Social perceptions of single-use plastic consumption of the Balinese population

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Abstract

The island of Bali has suffered from an increasing amount of single-use plastics being littered into the environment during the past few years. This research aims to determine the social perceptions of plastic bags and bottles in particular, through consumption habits, the degree of awareness of environmental impacts and the willingness to reduce their consumption. The methodology is based on a survey approach and literature review contrasting the characteristics of plastic bottles and bags, their associated impacts, the relationship between consumption behavior and attitudes and the current worldwide alternatives to reduce their consumption, including the usage of reusable bottles and bags, a Container Deposit Scheme (CDS), a ban on plastic bags and taxation. Results indicate that Balinese people alreary undertake a more environmentally friendly choice regarding bottles, the plastic bag usage is moderate, reuse rates are high, the environmental impact awareness is fairly high and the willingness to reduce consumption is elevated. In conclusion, consumption habits of the Balinese population suggest that single-use plastics are percieved rather negatively. However, a set of recommendations is provided for a continued improvement, considering the intermediate acceptance of a CDS to manage plastic bottles, and a contradictory preference for a ban on plastic bags and voluntary actions to reduce plastic bags.

Language: English Key words: single-use plastic, plastic bag, plastic bottle, reusable bags, bag ban, environmental impacts, Container Deposit Scheme

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List of abbreviations

ACC	American Chemistry Council
BCGP	Bali Clean and Green Program
BGTO	Bali Government Tourism Office
BPA	Bisphenol A
CDS	Container Deposit Scheme
DoE	Department of Environment
EA	Environment Agency
EC	European Commission
EU	European Union
GBG	Global Business Guide
GHG	Greenhouse Gases
HDPE	High-Density Polyethylene
MoE	Ministry of Environment
NOAA	National Oceanic and Atmospheric Administration
LCA	Lifecycle Assessment
LDPE	Low-Density Polyethylene
LLPE	Linear Low-Density Polyethylene
PITA	Plastic Industry Trade Association
UK	United Kingdom
US	United States
WRAP	Waste and Resources Action Program

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1. Introduction

The global production has been continuously increasing during the past 50 years. Yet when comparing the global production of 2013 and 2002, which respectively accounts for 299 and 204 million tones, an increase of 45,6% is noticed during the past few years (Plastics Europe, 2015). These figures reflect a growing dependence on plastic consumption all over the world.

In Indonesia, the plastic consumption per capita increased to over 17 kg per year and remained low compared to other Asian countries like Malaysia (35 kg) and Singapore (40 kg), and the demand grew up to 4,3 million tonnes. (GBG Indonesia, 2014). Nevertheless, the demand continues to grow when the population grows. Between 2007 and 2012 the population grew roughly 7% (World Bank, 2015). At the same time the plastic products market had an extraordinary increase of 165% during the same period (Euromonitor International, 2013).

This expansion of plastics consumption in Indonesia, and around the world, is not unjustified, since plastic products provide certain societal benefits. Some of these benefits regarding health, safety, energy saving and material conservation include, among many others, the reduction of food wastage by plastic food packaging, the reduction of transportation costs and carbon dioxide emissions as plastic packaging weighs less than other materials, as well as the creation of plastic construction materials that perform better than other materials (Andrady & Neal, 2010, p. 1980-1981).

On the other hand, the production of plastic is not exempt from environmental consequences since it is a durable and persistent material that may be lost from landfills to the environment if it has not been collected for recycling or simply recovered. Thus, plastics have been accumulating in the environment over the years and is being contaminated by these (EC DoE, 2011). A recent study on *Plastic waste inputs from land into the ocean* ranks Indonesia as the second country that introduces the most plastic waste into the ocean with 3,22 million metric tonnes per year, following China in the first place with 8,82 million metric tonnes per year (Jambeck et al, 2015). By 2006 the amount

of plastic waste generated in Indonesia accounted for 14% of the total waste generated, only surpassed by 62% of organic waste (Indonesian MoE, 2008).

The efficiency and adequate functioning of waste management systems play a crucial role in avoiding plastics being released into the environment. Regarding developing countries, the waste management infrastructures seem to be developing at a slower pace than the increase of plastic waste to be managed (EC DoE, 2011).

According to Meidiana and Gamse (2010), in Indonesia the current waste management system provides a low level of services and, thus, it is considered inadequate due to a lack of policies, financial support from Government and private companies and low community awareness. As much as 15,27% of the waste is dumped into rivers and streets, while landfill and open dumping accounts for 40,09%, open burning for 35,49%, buried for 7,54% and recycling as low as 1,61% (Indonesian MoE, 2005). In this way it is assumed that a more efficient waste management infrastructure would diminish the environmental impacts of plastics greatly.

As of today the variety of plastic products available to consumers is extremely wide but the most common single-use plastics consumed daily are found in food packaging, beverage bottles and carrier bags. Specifically, this research focuses on the consumption of the last two.

The waste hierarchy, or the so-called "3 R's" of sustainability, is defined by Beaty (2015) as:

> *"*Reducing, *to use fewer resources in a first place…* reusing *materials more than once in their original form instead of throwing them away after each use…and* recycling *or converting waste materials into new products, changing them from their original form by physical and chemical processes…".* (Beaty, 2015)

Wisconsin Department of Natural Resources (2014) claims that "the first and best option for reducing plastic waste is to minimize single-use plastics in your daily life" (Wisconsin Department of Natural Resources, 2014). Given the inefficient waste management infrastructure in Indonesia nowadays, including Bali, and with low rates of recycling (Meidiana & Gamse 2010, p. 202), it is considered that reducing consumption would be

the best choice within the actual context rather than recycling. By *reusing* one would also be *reducing* the amount of single-use plastics consumed since it stops the potential consumer from buying more plastic bags and bottles while using instead, reusable bottles and bags.

Consuming less plastic bags and bottles is a relatively easy task for people to help the environment. However, initiating this behavioral change for a whole society is not an easy one. Becker et al (2014) argue that individual intentions are less powerful than habits and that institutional regulation, incentives and supports have the ability to encourage such behavior change by altering the value and intention of the behavior. Bans or taxation on plastic bags, incentives to use reusable bags or a returnable bottles system are among these regulations and incentives.

In Bali, banana leaves used to be the most common material for packaging food while nowadays these have been replaced by plastic bags. The issue appears when the habit of littering banana leaves, which would organically decompose in a few months, remains but it is replaced by plastic bags that will rest in the environment practically unaltered during years. (Thiermann, 2013)

Thus, as a starting point for this research, and independently of littering habits, it is considered that the reduction in use of plastic bags and bottles is the best option for avoiding potential environmental impacts. As Ecomaine (2014) states, “the best plastic bag is the one you don’t use” (Ecomaine, 2014). However, is the Balinese population willing to engage in such alteration of consumption habits in order to reduce these environmental impacts?

1.1 Aims

Where littering single-use plastics is the ultimate cause of contamination, this study focuses on one step behind in the process: the consumption. More specifically, the aim of the research is to provide information regarding the actual Balinese population’s attitudes towards the consumption of single-use plastic bottles and bags and their awareness of environmental impacts caused by these.

Based on the results, and in case the local population shows interest in reducing their single-use plastic consumption, some feasible recommendations will be given to help with the task. This research may be used by Government authorities, non-profit organizations, private bodies or individuals in order to develop adequate strategies and take actions according to actual attitudes.

1.2 Research question

1.2.1 Main question

What is the Balinese social perception towards the consumption of single-use plastic bags and bottles?

1.2.2 Sub-questions

1. Is the Balinese population aware of the environmental impacts of single-use plastics?
2. Is the Balinese population willing to reduce the consumption of single-use plastics?

2. Theoretical Framework

The literature reviewed in this report encompasses the main characteristics of single use plastic bags and bottles, materials in which they are manufactured, lifecycle assessment of plastics and other alternative materials among others. It also covers the environmental impacts, the relationship between behaviors and attitudes regarding plastics and a set of existing strategies or alternatives to reduce the use of both plastic bottles and bags being used in other parts of the world.

2.1 Single-use plastics

Three of the most common single-use products that we use on a daily basis are: plastic bags, plastic bottles and plastic food packaging. For the sake of reducing the scope of the research, the focus is set on plastic bags and bottles.

2.1.1 Plastic Bags

Before plastic bags were created the most common way of carrying groceries home was with paper bags. In 1965, a Swedish company called *Celloplast* designed what would be the first "T-shirt plastic bags", which would slowly replace the habit of using paper bags (Petru, 2014). The terms single use or disposable carrier bags are defined by Zero Waste Scotland (2014) as "all carrier bags that are supplied with the intention that they are to be used once, to carry goods away from the point of sale" (Barnes, 2014, p. 4).

