly is based on several sources of data, and this strengthens the reliability and validity of the collected data (Creswell, 2014; Peräkylä, 2011). Furthermore, data triangulation is important to increase the validity of the research and its findings (Creswell, 2014). In this study the primary data is collected with interviews and secondary data is gathered through observations. The aim of the primary data collection is to gather



input from experts within the field. The sample for interviews is limited to companies, initiatives and experts that are working with SWM affecting the districts of Sardinial and Tamarindo and have the appropriate knowledge. Such samples for interviews are identified and reached out. In addition, snowball sampling is applied to widen the interview sample.

The interviews were conducted in a semi-structured manner either in English or Spanish, based on the preference of the interviewees. It is worth noting that the researcher is not native speaker of Spanish but has an adequate level of the language to conduct interviews in Spanish. Semi-structured interviews allow open-ended questions hence it provides a guideline for the interviews (Creswell, 2014). Furthermore, such interviews have a possibility of add-on questions and follow-up questions where needed. In addition, an interview guide was prepared prior to the interviews for further guidance and support. The interview guide can be found in Appendix A, and it has five main blocks that cover the prepared interview questions. The interview guideline was not shared with the interviewees in advance to avoid them being over-prepared or creating any biases before the interview. However, the interview blocks and aims of the interviews were shared with the interviewees beforehand for them to have an idea what the interview is about. Additionally, a pilot interview was conducted before the first interview to guarantee that the interview questions are understandable and appropriate.

Prior to the beginning of the interviews, all interviewees were presented with the background of the study and the aim of it. All interviewees were required to sign a written consent form, which can be seen in Appendix B. The consent form was written both in English and Spanish and based on the language of the interview one of the two was used. The consent form contains the necessary information for the interviewees of the purpose of data collection and the process for handling the collected data. Moreover, the interviewees were asked for permission to use the name of the organisation or the company where they work and a permission to audio record the interview. To protect the identity of the interviewees their names remain anonymous, and no views are directly attributed to any of the interviewees. To ensure that the collected data from the interviews is protected, the data has been stored in a password protected software environment.

### 3.3 Data Overview and Analysis

In total of ten interviews were conducted during the time period of the fieldwork. Six of the interviews were done face-to-face and four were done online over Zoom. Face-to-face interviews were the preferred method, but few interviewees preferred online interviews due to still working from home due to the on-going pandemic. The interviewees were reached out either via email or WhatsApp text message. Emails were the preferred method in the

beginning but with the researcher's experience WhatsApp is widely used in Costa Rica and a common method of communication. Additionally, for few interviewees no email was found or in case of snowball sampling method the contact was given with phone number only.

All contacted interviewees replied and agreed for an interview. The interviewees were available for the interviews generally fast, within a few days to one week. The length of the interviews was aimed to be approximately 40-45 minutes and to follow the created interview guide. The interviews were conducted between the dates 29.3.2022-15.4.2022 and were from 31 to 53 minutes. Eight of the interviews were in Spanish and two in English. Table 1 covers more information about the interviews.

*Table 1: Overview of conducted interviews*

<b>Interviewee</b>	<b>Date</b>	<b>Language</b>	<b>Length</b>	<b>Location</b>
Santa Cruz municipality	29.3.2022	Spanish	47 min	Santa Cruz (Tamarindo)
Asociación de Desarrollo Integral de Tamarindo	31.3.2022	Spanish	53 min	Tamarindo
Ecoins	1.4.2022	Spanish	39 min	Zoom
The Clean Wave	1.4.2022	Spanish	31 min	Tamarindo
ACEPESA	5.4.2022	Spanish	46 min	Zoom
Recycle Hermosa	5.4.2022	English	42 min	Playa Hermosa (Sardinal)
Carrillo municipality	6.4.2022	Spanish	37 min	Zoom
Asociación de Desarrollo Integral de la Comunidad de Playas del Coco	7.4.2022	English	34 min	Playas del Coco (Sardinal)
COOMUREC	7.4.2022	Spanish	33 min	Filadelfia (Sardinal)
ACEPESA	15.4.2022	Spanish	38 min	Zoom

The aim with the interviews was to gather similar actors in both focus areas to be able to view the differences and similarities between the two districts with regards to SWM. In both districts two local actors were interviewed and these covered the actors working on the SWM in these areas as more was not found. In addition to the local actors in these two districts, the municipalities responsible for the districts were interviewed. In the canton of Carrillo, a recycling centre was interviewed and for the district of Tamarindo and Santa Cruz canton there is a recycling centre located in the landfill that is located in Santa Cruz hence this was covered with the interview with Santa Cruz municipality. Three experts on the topic in Costa Rica were interviewed to get a deeper insight and more information on the topic. The experts work in organisations in Costa Rica that focus on improving the SWM processes and also

have a presence in the province of Guanacaste. Two interviewees were from ACEPESA, one with years of experience on solid waste management and the second one had conducted a project on the topic in Tamarindo. All the interviewees have a central role in their respective companies and organisations for SWM and commonly have a title related to sustainability or environment. Figure 3 has been created to illustrate the locations of the field trips. The map on the left show all of Costa Rica and highlights the province of Guanacaste, whereas the map on the right elaborates on the location of the two districts and the locations visited during the field trips.