The high presence of plastic bags in our society does not come unjustified. The convenience that they provide on a daily basis have converted them into a valuable product. These are characterized to be functional, strong, cheap to manufacture, lightweight and hygienic as they are disposable. (Australian DoE, 2008)

The main raw materials used for the production of plastic are crude oil and natural gas (ACC, 2015). For plastic bags, these are processed so that they form repeating units of ethylene which can eventually form polyethylene. In this process, where ethylene molecules are polymerized, long chains of carbon are created and each carbon atom bonds to two hydrogen atoms. Then these polymers are heated to form a plastic resin which is blown through tubes. This last step creates the pocket of the bag, which is followed by cooling, stretching and cutting of it into individual bags (ICF International, 2010).

The most common polyethylene types that plastic bags are made of: high-density polyethylene (HDPE), low-density polyethylene (LDPE), or linear low-density polyethylene (LLDPE). Usually, grocery bags are made of HDPE and thicker ones often provided in mall centers are made of LLDPE, and garment bags are made of LDPE. (Lajeunesse, 2004, p. 51)

Despite plastic bags being designed to be used only once, these can and often are reused in a number of ways. To serve as example, in a study carried out by the UK's WRAP (2005) several different reuses that consumers give to plastic bags are described, such as bin liners, for pets excrements, garden refuse, reuse for supermarket or other shopping, to store things at home, for packed lunches, to carry other things at home, and to keep bottles and cans in for recycling among others. In such study the most common use among the respondents was as a bin liner in kitchen (53%) (WRAP, 2005).

However, even if plastic bags are reused once or twice, the majority of bags will eventually end up as litter or on the landfill, where they can easily be blown away as a consequence of their light weight. The general lifecycle of a single use plastic bag is illustrated in *Figure 1* and, although the recycling rate refers to the case of California, it may also apply for Indonesia, where it accounts for 1,67% (Indonesian MoE, 2005).

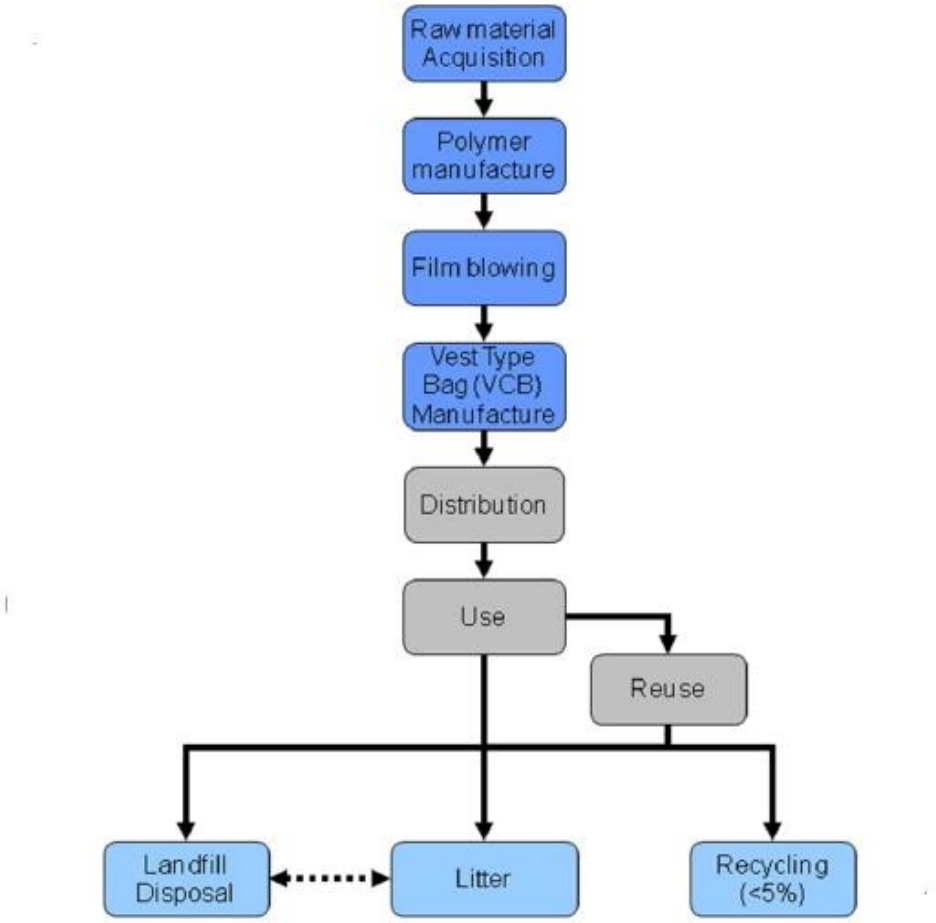

Figure 1. Lifecycle of a single-use plastic bag (ICF International, 2010)

Recycling of plastics bags is being carried out in many countries at a higher or lesser level. Tolinski (2012) argues that,

> *"a lack of comprehensive recycling (close to what we have now) puts pressure on the plastics industry to develop alternatives, or possibly will lead to more extreme regulations limiting plastics use, such as the shopping bag bans now being enacted".* Tolinski (2012, p.56)

Given the fact that there are thousands of different varieties of plastics, it is a more complex process to recycle these than other materials like paper, glass or aluminum. Besides, for the plastics to be recycled these have to be collected, sorted by type (every type of plastic is assigned a code), cleaned, processed and delivered to a manufacturer that will convert it into another product (Eureka Recycling, 2009, p. 1).

Other alternative materials are being used for the manufacturing of single-use bags. Paper bags have been used for years and according to Florida's Department of Environmental Protection (2013) these have a higher recycling rate although it takes almost twice the same energy to recycle one pound of paper than a pound of plastic and four times more energy to produce one paper bag compared to a plastic one. In addition, although paper comes from a renewable source, high pressures would be put into forests if all plastic bags were substituted by paper ones. Fuel used for transportation is seven times higher when carrying the same amount of paper bags than plastic ones, and the amount of fresh water used for paper bags is much higher as well (ICF International, 2010; ACC, 2015).

Recently, biodegradable bags are also being produced as an alternative to traditional plastic bags. These are designed to naturally degrade by activity of microorganisms like fungi, algae and bacteria and made from synthetic or biologically produced polyesters like sugarcane, corn or potatoes (ICF International, 2010). More specifically, there are three types of categories under the term "biodegradable" regarding plastics: startch-polyester, polylactic acid (PLA) and polyethylene with additives that accelerate the degradation (see *Table 1*).

Table 1. Descriptions of biodegradable categories

Category	Composition	Degradation pathway	Suitable environments for degradation
Biodegradable starch-based polymers	Starch-polyester (PCL, PLA, PBAT or AAC) blends	Hydrolysis by hydrolytic scission of the ester bonds in the chain backbone	Compostable, biodegradable and marine degradable. Suitable for degradation in controlled composting facilities, activated sludge (sewerage treatment). Also degrades in soil.
Biodegradable polyesters	Polylactic acid (PLA)	As above	As above apart from composting at $<60^0$C within time limit for Standard
Controlled degradation masterbatch additives	Polyethylene with a prodegradant additive	Two-stage process involving, in sequence, oxidative degradation, which is normally abiotic in the first instance, followed by the biodegradation of the oxidation products.	Insufficient data but appears to be slow to degrade in compost and landfill. Fragment into fine residue in open air.

Source: Camman et al (2010)

As shown in *Table 1*, the three categories require certain conditions for an effective degradation. For instance, plastic bags made from starch like sugarcane need to be composted in appropriate facilities under controlled conditions. Hence, degradation in the environment in case of being littered will occur at a similar pace than traditional polyethylene bags. The incorporation of additives to fasten the degradation of the plastic bag relates to "oxo-biodegradable" bags, which are intended to fragment into smaller pieces due to sunlight and afterwards to be degraded by microorganisms. However, arguments against oxo-biodegradables exist claiming that these do not completely degrade or that only the fragmentation of the bag takes place, posing then potential harm to birds or marine life that might confuse it with food (Tolinski, 2012, p. 55-57). European Bioplastics (2009) adds that "the fragmentation is not a solution to the waste problem, but rather the conversion of visible contaminants (the plastic waste) into invisible contaminants (the fragments)" (European Bioplastics, 2009, p. 4).

When comparing the different types of single-use bags, independently of which material they are made of, and reusable bags, the latter have proved to cause lower impacts into

the environment in case of actually being used several times (ICF International, 2010, p. 2). However, this alternative will be discussed in a separate chapter of this report.

2.1.2 Plastic Bottles

Plastic bottles were first commercially available in 1947. Nevertheless, likewise plastic bags, they did not start to be widely used until 1960s, when high-density polyethylene was created. Ever since, its consumption was on the rise due to its lightweight characteristics and the low production cost. (Nimbus Project, 2013)

In an article by Jensen and Danubrata (2014), Janice Wung mentions that "the bottled water market in Indonesia has seen increasing competition due to exploding bottled water consumption" (Jensen & Danubrata, 2014). In addition, "the almost non-existent anti-bottled water campaign in this part of the world compared to the U.S. and Europe, together with the economic growth, has presented Indonesia as a lucrative market to global bottled water companies" (Jensen & Danubrata, 2014).

Usually beverage plastic bottles are made primarily of either high-density polyethylene (HDPE) or Polyethylene Terephthalate (PET). In 1988, the Society of the Plastics Industry (SPI) introduced a universal system to facilitate the identification of the resin type of which different bottles were made. With this system, separation of plastics for the recycling process becomes more efficient (PITA, w.y.). The PET's are represented by code #1 (see *Appendix I*), they are clear, strong, and has good gas and moisture barrier properties and are commonly used in soft drinks, water bottles or juices among others. Regarding HDPE bottles, these are represented by code #2, they are more stiff than PET's and are used in water bottles and juices as well but also in milk bottles. Recycling of plastics assigned with codes from #3 to #7 are most likely not recyclable by the majority of recycling programs, while PET and HDPE (codes #1 and #2) are highly recycled (Eureka Recycling, 2009).

On the other hand, the downside of recycling is that when a bottle is recycled this does not become another bottle again, as every time that plastic is reheated it loses quality and other products, such as toys, are produced from it. In this way, recycling can only occur

a finite number of times before the plastic ends up incinerated or in the landfill. (Eureka Recycling, 2009)

2.2 Environmental impacts of single-use plastics

As of today, many studies have already proven detrimental effects of plastics into the environment as well as into human health. Regarding the latter, the more concerning components of plastics that can harm our health are the following additives: Bisphenol A (BPA), Phthalates and Brominated Flame Retardants (EC DoE, 2011).

Only BPA is found in plastic bottles, while the other two additives are found in other plastic products like PVC pipes, raincoats, televisions and more, which are out of the focus for this research. Thus, the purpose of BPA is to make the hard and clear plastic found in plastic bottles and other products. Nevertheless, the health risks associated to BPA are that it functions as endocrine disruptors and particularly affects more to early developing stages of humans, especially for chronic diseases like diabetes and obesity (EC DoE, 2011).

In regards with the negative environmental effects, it is believed that all plastic that has been at some point spread into the environment still remains in it. Not necessarily in its product form but more likely fragmented into smaller pieces due to UV light and physical abrasion (Barnes et al, 2009, p. 1993). Due to the resilience of plastics, ecosystems in environments like oceans and rivers can be harmed and, with aims to gain understanding about the issue, multiple studies have been carried out in efforts to assess such impacts.

2.2.1 Ocean pollution

Conforming to the study presented by Jamberick et al (2015), the annual amount of plastic introduced into the ocean from land sources ranges between 1,1 and 8,8 million metric tonnes per year for the top 20 countries, that mismanaged 83% of total waste. The most influencing factors are population size as well as proportion of mismanaged waste. As

already stated before in this report, Indonesia ranks second in this list (see *Appendix II*) with 3,22 million metric tonnes.

Increasing amounts of plastic are found on the ocean surface, deep ocean, ocean bed, coastlines, and sediments. However, they have also been found in wildlife that confused small pieces of plastic with food as well as entanglements that could lead to injury or death of marine flora and fauna. The sources of this contaminants come from both littering at sea and from land sources such as plastic blown away from landfills, sewage effluents, transportation accidents as well as littering on the street. (Barnes et al, 2009, p. 1985-1989)

The famous "Great Garbage Patch" is the name given to large concentration of marine debris in the North Pacific, even though there are four more gyres around the world. Many believe that this gyres contain large pieces of floating garbage, while the reality is that the majority of this garbage corresponds to micro-plastics that cannot be easily seen by the naked eye (US NOAA, w.y.). There is, however, at least four more gyres around the world of similar magnitude.

2.2.2 River pollution

Streams and rivers serve as an entry point of all kind of waste, including single-use plastics, into the oceans. This is due to direct littering into them or through storms that carry plastics into the drains. In this sense, depending on the size of the river and the strength of its currents, a larger or smaller amount of plastic will be introduced into the ocean or will remain in riverbanks. (Barnes et al, 2009, p. 1992)

In an article by the newspaper The Bali Times (2013) the Indonesian Ministry of Environmental affirmed that 52 rivers are currently polluted and, "based on the 2012 monitoring results, only 0.49 percent of rivers being monitored meet the water quality standard, while 75.25 percent seriously polluted, 22.52 moderately polluted and 1.73 percent slightly polluted" (The Bali Times, 2013).

2.3 Consumption behavior and attitude

Both developed and developing countries can be considered to be dominated by a "throwaway society" were the norm is to produce short-lived products in order to keep producing more. Natural resources are relentlessly exploited in order to satisfy the society's demand for use-and-toss products, where reusing and recycling practices remain in the background. (Upstream, w.y.)

If having in mind that the whole society is compounded of individuals, then each individual action affects the whole and vice versa. Despite attitude being a major factor influencing behavior, Arbuthnott (2008, p. 152) argues that behavior is also influenced by others such as contextual support, social norms, action difficulty, and habitual behavior.

Independently of which factors might affect consumption behaviors, there are studies defending the idea that occasionally there exists a gap between attitude and behavior, i.e. these two aspects might not always go in line. For instance, d'Astous and Legendre (2009) claim that there is a "significant difference between what consumers say about the importance of consumption-related ethical issues and their actual behavior" (d'Astous and Legendre, 2009, p. 255). Moreover, as Arbuthnott (2008) states, "the more personal and specific our intentions are, the more likely they are to influence our behavior. For instance, we are more likely to act consistently with attitudes about our own needs than attitudes about the needs of others or the generic environment" (Arbuthnott, 2008, p. 154).

Therefore, consumption decisions regarding single-use plastics should be determined by environmental consciousness or, on the contrary, such behavior might not be altered at all despite showing an attitude towards changing it. In other words, the consumer might show intentions of using less single-use plastic bags or bottles, but if s(he) is not concerned enough about the environmental consequences of these s(he) will probably not act accordingly. This would create the so-called gap between attitude and behavior.

2.4 Strategies and alternatives to reduce single-use plastic bottles

Although there are more strategies in order to reduce plastic bottles consumption, the usage of reusable bottles and the implementation of a Container Deposit Scheme (CDS) are the only two strategies considered.

2.4.1 Reusable bottles

Reusing plastic bottles that are meant to be used once may increase the chances of BPA leaching and, therefore, the health risks associated with it (Ellsbury, 2012). Due to this, in order to reduce the consumption of single-use plastic bottles in a safe manner reusable bottles appear to be a suitable solution. Ellsbury (2012) lists a series of benefits of reusable bottles over traditional single-use bottles, where: these reduce the amount of fossil fuels used and toxins released into the air, they are durable and stylish, healthier as these are BPA-free, possible to refill in most public facilities and lastly, more cost-efficient as tap water can cost 500 times less than bottled water.

Regarding the last of the benefits mentioned before, it is important to notice that in Indonesia is not safe to drink from tap water and it is common to consume mineral water from 19 liters gallon containers. Still, habitants that cannot afford to buy mineral water rely on boiling tap water to survive. (Union Panels, 2014)

Reusable bottles are commercially available in different materials: plastic, stainless steel, aluminum and glass. Each one has advantages and disadvantages over the others (Because Water, 2014) but, independently of which material these are made of, all of them contribute to reduce single-use plastic.

2.4.2 Container Deposit Scheme

Clean up Australia (w.y.) defines a Container Deposit Scheme (CDS) as “the collection of drink containers and receiving a cash refund for each container returned. Depending

on the deposit system, containers can be returned to the manufacturers via the retailer, to designated collection depots, reverse vending machines or recovered as part of existing waste or recycling collection system". (Clean up Australia, w.y.)

Among the benefits of this system there is the reduction of waste spreading into the environment, the job creation, and the increase in recycling rates, with all the advantages that it involves on its own (Clean up Australia, w.y.). New Zeland's Zero Waste Plan (2002, p. 4) adds that a CDS also reduces the use of natural resources to produce more bottles and cans, provides a monetary incentive to return them as well as an infrastructure for collection-recycling. In the case of Indonesia, the bottle collection market is dominated by an informal sector of scavengers, truck helpers, intermediates, distributors and more (Chaerul et al, 2006).