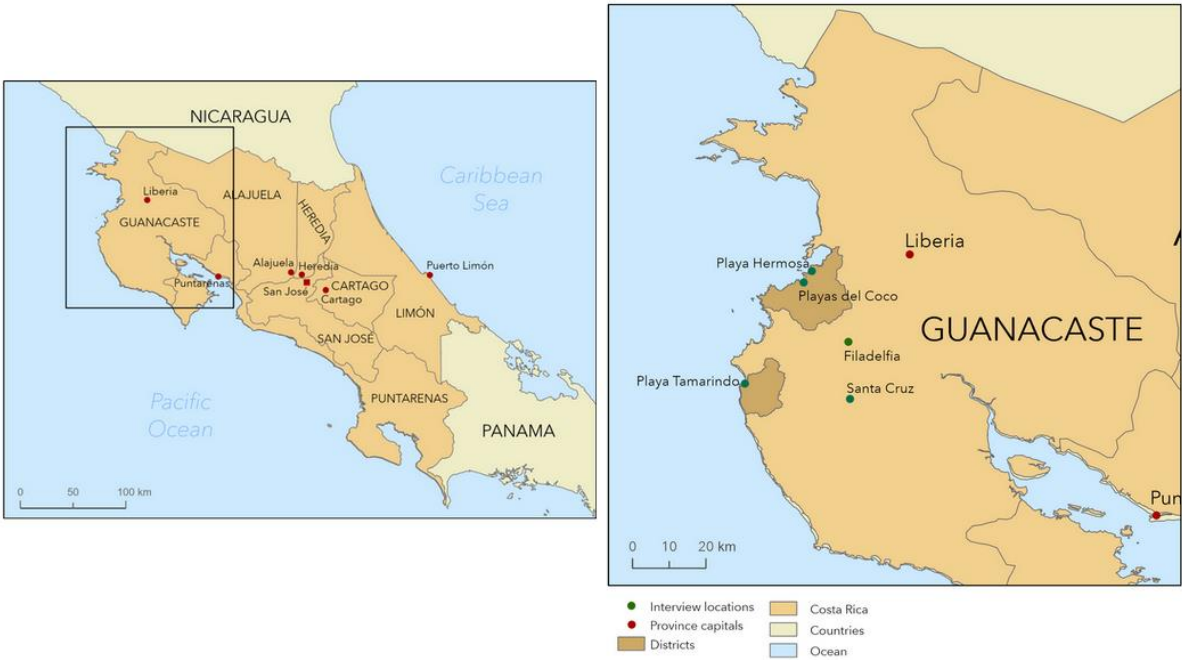


Figure 3: Interview locations in Costa Rica (own elaboration)

In order to create a better understanding of the interviewees and their role and function for SWM, a short description of each is provided. The information of the role is gotten through their websites and also based on the interviews.

Santa Cruz municipality

The environmental management unit in Santa Cruz municipality was interviewed. The environmental management unit is in charge of SWM in the canton of Santa Cruz, including the district of Tamarindo. They are in charge of collection to final disposal of the waste in the canton. The municipality also has a landfill that they operate and bring the waste from the collection.

Carrillo municipality

In Carrillo, also the environmental management unit was interviewed who is in charge of the SWM in the canton of Carrillo, including the district of Sardinal. The municipality is in charge of waste collection and transportation of the waste that is delivered to the landfill in canton of Santa Cruz.

### Ecoins

Ecoins is an initiative that promotes recycling and intends to encourage individuals to change their consumption habits (Ecoins, n.d.). Ecoins is a platform that works currently in five countries, and they have a loyalty programme where individuals can bring their recyclable waste and in return they collect 'Ecoins' with what they get discounts on certain services or products (Ecoins, n.d.).

### ACEPESA

ACEPESA stands for Asociación Centroamericana para la Economía, la Salud y el Ambiente (Central American Association for Economy, Health and Environment) and it is a non-profit association focusing on addressing climate change with priority for sanitation, integrated waste management and local economic development (ACEPESA, n.d.). They have nearly 30 years of experience working on SWM with different actors and projects.

### COOMUREC

COOMUREC is a women-led cooperative that has their own management centre for recyclable waste, and they collect and sort recyclable waste in the canton of Carrillo and operate in the district of Sardinal.

### Asociación de Desarrollo Integral de Playa Tamarindo (ADIT)

ADIT stands for Integral Development Association of Tamarindo, and it is a non-profit organisation focusing on different programs to develop the well-being of the community (ADIT, n.d.). One of their focuses is SWM and they are aiming to improve the current processes of SWM, wastewater and recycling.

### The Clean Wave

The Clean Wave is an initiative that focuses on community building and beach clean-ups in Tamarindo. Further, they carry out different projects within SWM and promote recycling, education and zero waste in Tamarindo (Clean Wave, n.d.).

### Recycle Hermosa

Recycle Hermosa is a local initiative aiming to reduce the amount of waste and increase recycling. Furthermore, the focus and aim of Recycle Hermosa is to increase awareness and

education in the community about SWM while simultaneously attempting to get the community more involved (Recycle Hermosa, n.d.)

#### Asociación de Desarrollo Integral de la Comunidad de Playas del Coco (ADICoco)

ADICoco stands for Integral Development Association of the community of Playas del Coco, and it is a non-profit organisation. ADICoco focuses on different projects to support the community and projects on waste management are one their priorities (ADICoco, n.d.). Their operations on waste management include beach and street cleaning, maintenance of the waste bins and promoting recycling in the community (ADICoco, n.d.).

The face-to-face interviews were carried out with field trips. These interviews allowed observations to be made simultaneously both for the companies and for the surroundings in the districts of Sardinal and Tamarindo. Additionally, participation for a couple of events arranged by the interviewed companies were joined for further observations in both districts. Joining these events allowed not only to see how the companies work first-hand but also to see how waste is treated and handled in Sardinal and Tamarindo.

When doing the face-to-face interviews all necessary preparations were done beforehand. Necessary documents were prepared and printed, and the functionality of the audio recorder was checked. For Zoom interviews, a stable internet connection was the key to allow a smooth interview. In addition, all necessary documents were prepped and working prior to the interviews.

All the interviews were recorded and transcribed. The transcriptions were done by using either the transcription tool by Microsoft's Word or Otter.ai depending on the language. Word was used for Spanish interviews and Otter.ai for English ones. After the creation of the transcripts, they were used for analysing and coding the data. This was done by using NVivo software that works for both English and Spanish. The transcripts were organised by creating categories and themes to code the data that will allow better understanding of the main outcomes from the interviews. Appendix C contains information about the created codes and number of references. The transcripts were not translated but rather kept in the original language to decrease the risk of losing any meaning and only direct relevant quotes were translated into English.