Hopewell et al (2009, p. 2119) believe that unless the bottle consumers are greatly committed to recycle their bottles or a returnable deposit scheme that offers an economic incentive is present, the collection rates tend to be very low. Therefore, they imply that a returnable deposit scheme would increase collection rates.

Currently, many countries have implemented laws regarding container deposit schemes. Just to name a few: some states of US, Canada, Australia, South Korea, Israel, Belgium, Estonia, Denmark, Sweden and Finland (Bottle Bill, w.y.). Considering only the return rate of plastic bottles, some countries have proven being very successful and effective. Then, countries like Estonia, Denmark and Finland reach around 96%, 93% and 89%, respectively. On the contrary, the efficiency of this system can differ greatly from country to country, as it is the case of Sweden with only 40% of plastic bottles are returned despite showing high return rates in aluminum with 91% (Weisfeld, 2012).

2.5 Strategies and alternatives to reduce single-use plastic bags

In order to reduce the usage of single-use plastic bags the consumption of reusable bags, a ban and taxation are the three strategies reviewed.

2.5.1 Reusable bags

The terms reusable bags, often called "bags for life", comprises bags made of any material that are meant to be used from several to hundreds of times. Usually these are commercially produced in materials like cloth, woven, jute, canvas, hemp, synthetics, thicker plastics, etc. (UK EA, 2006). When comparing with single-use plastic bags, these require more energy and resources per bag but if used several times, as intended, the environmental footprint becomes lower and lower after each use (ICF International, 2010).

Dilli (2007) compares, in a LCA, the environmental footprints of single-use HDPE, single-use LDPE, paper, degradable, cloth and non-woven reusable plastic bags and concludes that reusable ones have the lowest environmental impacts in terms of water usage, GHG, energy and resources usage, and litter.

In its study over consumer attitudes towards single-use and reusable bags, WRAP (2015) claims that "over a quarter of respondents considered budget bags for life [non-woven plastic bags] to be a *normal shopping bag* [single-use plastic bag]" (WRAP, 2015) and that "half of the respondents claimed that they did not re-use bags for life has time they went food shopping…" (WRAP, 2015), i.e. they forgot to bring them.

2.5.2 Ban on plastic bags

A plastic bag ban in considered as the prohibition from retailers to sale single-use plastic bags in a given territory. Several countries around the world have successfully implemented bans and many others are on their way. For instance, Philippines implemented in 2011 a "Total Plastic Bag Ban", which entails a strict system where retailers can only offer paper bags or biodegradable bags and those who disobey the law are punished through fines, revocation of business license or even prison (Hogaza, 2014).

In China, a ban was imposed in 2008 which has resulted in a decrease of 60% for local supermarkets against 80% for foreign- owned ones. Still, it is reported that at least 80% of supermarkets in rural areas did not stop providing with free single-use plastic bags due to more difficult control. (Block, 2013)

In a study undertaken by Piazza Research (2012) made in Canberra, Australia, attitudes of the habitants concerning a plastic bag ban implemented in 2011 were evaluated. The results showed that 84% of the shoppers brought their own reusable bag "always" or "most of the times", while only 3% never did bring them. Besides, in favor to the success of the ban, 84% admitted that as a consequence of such ban they now bring reusable bags when shopping. Also, 56% affirmed that they were already using reusable bags before the ban came into force. When respondents were asked whether they support the ban or not, 58% did, 33% did not, and 9% was not sure (Piazza Research, 2012). This study reflects, as in any other part of the world, the difficulty of reaching consensus regarding bans and the controversy of the matter.

2.5.3 Taxation or fees

Introducing taxes to plastic bag consumption is different than charging a fee. The first will usually consist in an imposition of taxes at a retailer level, which will eventually be paid indirectly by the consumers. The second consists of a fee that is charged directly to the consumer at the counter. In any case, Poortinga et al (2012) suggest that voluntary actions are half as effective as fees in order to reduce single-use plastic bag consumption and that, in England, 54% of the population is in favor for a plastic bag charge.

3. Materials and methods

In order to reflect the most accurately possible the social perceptions of the Balinese population regarding single-use plastic consumption, a questionnaire (see *Appendices III and IV*) in Indonesian was selected as the most suitable method. This method is appropriate for collecting data with large number of respondents in many locations, when the information required from the respondents is fairly brief and uncontroversial, the research requires standardized data, the respondents are able to understand the questions once considered factors like age and language, and the social climate is open enough to receive honest answers (Denscombe, 2010, p. 156).

The characteristics of this research required a method that allows the collection of quantitative data at the same time that provides opportunity to gather some qualitative data. Thus, the questionnaire consisted of close-ended questions with some of them containing an "other" or similar option to serve as open-ended questions. The first type provide standardized, pre-coded answers and data accuracy and the second allows for more scope for respondents to give answers that reflect better their real opinion (Denscombe, 2010, p. 165-166). The questions consisted of dichotomous, multiple choice and Likert scale ones, where considered suitable.

The software Microsoft Word 2013 was used for the creation of the questionnaire and Microsoft Excel 2013 for the tabulation of data and creation of graphs was considered appropriate.

3.1 Questionnaire structure

The questionnaire consisted of 17 questions divided into four parts, which measured:

Part I. Background information *(questions 1-3)*
Part II. Consumption behavior *(questions 4,5,7,9 and 10)*
Part III. Environmental impacts awareness *(questions 13-15)*
Part IV. Willingness to reduce consumption *(questions 6, 8, 11, 12, 16 and 17)*

Some questions focused specifically in plastic bags, while other in plastic bottles. However, there was a series of questions that contemplated both products in a single question, since it concerned the two single-use plastics.

Before handing the final questionnaire among potential respondents, 15 questionnaires were handed to a test group which, after having filled them up, provided valuable feedback. Corrections were made regarding the overall length of the questionnaire and several questions less relevant to the research were excluded while others were reformulated. The 15 responses gathered from the test group were not included in the total for the final questionnaire.

Instructions at the beginning of the questionnaire were facilitated, which included a short description of the purpose of it and a confidentiality statement. The language used in the survey was easy to understand and questions were formulated as short as possible to avoid loss of interest from the respondents. Indonesian was chosen as the most suitable language.

3.2. Location

The questionnaire took place in three different supermarkets around Bali: *Carrefour*, *Hypermart* and *Hardy's*. The first two are located in Kuta area, while the last one is in Nusa Dua. The reasons for choosing these three supermarkets are due to the fact that these are among the largest commercial centers or supermarkets in Bali, with high affluence of customers. This fact probably contributed to obtain higher responses rates, even though it would have been equally valid to obtain responses from any person who consumed plastic bottles or bags, independently that they were present where the actual consumption of these occurs.

As a subjective observation, it was noticed that, although in general in *Carrefour* the number of customers was higher than in the other two establishments, there was a more "rushy" atmosphere and less responses were gathered there. On the contrary, at the entrance of *Hypermart* and *Hardy's* there were benches and less customers around so people seemed more keen to participate in a more relaxed atmosphere. Two other large supermarkets, whose names have been preferred to be omitted in this report, were targeted for questionnaire sampling. Nevertheless, permission to distribute the surveys among their customers was denied by the management of the respective establishments.

The questionnaire was handed personally during 7 days on the afternoons, when more affluence of customers was found. The nature of this research implied an ample target group, which essentially includes any Balinese that consumes plastic bottles or bags. Thus, efforts were made to distribute the questionnaire among persons of all ages and gender, aiming to gather the greatest variety of responses possible.

4. Results

4.1 Background information

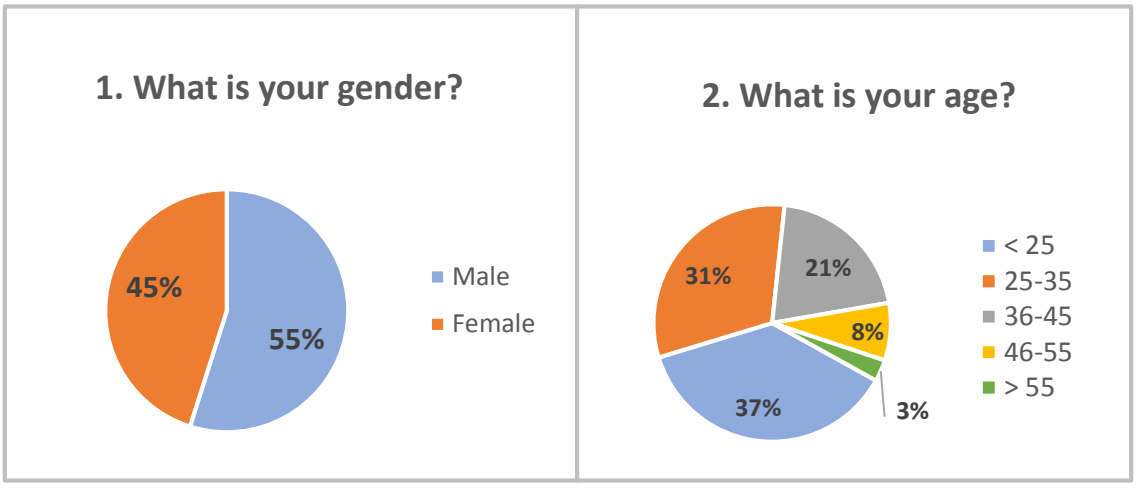

Figure 2. Gender of respondents

Figure 3. Age of respondents

In total, **102 responses** were obtained from the questionnaire distribution process. Among all the respondents 55% were male and 45% female (*Figure 2*). Efforts were made to hand out the questionnaires equitably within the potential respondents in order to gain representativeness from both genders and all age groups. *Figure 3* illustrates that the highest number of responses were from people under 25 years old (37%). Respondents between 25 and 35 years old correspond to the 31% of the samples, followed by 21% between 36 and 45 years old and then, 8% between 46 and 55 years old. The last group represents the respondents over 55 years old, with only 3% of the total.

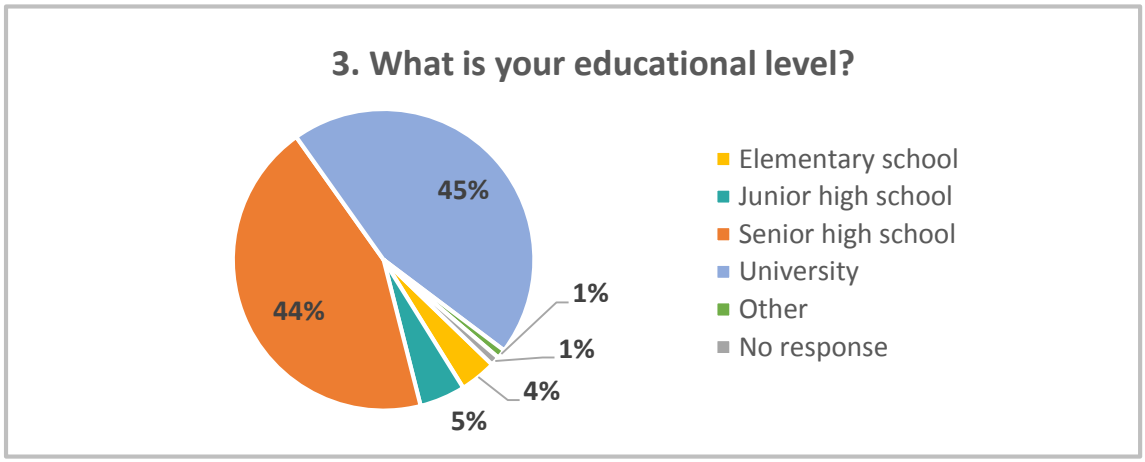

Figure 4. Educational level of respondents

As *Figure 4* shows, almost half of the respondents (45%) had attended to University and 44% of the respondents had attended to Senior high school. Regarding the rest of them, 5% attended to Junior high school, 4% to Elementary school, 1% to other type of education (no specification given) and 1% did not respond.

4.2 Consumption behavior

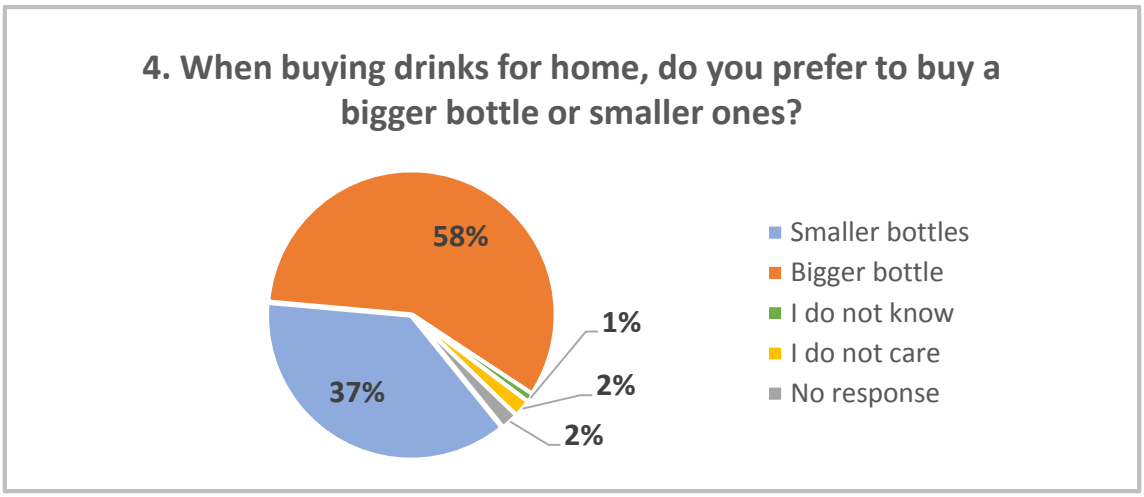

Figure 5. Beverage packaging size preferences

Question 4 was asked in order to explore Balinese's preferences regarding the bottle size of the drinks when buying drinks "for home". It is emphasized the fact of buying for home since it is assumed that, in general, beverage consumers that buy to drink "on the way" probably prefer a smaller bottle for mainly two reasons: a) they usually do not want to carry a larger, heavier bottle if they plan to drink it at the moment; and b) they most likely do not want to consume large amounts of a drink which is intended to be consumed in several servings.

This being clarified, 58% of the respondents preferred to buy a bigger bottle against 37% that would rather buy smaller ones instead. Only 1% did not know and 2% was indifferent. The rate of no responses stayed low at 2% (*Figure 5*).

Figure 6. Reasons to buy smaller bottles versus big ones

In relation to *question 5*, respondents who preferred to buy smaller bottles (i.e. only those who selected "smaller bottles" in *question 4*) were asked to choose between 5 reasons or to give another not already provided.

Respondents were given the opportunity to choose all options that apply, hence the results of *Figure 6* represent the frequency with which a given reasons was chosen. The most famous answer was that smaller bottles are "less expensive", selected by 18 respondents. As for the rest of the choices, the frequency with which these were chosen was relatively similar: 11 respondents claimed to prefer smaller bottles because they "do not have enough storage space at home", 9 because these "weigh less", 8 because they "prefer to buy smaller bottles more often", 7 because they "drink it faster and it does not get spoiled" and 5 selected "other" reasons. Among these other reasons, 3 did not specify, one respondent expressed that he consumed smaller bottles "according to necessity" and another one stated that the reason was "to give to the kids".

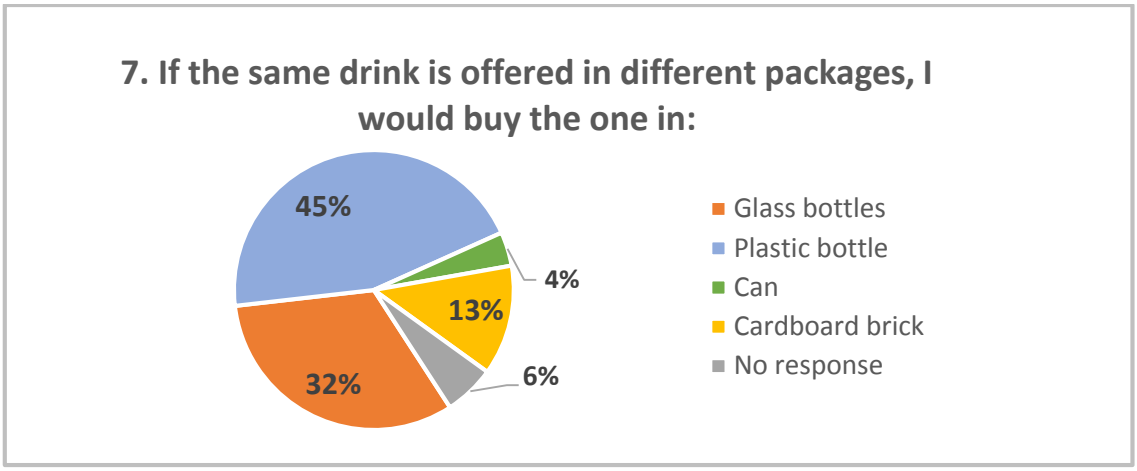

Figure 7. Bottle material preference.