### 3.4 Limitations and Ethical Considerations

Qualitative research design and case study approach has been viewed as the most suitable method for the study, but it still contains certain limitations that need to be considered. In the

study the researcher serves as an important tool, and they often collect data and information for the study (Creswell, 2014). This implies the importance of the researcher and their major role in designing, collecting and arranging data. Creswell (2014) also highlights that the outcomes of the collected data are interpreted by the researcher. Therefore, it is important that when collecting and handling data, right measures are taken, and the researcher is aware of any bias to assure accuracy of the data and its inclusiveness (Peräkylä, 2011). Furthermore, Peräkylä (2011) states that measurements of validity need to be considered and such aspects are transparency, consistency and documenting each step of the research thoroughly. To ensure validity, data triangulation is important and due to this more than one source of data is used. Apart from interviews, observations, photography and field diary is used for the study to triangulate the information gather from the interviews.

Collecting data and how it is done requires attention to ensure that any bias is acknowledged, and interviewees experience is favourable. Shah (2019) highlights that the risks for bias should be acknowledged and attempted to reduce as much as possible. In order to reduce risks for bias, thought needs to be put into how to phrase the interview questions and allow the interviewees feel comfortable and accepted during the interviews (Shah, 2019). Moreover, the interviewer should not prompt interviewees to go into any certain direction during the interviews. To avoid such biases and risks, the interview questions have been formed to be open and start with more generic questions and moving to more specific ones. Further to create a comfortable experience for the interviewees to answer the interview questions freely, the identities of the interviewees is kept confidential. In addition, the interviewees are made aware of their rights in the consent form, which they are required to sign before the start of the interview.

Another factor that needs to be considered is linguistic limitations. As the researcher is not native speaker of Spanish some small linguistic nuances might have gotten lost during the interviews. However, the researcher has a good level of Spanish and experienced no issues with the language during the interviews but to ensure correct understanding of the interviews, the transcriptions were verified by a native Spanish speaker who is also proficient in English.

When considering the limitations of the chosen case study approach, generalisation is often mentioned. The nature of case studies commonly does not allow generalisation as it is particularly developed in a specific context (Creswell, 2014). This study focuses on two locations to get in-depth knowledge of a certain topic and context and does not necessarily allow generalisation, which is not the aim of the study either.

## 4 Results and Discussion

This section focuses on the findings of the study. The findings are presented and discussed regarding the collected data and theory. The aim of the section is to provide an understanding for each of the three research questions in the context of Sardinal and Tamarindo districts. The following sections, 4.1-4.3, are consequently divided based on the research questions to analyse and discuss each of them and their findings. In section 4.4 a discussion of the main commonalities and differences between the districts is covered. Furthermore, the participants for the interviews are identified as P1 to P10 in this section in no particular order.

### 4.1 Identification of the challenges in SWM in Tamarindo and Sardinal districts in Costa Rica

This section addresses the first research question that is aimed to look into the largest challenges the districts of Sardinal and Tamarindo have in terms of solid waste management. The research question is formed as: “What are the largest challenges for solid waste management in the Sardinal and Tamarindo districts in Costa Rica?”. It takes a multi-scalar perspective, starting with the challenges on the national level in Costa Rica that also apply and affect the districts of Sardinal and Tamarindo. Afterwards, the main challenges on the districts are covered.

#### 4.1.1 National challenges

In the interviews when discussing the current situation of the solid waste management in Costa Rica, all the interviewees agreed that waste management is a problem in Costa Rica and there is room for improvement. One of the interviewees identified the matter as: “In Costa Rica we have grown a lot but, in some things, we have stayed far behind. For example, in waste management we are still far behind other countries, and we have to improve a lot in this area.” (P2).

The common worry among the interviewees is the rate of recycling and reuse. A goal to increase the waste recovery rate was set by Estrategia Nacional de Separación, Recuperación y Valorización de Residuos (National Strategy for the Separation, Recovery and Valorisation

of Waste) to increase the recovery rate to 15% by 2021 (Ministerio de Salud, 2016). The goal has not been met but there has been improvement in the past decade. In 2014, the waste recovery rate was 1.3% and by 2017 it had increased to 6.6% (Fernández Vicente, 2020; Ministerio de Salud, 2016). More recent information is not currently available and few of the interviewees argued that the availability of such data is lacking in the country and can affect many matters, such as decision-making for the municipalities (P3, P9, P10).

The current situation of the solid waste management in Costa Rica is aligned with the insights from the interviewees and the literature. While Costa Rica has started to prioritise SWM more than before, there is still a lot to advance to make the process and handling more efficient and sustainable. The need for more focus on the valorisation of waste and circular economy came up in several interviews that could support the transformation to more sustainable processes and communities in Costa Rica (P1, P3, P5, P6, P8, P10). One of the interviewees stated that “the challenge is to be able to change the way we look at waste as a problem to an opportunity, to valorisation and to the generation of value” (P5), which is one of the themes that was emphasised during the interviews.

In Costa Rica, the municipalities have a large responsibility when it comes to SWM. The municipalities are the local governments that are responsible for the management of the waste, ensure that national laws are followed, and that sufficient budget is allocated to allow proper processes of SWM. The two municipalities that were analysed for the study, both understood the responsibility, the role they have for SWM and their effect in their cantons. However, the interviews concluded that in Costa Rica, there are large differences between municipalities and cantons how the waste management processes are handled (P1, P3, P4, P5, P6). The differences between municipalities come from different factors, such as resources, capacity and financial and economic matters (P1, P3).

The cantons of Carrillo and Santa Cruz are both working on improving SWM but there are challenges. Especially in Carrillo, the challenge of resources came up as there is only one person in charge of the environmental management unit of the canton, which hinders progress as there are very limited resources. Such resource challenges were described as:

It seems to me that this issue is missing the importance of the environmental management units because, believe it or not, in Costa Rica there are environmental management units that have only one official. For example, if you are the only one responsible for such a heavy subject, it is difficult to get anything done (P1).

In general, municipalities in Costa Rica struggle financially and economically as there are limited economic resources both on national and municipal level and to implement changes for SWM requires money (P3). Additional budgets for municipalities could bring significant



improvements to the processes and handling of SWM. It could allow municipalities to invest in collection trucks to improve frequency of collections (P2), new recycling centres to improve recycling (P6) and different projects that are aimed at improving SWM processes in communities (P6, P8).