The purpose of *question 7* question was to gain further knowledge regarding preferences of the Balinese population towards **plastic bottles**, where respondents were given to choose between different materials for beverage packaging: plastic, glass, can (aluminum) or cardboard.

Of all the respondents, 45% preferred plastic bottles over other materials, followed by 32% which chose glass bottles instead. Cardboard bricks accounted for the 13% of the responses, cans for the 4% and 6% did not respond to the question (*Figure 7*).

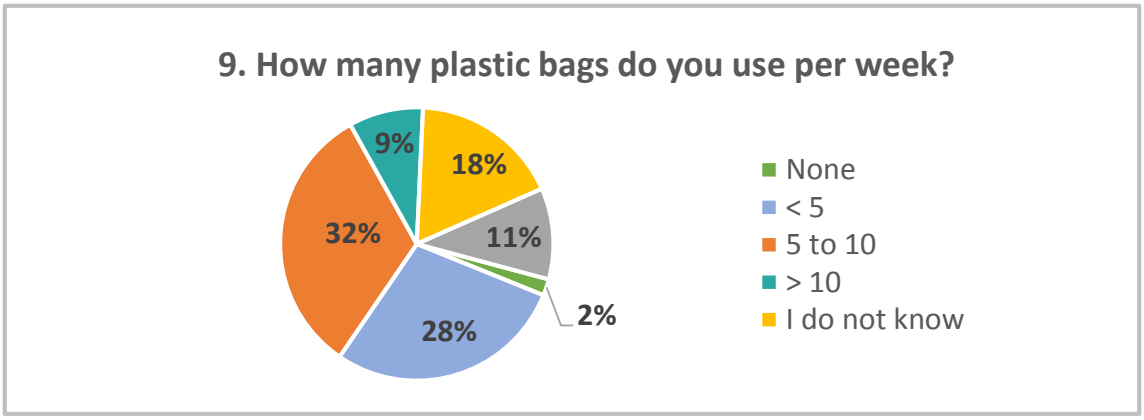

Figure 8. Number of plastic bags consumed per week

With aims to understand **plastic bags** consumption behaviors of the Balinese population, *question 9* was included in the questionnaire. The number of plastic bags used by the each individual is a major factor in determining the behavior towards single-use plastic consumption.

In *Figure 8* the responses are divided into 5 different groups in addition to the "no response" one. Only 2% of the respondents claimed that they used "none" plastic bags. At the same time, at least 28% uses less than 5 bags per week but the greater part of the responses corresponds to consumers of between 5 and 10 plastic bags per week (32%). In regards with those participants that consume more than 10 bags per week, 9 of them (9%) selected this option. A fairly large part of the respondents (18%) did not know how many bags the used and 11% did not respond at all.

Figure 9. Plastic bag usage

Almost half of the respondents (49%) claimed to reuse all of the plastic bags after they have used them for carrying their shopping home (*Figure 9*), which is the main purpose of single-use plastic bags. Moreover, 17% of the respondents confirmed that they "reuse some and throw some away", without delving into the quantity of bags that are reused and discarded respectively. Only 11% throw all of them away, i.e. they did not reuse the bags under any circumstances.

The option "I sell them" was included in the final questionnaire after receiving feedback from the test group, where 2 out of 15 respondents assured that they occasionally sell the plastic bags to "neighbors or whoever might need them". The fact that more than a single respondent answered that they sell the bags was considered a justifying factor to create a new category on its own, instead of considering them as "other" answers. However, only 1% of the respondents in the final questionnaire affirmed that they sell the bags (*Figure 9*), making it a fairly uncommon practice.

Among other practices carried out by the respondents, one of them assured that he/she "use[s] them to make crafts", and another one did not give an explanation but also selected "other" between the options. This two respondents accounted for 2% of the sample. The no-response rate reaches the 20% (*Figure 9*).

4.3 Environmental impacts awareness

Figure 10. Environmental impacts awareness

The purpose of *question 13* was to verify whether respondents believe that single-use plastic can have negative environmental impacts and, if affirmative, to identify which ones they believe to be harmful. The respondents, apart from the options "no" and "I do not know", they were given the chance to choose between three other options that already included three interrelated, yet independent, environments susceptible to plastic pollution (forests, rivers and oceans). Furthermore, a last option called "Yes. Other" was included to reflect the respondent's acknowledgment of the possibility for plastics to harm the Environment, but also to give opportunity to express his/her opinion on other impacts not considered.

The numbers on the left side of *Figure 10* represent the frequency that a given answer is chosen and the most frequented answer was that rivers are contaminated, which was selected 45 times. In second place, ocean pollution was chosen as one of the negative

impacts, with 42 responses. Moreover, at least 28 respondents believe that forests are polluted by single-use plastics. Among other impacts (21) not pre-defined within the options at least 8 respondents believed that "the land is contaminated", another one agreed that pollution occurs but claimed that "it cannot be analyzed" and the rest also agreed on it but did not explain further. On the other hand, 9 respondents believed that single-use plastics are *not* harmful to the Environment while one did not know.

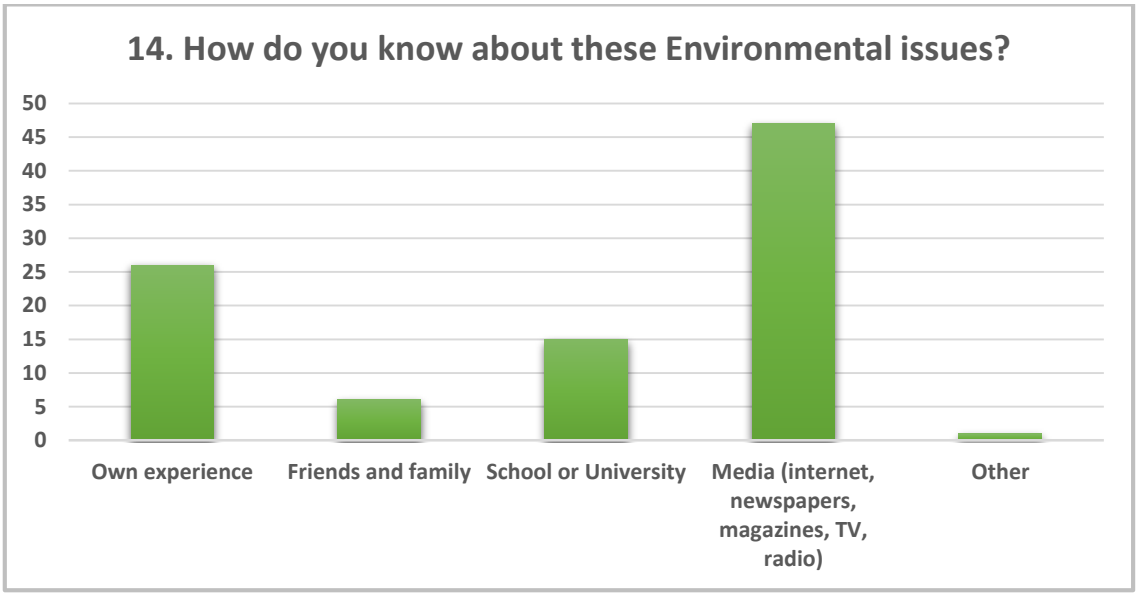

Figure 11. Information sources of environmental issues

Determining the sources of information from where the respondents obtained knowledge about the environmental impacts of plastic will help identify which channels are more effective in spreading information in the present context in Bali.

The graph above (*Figure 11*) illustrates how media is by far the most common source of information among respondents (47), including internet, newspapers, magazines, TV and radio. Following media, there is participant's own experiences (26), school or University (15) and family and friends (6). Lastly, one participant selected "other" sources of information but did not specify which one. Again, the numbers on the left side of *Figure 11* represent frequency and not percentage of answers.

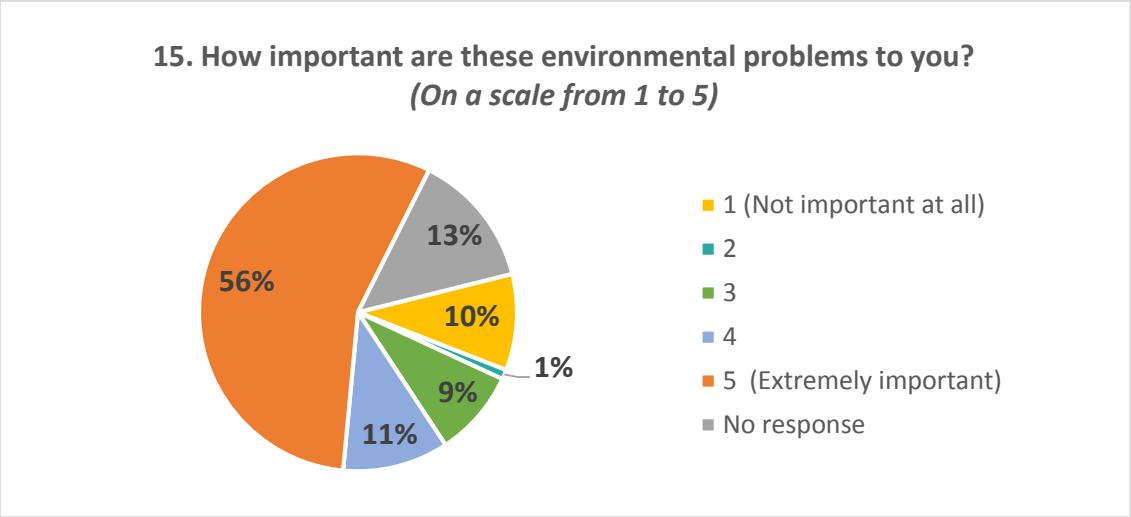

Figure 12. Importance of environmental issues (On a scale from 1 to 5)

A five point Likert scale was considered appropriate for measuring the degree of importance of environmental consequences to the respondents. Extremely important to the respondent is represented by number 5, while number 1 corresponds to not being important at all.

For the majority of the respondents (56%) environmental issues are "extremely important", as shown in *Figure 12*. On the other hand, these are "not important at all" for 10% of the participants. In between the two extremes, there is an 11% that considers these as very important (option 4), 1% as slightly important (option 2) and 9% as moderately important (option 3). No-response rate remains relatively high, with 13% of abstinence.

4.4 Willingness to reduce consumption

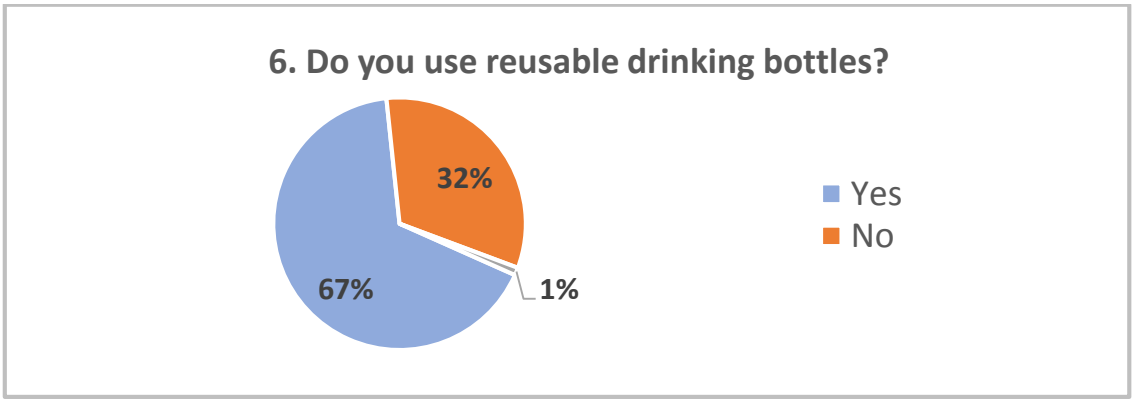

Figure 13. Reusable bottle usage

Approximately two thirds of the respondents assured that they use reusable drinking bottles (67%), while 32% denied making use of them. Only 1% of the participants did not respond to this question (*Figure 13*).

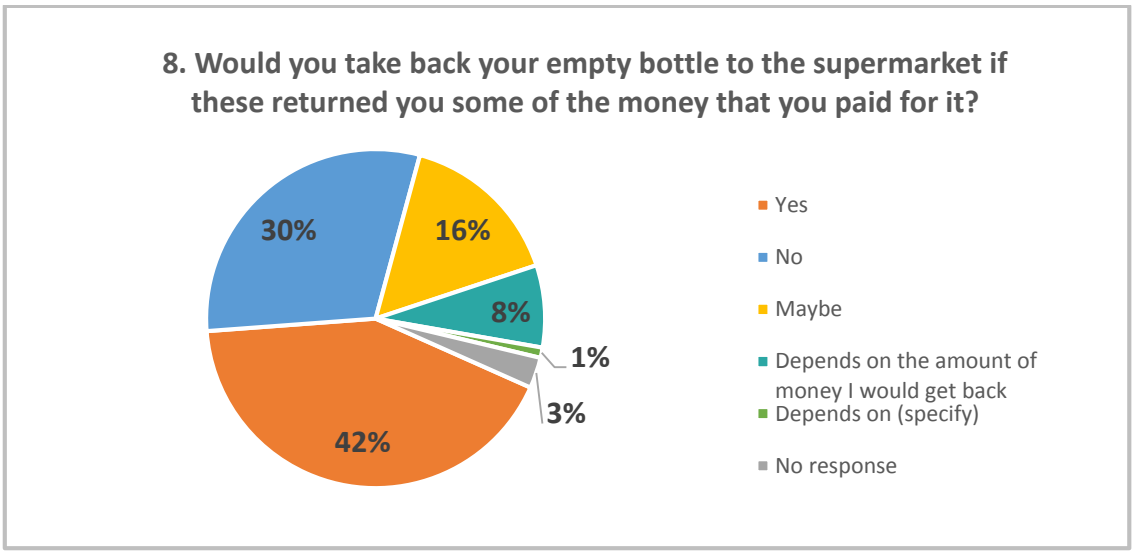

Figure 14. Returnable bottle system acceptance

Identifying willingness of Balinese to return the plastic bottles to a store or supermarket in exchange of some of the money they paid for these will help determine whether it would be feasible or not to introduce a returnable bottle system with container deposits in the island.

Results in *Figure 14* illustrate how 42% of the respondents would be willing to return their bottles to the supermarket if they received "some of the money" back. Furthermore, 16% would "maybe" accept to return these, 8% would do depending on the amount of money received back and 1% did not give an explanation to "depends on (specify)". On the contrary, 30% of the participants would not return the bottles to the supermarket.

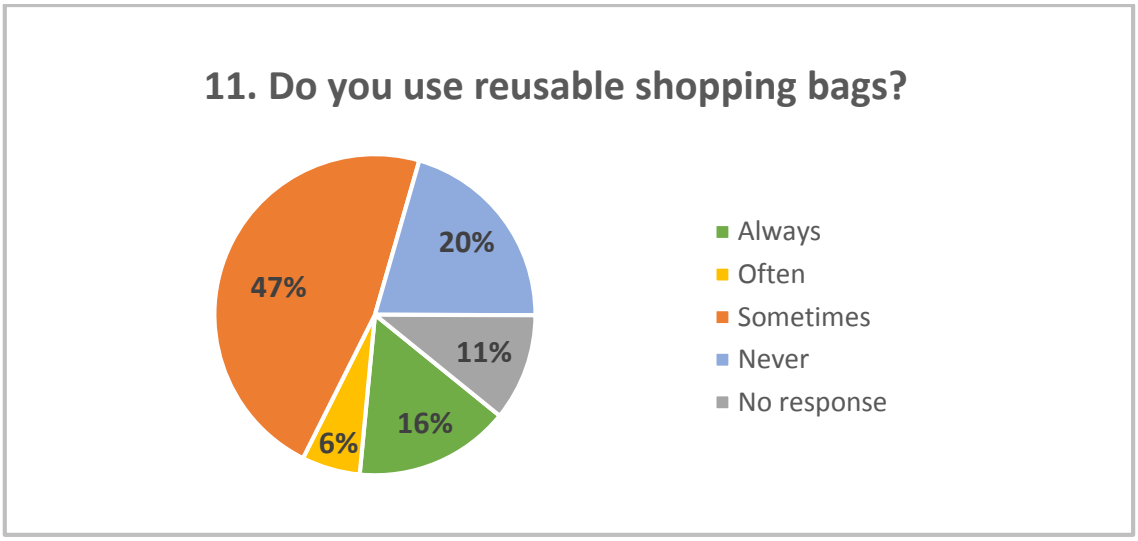

Figure 15. Reusable shopping bag usage

The use of reusable shopping bags implies the less consumption of single-use plastic bags. The intention of *question 11* was to determine whether the Balinese have knowledge of reusable shopping bags and how often they use these. The terms "reusable shopping bags" involved any type of reusable bags, like cloth, jute, hemp or thicker plastic.