During the interviews, the municipalities faced criticism as well. Few of the interviewees pointed out that municipalities, at times, lack communication with the communities (P5, P6): “All the municipalities have in common that they do not use the communication that brands use, they use communication of punishment, of a fine, of obligation, but not of value” (P5). Further criticism that municipalities faced was commitment from the municipalities in regard to recycling and the separation of waste (P10). It was viewed that the communities would benefit from more responsibility from municipalities to require separation of recoverable and non-recoverable waste to increase the amount of recycling (P10). In addition to the responsibility, the municipalities need to ensure that there is a system in place that allows the population to separate their waste and recycle (P6, P8). Without a working system, there will not be a functional SWM process that would allow more effective handling and managing of waste that reduces the amount of waste ending up in the landfills.

A major factor affecting how SWM works in a country is regulations. In Costa Rica, a relevant regulation for waste management is the law 8839, which aims to establish waste hierarchy, highlight responsibilities and available tools and incorporate mechanisms for an application of fines and sanctions when separation is not done correctly (Soto Córdoba, 2019). The topic of regulations was discussed during the interviews and generally the interviewees agreed that Costa Rica has sufficient regulations of SWM, but the problem currently is how they are applied. The interviews highlight that the application of the regulations is the largest challenge (P3, P4, P5, P6). It was viewed that the application of the regulations should be monitored better (P4, P6) and any malpractice should have fines or sanctions applied whether it is the population, municipality or companies (P3, P4, P5, P6). The outcomes are similar to the ones found in the literature where it was emphasised that the law 8839 has been deficient of what its goals initially were.

#### 4.1.2 Local challenges

National challenges apply for the districts of Sardinal and Tamarindo but there are also more specific challenges that concern the districts more locally. In the interviews these challenges were discussed, especially with the local actors who have first-hand experience. Both Sardinal and Tamarindo are touristic locations, and they have high and low seasons. Particularly during the high season and during certain holidays, such as Easter and Christmas, more waste is created, which affects the handling of solid waste and poses a challenge (P1, P2, P4, P6,

P9). Hence, it is important that there are goals and plans on how to handle the additional quantity of waste created during the high seasons (P3, P7). For example, a higher frequency of collection trucks is sent during such times in Tamarindo district (P1). Appendix D contains photography that was taken during the field trips to demonstrate recycling collection points, signs to remind people of taking care of waste and accumulated waste in a recycling centre.

As discussed in the section of national challenges, the interviewees highlight the importance of decreasing waste ending up in landfills and increasing the recycling rate (P3, P5, P6, P7, P8, P9). In Sardinal and Tamarindo, the largest challenges are viewed to be that there are not enough recycling activities, lack of education and information and financial issues (P1, P3, P4, P6, P7, P9, P10). Moreover, tourism is considered as an additional challenge as it creates more waste during certain periods of year and commonly the waste is recoverable, such as plastic bottles or cans, that would be rather easy to recycle (P2, P6, P8, P9).

Recycling activities are considered lacking in both districts. A couple of the interviewees stated that it would be crucial to start including the private sector and the inhabitants in recycling, which has been deficient (P3, P4, P5, P10). To incorporate private sector and inhabitants better to recycling efforts, the responsibility would fall for municipalities, and it would also benefit to start applying disciplinary measures when handling of waste is not done appropriately (P4, P6, P10). This means that the districts need to have sufficient locations to leave the recyclable waste. According to the interviews this is not the case so far and it was mentioned as one of the problems currently (P6, P9). In Sardinal and Tamarindo there are few locations where the recyclable waste can be left, mainly by the beaches and town centres. This does not serve the entire population of the areas and what was seen during the fieldtrips the recycling bins lacked maintenance and proper sorting of the waste.

One of the interviewees explained that “because [municipal waste collection] don’t have [time], so in the end the recycling ends up being taken away by the garbage truck for non-recoverable waste” (P6). This is especially an issue during high season and holiday periods when more waste, and specifically more recoverable waste is created (P2, P6, P8, P9). This indicates that the execution of recycling is still lacking and needs further support and implementation methods. As a potential solution to improve and increase recycling is seen local recycling centres (P3, P6, P7). Local recycling centres are seen as beneficial where the waste can be directly sorted, handled and potentially sold onwards.

In the district of Sardinal there are recycling centres in Filadelfia and in Playas del Coco. Whereas, Tamarindo district does not have a recycling centre, but the canton has one with the landfill in Santa Cruz. In Tamarindo, both local actors addressed the need for a local recycling centre. Not having one was stated as one of the largest challenges for them and considered that establishing one would increase recycling between community, businesses and tourism

establishments. In Sardinal district, the situation with recycling centres was considered better but more visibility is needed to have more of the community participating in the recycling more actively.

Financial matters arose as a common challenge in the interviews. Many of the occurring challenges, such as lack of recycling centres and education, are due to the fact that there is not enough budget for SWM. More priority for SWM is needed to allow more budget to improve the current processes and handling of the waste in the districts (P6, P7, P8, P9). Waste management is expensive and new projects and improvements need budget allocations to ensure that the SWM processes are adequate (P2, P7, P9).

Profitability was another challenge that was mentioned in the context of financial matters and recycling. Most of the larger recycling companies are located in San José, which is quite far away from the districts therefore transferring the recyclable material is expensive (P2, P4, P9). Either the recycling companies come to pick-up the recyclable waste, or it needs to be transferred to the companies. If pick-up is offered, the recyclable waste needs to be collected for periods of time and adequate storage is required (P7, P9). In case transfer is needed also time for collection is needed to fill up a truck and operations costs are rather high, such as fuel (P2, P9). Additionally, it was mentioned in the interviews that selling the recyclable material is not very profitable currently (P4, P7, P9, P10).

A major challenge mentioned by all the interviewees was the lack of education and information in regard to solid waste management. In the districts of Sardinal and Tamarindo and especially around the beach areas, it is still visible that waste is being left lying around. This indicates that there is still a certain level of absence of interest and understanding how incorrect management of waste affects the environment (P3, P5, P7, P8).

The importance of education was highlighted in the interviews and one of the interviewees stated that “environmental education, that’s where it all starts.” (P6). To improve the level of environmental education in the districts, it was mentioned that it is important that the inhabitants understand the value of recycling (P7, P9). To achieve this, it was seen that there needs to be a change in the education system and include environmental education from a young age to change the pattern of the population’s habits (P1, P3, P4, P6, P7, P8, P9). Apart from educating the population, local businesses need to be educated to work according to the best SWM practices (P2, P3, P9, P10). The education process was described by one interviewee as “the education has to be a sustained education over the years so that the population, separation at source, the processing of waste in homes will be seen as a habit.” (P1). A few of the interviewees see that the more educated people are on the topic, the more change is going to be demanded from decision-makers (P3, P4, P5, P6).

Tourism also brings additional challenges for the SWM. It increases the burden of the system as more waste is produced by tourists. It is important to have adequate systems and infrastructure in place in the districts to be able to handle the additional waste created by tourism, especially since both of the districts include coastal areas (P6, P8, P9). The interviewees consider that tourists create more recoverable waste, such as plastic and glass bottles and cans, which are easier to recycle (P2, P6, P8, P9). During high season and holidays, this is visible, and waste accumulates faster, and waste collection is required more frequently to avoid excessive waste accumulation (P4, P5, P6, P8, P9).

Another challenge is the behaviour of the tourists. Tourists do not have responsibility for SWM and during holidays it is easier to be careless, which creates bigger responsibility for municipalities to manage (P2, P6, P7, P9). The behaviour of tourists also comes down to the education level and habits of waste management tourists have at home (P3, P5, P7). Furthermore, the interviewees considered that tourism establishments should take more responsibility when it comes to recycling (P3, P5, P7, P8, P10). Tourism establishments, such as hotels and restaurants, use a lot of recoverable waste, which would be important to be recycled (P7, P8, P10). More discussion on tourism is covered with Research Question 3 in section 4.3.

## 4.2 ISWM Aspects

The second research question was formed as: “how are the aspects of Integrated Sustainable Waste Management considered in the solid waste management in the districts of Sardinal and Tamarindo?”. The section addresses the six different aspects of the ISWM framework, and the aspects are technical, environmental, financial/economic, socio-cultural, institutional, policy/legal/political. Further, the section addresses how the two districts identify the aspects based on inputs from the interviewees. Moreover, the interviewees’ opinions on the importance of the aspects are covered.

Commonly developing countries experience larger issues with SWM as the processes and systems are more inefficient due to several limitations and more open dumps and landfills are used (Popkin, 2021; The World Bank, 2022). The ISWM framework is primarily created for the use of developing countries to address certain issues of SWM to advance their processes and create further development for more sustainable practices (Topic & Biedermann, 2015). When considering the ISWM framework in the context of Costa Rica, the aspect dimension of the framework serves as the most interesting focus whereas stakeholders and waste system elements are more researched and identified in the country. Dimension of aspects has not had much focus yet in Costa Rica and could serve as a useful support in guiding the country to

more sustainable practices. Additionally, the focus for aspects can benefit to further provide tools on how to attain better results.

The six different aspects were discussed in the interviews to gain input from the interviewees regarding how the different aspects are viewed in the districts currently and what sort of priority is given to them. In the interviews all of the aspects were considered important and valuable for the SWM in the two districts. Furthermore, it was considered that each of the aspects already has some certain foundation existing in the districts, but more focus and improvement would be needed to each of the aspects to improve the current SWM processes.

In the interviews not only were each of the aspects discussed but also the interviewees were asked to rank the aspects based on importance to see what is considered of highest significance. The most focus was given to the environmental, socio-cultural and institutional aspects and they were pinpointed as the most important ones and would require improvements and changes in the districts of Sardinal and Tamarindo. All these three aspects were considered as priority areas where change would be needed first and foremost. While the least importance was given to technical and policy/legal/political aspects and financial was in the middle. Technical was not commonly seen as a priority as there are other factors that require attention, and it was thought to be working adequately. The policy/legal/political aspect was ranked lower due to the fact that the interviewees considered that there is not much they can affect for the aspect.

There were some differences between the interviewees when it came to the ranking. For example, municipalities ranked policy/legal/political aspect higher and socio-cultural aspect lower than the rest of the interviewees. For institutional aspects, there were some differences between two local initiatives ranked this aspect lower as they consider they do not have enough influence to affect it. However, in general the ranking of the aspects was quite similar between the experts and local initiatives and larger differences were found only with municipalities.

The ISWM framework has not been applied either in Sardinal or Tamarindo, but all the six aspects are identified and considered to a particular level. Both districts have similar views of the aspects on how they are presently functioning. The interviews demonstrate that there is room for improvement to strengthen each of the aspects individually and in collaboration. Holistic approach is also beneficial with the aspects. Moreover, it was comprehended that there has been improvement within the aspects in the past years, but changes generally take a long period of time and therefore any improvement done will not be visible immediately.

The interviewees viewed that all of the aspects are connected and complement each other and what changes happen in one of the aspects affect the others as well. When discussing the aspects individually during the interviewees a few main points came up:

#### Environmental

The environmental aspect was one of the dimensions, along with institutional, which raised the most discussion and was a large concern for the interviewees. It was considered that the state of it has improved in the past decade but still a lot of work remains to be done to minimise negative effects of SWM for the environment (P3, P6, P9, P10). It was additionally discussed that other aspects and their state has consequences on the environment (P3, P4, P9).

#### Socio-cultural

Socio-cultural aspects were considered to be one of the main dimensions that needs improvement and contains plenty of challenges. One of the interviewees explained the need for change for the aspect as: “It is important to change the habits of the population and of the civil servants, as well as their vision, even to think about sustainable production and consumption to start taking preventive approach.” (P3). Moreover, socio-cultural aspect was identified as a major consequence and effect for environmental matters (P7, P8, P9, P10).

#### Institutional

The institutional aspect was identified to have several deficiencies that need more focus and improvement. It was viewed that the dimension lacks supervision, monitoring and implementation as well as better political structures to be in place (P3, P4, P6, P9, P10). It was also regarded that further commitment from institutions is needed to improve the SWM processes (P3, P6, P10). Furthermore, additional alignment with different actors would benefit improving the aspects as the objectives are not often the same (P3, P4, P6).

#### Financial/Economic

Financial/economic aspect raised similar discussion that arose for the challenges. The aspect was seen as essential to advance the current situation of SWM in the districts as more budget is needed to implement changes but there are limited resources on national and municipal level dedicated to SWM (P4, P5, P6, P9). Hence it was seen limiting other aspects currently.

#### Policy/Legal/Political

The aspect was considered to have sufficient focus, yet the quality and quantity is not matching. The interviewees thought that more guidance is needed for different actors and better applications of existing policies would support better implementation of the aspect (P3, P5, P9, P10).

#### Technical

The technical aspect is not seen as a priority currently as it was viewed to have the highest level of implementation currently. Additionally, it was seen as an instrument to make changes and further improvement and investments could be made as long as budget allows (P3, P7). One of the interviewees considered that any additional collaboration, technology or innovation would benefit and ensure smoother practices of handling SWM (P5).

The concept of ISWM is not entirely new to Costa Rica as there is already existing collaboration with WASTE and several Costa Rican actors, including ACEPESA and the Ministry of Health. In the interviews with two experts from ACEPESA, it was discussed that they have worked together on a project concerning electronic waste in Costa Rica with a rather successful outcome. Hence certain actors in the country already have knowledgeable experts on the matter and since the relationship already exists it could be rather effortless to continue collaborating on different projects on SWM to improve the current processes and scale up current collaboration using the ISWM framework.

### 4.3 Impact of Tourism on SWM

This section addresses the impacts tourism is viewed to have on SWM in the districts. The research question has been formed as: “what impact tourism has on the solid waste management and its handling in the districts of Sardinal and Tamarindo?”. In section 4.1 tourism was discussed in the context of challenges it poses for SWM. It was noted that more waste is created by tourists, especially during high season and certain holidays, and the waste is commonly recoverable waste. Furthermore, the behaviour of tourists and the responsibility for tourism establishments was briefly covered but will be discussed further in this section.

Tourism creates a substantial contribution to the Costa Rican economy and in the past few decades there has been an increase in tourism with 3.1 million international tourists received in the country in 2019 (ICT, n.d.; OECD, 2020). The increase in tourism signifies more produced waste in touristic areas in the country, including the districts of Sardinal and Tamarindo. One of the interviewees mentioned that the waste management system and infrastructure is created for the locals and the system would need to be accommodated for the tourists (P5). Hence there is additional planning and management required for the municipalities and districts to handle the additional waste created.

During the interviews the different types of tourists were defined, mainly divided into either national and international tourists and recycling-educated and less recycling-educated tourists. International tourism was viewed as more long-term, from one week up to a few months whereas national tourism was seen as short-term, from one day up to one week. The

interviewees perceived that especially short-term tourism has less regard for the environment and people tend to care less about managing the waste during holidays (P2, P7, P8). Furthermore, it was seen that international tourists do not litter as much as national tourists (P3, P4, P6). One of the interviewees stated that:

The perception is that foreign tourists do not litter as much, as in general they come with habits of recycling and not contaminating etcetera. The national tourists contaminate a lot, especially during the high season (P3).

This leads to the division of recycling-educated and less recycling-educated tourists, in which the interviewees mainly divided the international tourists are more educated whereas the less educated are considered to be national tourists. This was described by one interviewee as “Costa Ricans have no awareness how to recycle, there is no education, and you see people throwing empty bottles out of car windows without any conscience.” (P6). International tourists and particularly the ones from Europe, United States and Canada were thought to have better education on the matter and knowledge of how to recycle. Hence, international tourism was considered mainly a positive matter as it has allowed exchange of cultures and customs, which can allow locals to learn from foreign tourists (P4, P5).

Even if the tourists attempt proper management of waste and recycling, it has no significance unless there is proper handling of waste by the municipalities and the locations that tourists use and visit during their stays. Thus, tourism establishments have a rather large role in handling the waste produced by tourism as tourists do not have the responsibility to ensure that the SWM is correctly managed (P3, P5). In the interviews, the tourism establishments and their role were discussed. The general view from the interviewees was that tourism establishments do not currently take enough responsibility handling the waste correctly and it was perceived that the majority of the waste they handle could be recycled (P3, P5, P6, P7, P8, P9, P10).

As the proper management of waste by tourism establishments is seen low in the districts of Sardinal and Tamarindo, it indicates that most of the produced waste ends up in landfills. The interviewees viewed that the tourism establishments should take more responsibility to recycle but also considered that incentives would help them to get started (P4, P6, P8, P10). If the tourism establishments would increase recycling it would affect the amount going to the landfill as described one of the interviewees: “obviously the landfills would have more life, if hotels, restaurants and so on would take care to do the proper separation and even require putting the materials in its correct place” (P10). To get the tourism establishments more involved with recycling, it was perceived that it should be free, have adequate space to store the recyclable material and to have collection organised by municipalities often enough so the waste will not accumulate (P4, P6, P7, P9).



Both Sardinal and Tamarindo districts are aiming to become more sustainable communities that serve the locals and tourists alike. The interviewees viewed that it is important that the districts are kept clean as both tourists and locals benefit from the clean environment (P2, P4, P6, P8). As both districts are coastal ones, it was seen as additionally important that SWM is handled well to avoid waste going into the ocean. To increase awareness of the importance of SWM, it was considered that different initiatives and education should take place in order to have more of the locals and tourists involved (P3, P5, P6, P7, P8). It was viewed that if more locals and tourists get involved and start wanting a more efficient SWM system, change could be demanded from the municipality to improve the current SWM processes (P4, P6, P7, P8, P9, P10).

## 4.4 Commonalities and Differences of the Districts

The focus of the study is to look into the districts of Sardinal and Tamarindo in Guanacaste province of Costa Rica and the main outcomes for the three research questions were covered in sections 4.1-4.3. This section analyses the largest commonalities and differences discovered between the districts during the research. The largest commonalities and differences are discussed in the terms of observations made during the fieldwork and outcomes from the interviews and literature review.

Both Sardinal and Tamarindo districts are considered to have one of the most visited beaches in Costa Rica, most namely Playa Tamarindo in the district of Tamarindo and Playas del Coco in Sardinal district. Both of the areas attract national and international tourism and during the fieldwork several day field trips were done in both of the districts, hence a good understanding of the districts was gathered. Furthermore, the districts are located in close proximity to each other, approximately 60 kilometres apart. The districts are similar in many ways but there are also differences between the areas, the description is based on Playa Tamarindo and Playas del Coco which are the largest towns in the districts and most initiatives and main activity on improving current SWM processes occurs.

Tamarindo is a more developed beach town with a large number of tourism establishments, but the planning of the town is disorganised, containing many small roads and buildings packed together. Tamarindo is also a busy town, especially during the high and holiday season. Tamarindo has gained its popularity due to being a beach town for surfing and attracts more younger travellers, families and locals alike. Tamarindo is an expensive area to live in as foreigners have driven up the rent and land prices and most of the locals live outside of Tamarindo in small towns.

Playas del Coco, like Tamarindo, is a beach town but it is smaller compared to Tamarindo even though it has experienced fast growth in the past few decades. Playas del Coco is known as a fishing village but that is less prominent nowadays and the town has a rather large number of tourism establishments but especially the hotels are smaller in size than in Tamarindo. Playas del Coco has one main road and smaller roads, but the town is more organised when it comes to city planning. Where Tamarindo attracts a younger population, Playas del Coco attracts older and retired population, but it gets busy during the high and holiday season. However, Playas del Coco does not get as busy as Tamarindo and there are locals living in town.

In both districts, the interviewed local actors working on the matter of SWM system and processes, similar associations and initiatives were found. All these four interviewed experts in the districts had similar views on the current SWM system and processes. They all agreed that there is a lot to improve on the topic but still progress is visible in the past few years for both districts. In general, it was seen that waste hierarchy should be implemented better and it is not currently considered adequately. The most dominant options currently are either recycling or landfill and rest of the options from the waste hierarchy pyramid are not often discussed.

The upcoming focuses and plans varied between the districts. Tamarindo seemed to have a better image and ideas of what the next focus should be as long as funding allows. The local actors in Tamarindo discussed wanting to start applying and promoting circular economy methods and to increase the reuse of plastics. Moreover, to invest in a recycling centre in Tamarindo that could allow them to expand their processes and to reach a larger share of the community. Whereas, in Sardinal the principal focus was to continue increasing the number of materials for recycling, scaling up current operations, educating the communities and getting more tourism establishments involved with recycling.

Another factor that the majority of the interviews introduced during the interviews was the problem of organic waste. It was referenced as a problem in both districts as the amount is rather high and it is the heaviest type of waste. Composting is seen as a solution, but it is still in the early stages of implementation in Sardinal and Tamarindo. Particularly, the district of Tamarindo is aiming to start implementing solutions to create options for composting in the community.

What comes to the research questions, the views the interviewees had on the topics were relatively similar throughout the interviews and no major differences were found. Both districts have similar activities and initiatives occurring currently to support improving the current situation of SWM. As Tamarindo has more people, it generates more waste and currently has larger scale plans and ideas how to improve the operations. However, all the

local actors in both districts are attempting to create awareness and interest towards the issue of SWM to get more of the community involved and simultaneously create and work on different projects that allow cleaner and sustainable communities. There is still work to do but in the recent years change and improvements has started to occur in both districts.

## 5 Conclusion

The world is experiencing an increase in waste generation rates and due to this SWM has become a large challenge worldwide. Inadequate management of waste has a huge impact on the environment, health and economy, therefore it is crucial that more sustainable SWM systems and processes are put in place to decrease the impact of the current SWM. SWM is especially a challenge for developing countries due to high costs and poor disposal methods and because of this, developing countries require more attention and research to be able to improve.

The study is aimed to create a better understanding of SWM in the districts of Sardinal and Tamarindo in Costa Rica. The two localities have undergone rapid development and are experiencing an increased amount of tourism that brings additional challenges for their SWM systems. The first aim for the study was to investigate the largest challenges the two districts experience currently with SWM. The second aim was to identify and define the aspects of the ISWM framework in the districts currently and their importance. Final aim was to see how tourism is impacting SWM in the districts. In addition to these three main aims, similarities and differences between the districts were considered. A qualitative case study approach was chosen to create an understanding of the main aims of the study and data was collected by conducting interviews with different actors working on SWM in the districts and Costa Rica.

The findings of the study suggest that Sardinal and Tamarindo districts are considerably similar in many ways and when it comes to socio-demographic qualities. Both districts are actively attempting to improve the existing SWM systems and processes with local initiatives leading the way, but work remains to be done, especially with creating further awareness and interest within the communities on the matter. Both districts experience several challenges that hinder with the current SWM, and the challenges discovered were divided into national and local levels. The predominant challenges on national level were identified as the low waste recovery rate, the responsibility of municipalities and existing regulations, which were also indicated on the existing literature. On a local level, the main challenges indicated were the level of education, tourism and financial matters.

For the ISWM framework, it was noted that the concept has already been applied in Costa Rica for electronic waste and it could serve as a beneficial framework for future use as well. The framework has not been used in the districts but when looking into the six aspects of the framework, a foundation for each of the aspects exists in both districts. However, the study

indicates that more focus and improvement would be needed for each of the aspects. The interviewees considered that most important aspects are environmental, socio-cultural and institutional and these would require the improvement most urgently.

Tourism was viewed to make an impact for the SWM in Sardinal and Tamarindo and especially the role of tourism establishments was highlighted. It was seen that tourists produce more recyclable waste that would be easy to recycle as long as the processes are in place. Furthermore, tourism establishments were considered to have currently too little responsibility and they should get more involved with recycling efforts as they handle a lot of recyclable materials. However, support from the municipalities would be needed for that. The outcome of the interviews also suggests the difference between international and national tourists. International tourists considered to have a better environmental education, and they could potentially contribute to making a positive impact on the districts.

The current SWM systems and processes in Sardinal and Tamarindo are getting increasing attention and this study has suggested that while the districts are moving into the right direction with increased initiatives and projects there are still improvements needed. The study indicates that more alignment between different stakeholders and more resources are needed in order to improve the current SWM processes further, which is also the generic input from current literature for Costa Rica. Moreover, the study highlights the importance of environmental education for the communities as well as for local businesses as a way to increase the interest and to create an understanding that waste is also a resource not just a problem.

SWM is gaining more awareness in Costa Rica, and it offers a lot of research to create a better idea of the current situation. Future research has a lot of options as SWM is becoming a more relevant topic in Costa Rica and both municipalities and population are paying more attention to it. A potential future research could be conducted on certain types of waste, such as organic waste. Costa Rica produces a high amount of organic waste, which is often thrown into nature or ends up in landfills. Recently, more projects on composting are surfacing and could pose an interesting research focus. Additionally, further research on how to increase environmental education, sustainability and circularity in SWM in Costa Rica would serve as relevant topics to create a better overview.

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# Appendix

## Appendix A

### **Interview Guide:**

#### **Block 1: Introduction**

1. A short description of your role in the field of municipal solid waste management?
2. What are the main aims in your operations?

#### **Block 2: Solid Waste Management**

3. What are the processes for the SWM here?
4. Are the different stakeholders identified and operating adequately throughout the value chain?
5. How do you experience how the SWM processes are currently working in the district?
6. What do you think are the largest challenges currently for the SWM?
7. Any suggestion how SWM could be improved in the district?

#### **Block 3: Integrated Sustainable Waste Management aspects**

8. How would you rank the ISWM aspects from the most important to least important in your opinion? Ask for a brief elaboration for the choices.
9. Which aspects do you consider are lacking in the district? Why?
10. Which aspects do you think are considered well? Why?

#### **Block 4: Tourism**

11. What sort of an influence tourism has on the amount of generated solid waste in the district?
12. How do you consider tourism affects the management of the waste?
13. Are tourists aware of how to handle the waste and recycle in the district?
14. Do you consider that touristic locations, such as accommodation and restaurants, take enough precaution on how to treat generated waste?
15. What do you see as the largest challenges with waste created by tourists?

#### **Block 5: Closing**

16. Anything else you would like to add that was not covered?
17. Do you have anyone else in mind that could be interviewed for this topic?

For Question 7:

<b>Ranking (most to least important)</b>	<b>Aspect</b>
1	
2	
3	
4	
5	
6	

<b>Aspects</b>	<b>Description</b>
Technical	Practical implementation and maintenance of waste elements, such as their design, facilities and equipment that are in use
Environmental	Effect on land, water and air, pollution control and health concerns
Financial/economic	Budgeting and cost accounting in waste management systems
Socio-cultural	Influence of culture on generation of waste and managing waste in the households and institutions as well as community and its involvement
Institutional	Political and social structures controlling and implementing waste management, organisational structures and available institutional planning
Policy/legal/political	Boundary conditions where the waste management system exists, sets goals and priorities, basic decision-making processes and the existing legal and regulatory framework



## Appendix B

### **Interview consent form**

#### From Waste to Resource: Solid Waste Management in the districts of Sardinal and Tamarindo, Costa Rica

This interview is part of an ongoing master thesis research project called ‘From Waste to Resource: Solid Waste Management in the districts of Sardinal and Tamarindo, Costa Rica’ project is funded by and carried out at Lund University in Sweden, as part of the Master programme in Innovation and Global Sustainable Development.

The study examines solid waste management in Guanacaste, Costa Rica and more closely the districts of Sardinal and Tamarindo. The study aims to understand different aspects of the Integrated Sustainable Waste Management framework in the context of the two districts. The study aims to explore how the different aspects are considered and what are the largest challenges for the solid waste management in the districts of Sardinal and Tamarindo. Furthermore, the study aims to assess how tourism affects the municipal solid waste management in the two districts that both attract tourists. The main focus is the solid waste management in the two districts from the perspective of different actors, such as cooperatives, non-governmental organisations and decision makers.

The project is led by the Master student Jeni Särmäkari and supervised by Professor Cristina Chaminade. The project is supported by Lund University, the International Centre for Economic Policy for Sustainable Development (CINPE) of the National University of Costa Rica (UNA), and the Erasmus+ International Credit Mobility (ICM) Fellowship.

## Interview Consent Form for Individual Interviews

The interview will be digitally recorded, and the interviewer will take notes. Both notes and recordings will remain confidential. Your personal identity will remain anonymous. No views will be directly attributed to you in any document that may be produced from the interviews. The name of your firm or institution may, however, be included in the report unless you explicitly request otherwise.

We are aware that these interviews may include risks by discussing sensitive information. These risks will be mitigated by a strict protection of the data in a password protected software environment. Only the project leader, supervisor and the researchers in the project will have access to the notes.

The information gathered from this study will be used to contribute to the project. It may be presented in the form of a report, a paper to a colloquium and/or a published scientific paper.

If you have any questions about your rights as a study participant or are dissatisfied at any time with any aspect of the study, you may contact Jeni Särmäkari at the email XX or the phone number XX (WhatsApp) or XX (mobile).

### Consent

I hereby agree to participate in research 'From Waste to Resource: Solid Waste Management in the districts of Sardinal and Tamarindo, Costa Rica' on the conditions stated above.

I understand that if I decide to participate in this study my participation is free and voluntary, and I have the right to withdraw my consent to take part or to stop my participation at any time without penalty or negative consequences.

.....

Date: .....

Signature of the participant

Full name (in capital letters): .....

I hereby agree to the tape recording of my participation in the study: ( ) Yes ( ) No

## Appendix C

Codes – keywords from the codes and number of sources and references

<b>Codes</b>	<b>Sources</b>	<b>References</b>
ISWM aspects		
Environmental	8	14
Financial/Economic	7	10
Institutional	8	15
Policy/Legal/Political	5	11
Technical	4	6
Socio-cultural	8	12
Challenges		
Education	10	30
Finance	7	26
Institutional	10	26
Tourism	10	25
Waste	10	47
Community		
Culture	7	14
Education	7	20
Participation	7	13
Regulations		
	6	13
Districts		
Sardinal	4	24
Tamarindo	4	36
Municipality		
Carrillo	4	33
Santa Cruz	4	21
SWM		
Landfill	9	19
Processes	10	45
Recycling	9	46
Waste	5	12
Tourism		
Effect	8	13
Tourism establishments	9	24
Tourists	10	21

# Appendix D

Photographs (own photography) from observations made on the field. Upper two photos are examples of recycling points in both districts. Middle photographs are sign in the communities to inform that no waste should be left in the nature and last lower photos are collected recyclable waste in a recycling centre.