Among the respondents that used reusable bags, a large part (47%) claimed to sometimes use them, whereas 6% would often make use of them and 16% assured that they always use them. On the other hand, 20% of the participants admitted to never use them. The no-response rate in this question reached 11% (*Figure 15*).

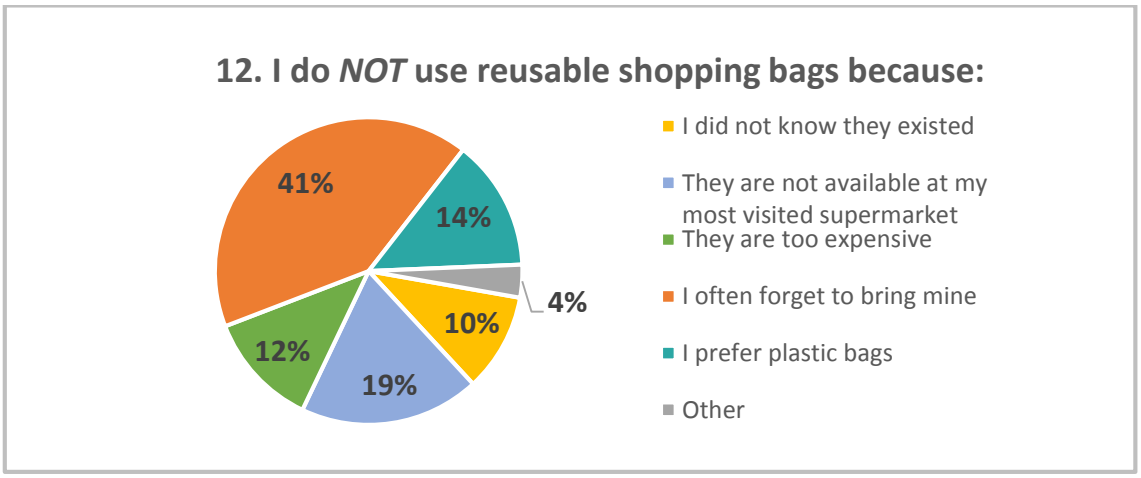

Figure 16. Reasons for not using reusable bags

Understanding the reasons for not utilizing reusable bags is of significant importance to this research, since encouraging the further use of them by Balinese is one of the key recommendations to reduce plastic bags consumption.

In *Figure 16* it is shown the reasons for not using reusable bags and the most common is that respondent's often forget to bring their own to the store (28%). Followed by this, 15% of them stated that reusable bags are not available at their most visited supermarket, 9% prefer to use plastic bags, 8% responded that these are too expensive and 7% is unaware of the existence of these type of bags.

On open answer was provided with the option "other" but no responses were obtained in this category. Regarding the rate of no responses, this question obtained the highest rate within the questionnaire (33%).

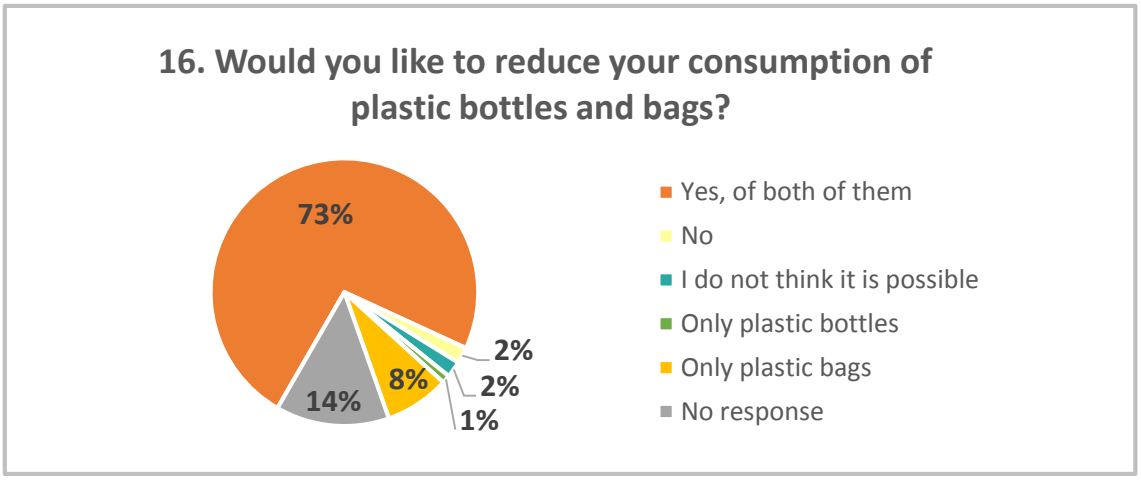

Figure 17. Willingness to reduce single-use plastic consumption

When respondents were directly asked if they are willing to reduce the amount of plastics that they consume 73% agreed to do so for both bags and bottles (*Figure 17*). Roughly 8% would like to reduce only their plastic bags consumption and 1% only plastic bottles. On the contrary, 2% of the participants would not like to reduce it and another 2% do not believe it is feasible. No response rate obtained is 14%.

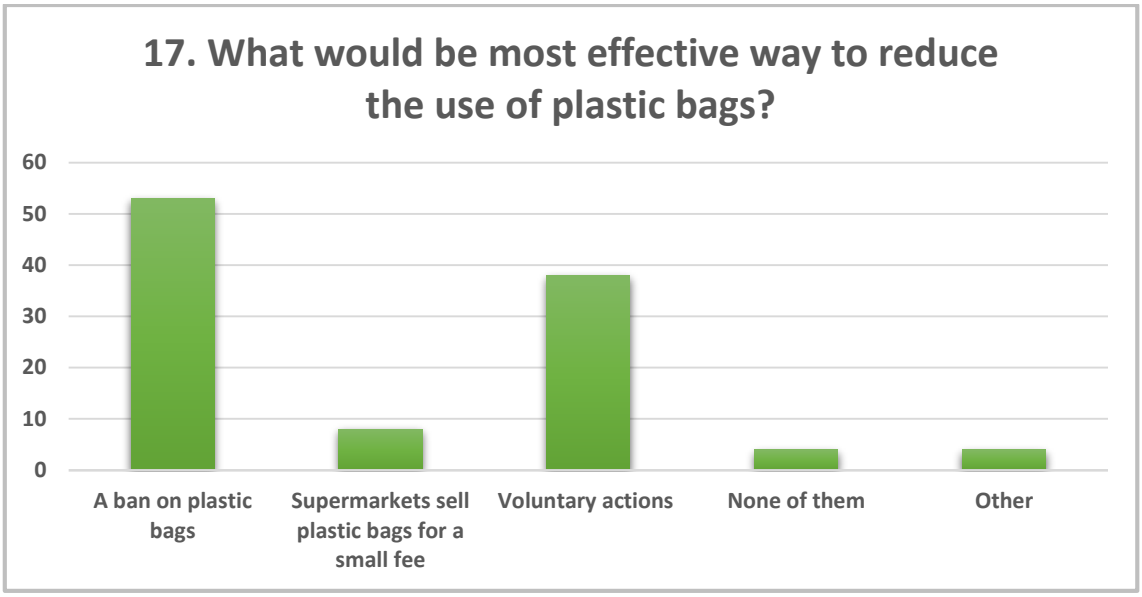

Figure 18. Acceptance of strategies to reduce plastic bags consumption

In *Figure 18* it can be observed a series of potential strategies to reduce the use of plastic bags and respondent's preferences towards them. Furthermore, an open option ("other") was provided to allow respondents to express their opinion on the most effective strategy. In this graph (*Figure 18*) the numbers found on the left side correspond to the frequency that a given answer is selected.

The answer selected the most times was "a ban on plastic bags, so customers would have to bring their own reusable bags" (53). In second place, the respondents believe that voluntary actions are the most effective method (38). In a much lesser frequency, 8 respondents believe that supermarkets should sell plastic bags for a small fee and 4 of them disagreed that any of the provided strategies are suitable. Among the 4 respondents that chose "other" strategies, answers such as "with Government policy and increase of awareness" or "replacing plastic bags for cardboard boxes" were given (*Figure 18*).

5. Discussion

It is important to notice that the responses of the questionnaire represents 89% of "highly" or "moderately high" educated Balinese, which could mean either that a large part of the population is actually highly or moderately high educated, or that only that niche of the population was keen to participate in the survey.

The assessment of bottle size preferences of the Balinese population is based on the assumption that a person that usually consumes smaller bottles increases the chances of more plastic bottles spread into the environment, as more bottles would need to be consumed to equal the amount of one bigger bottle. For example, 6 bottles of 33cl. will be needed to equal a single bottle of 2 liters. However, 58% of the Balinese showed preference for bigger bottles which can be considered a more environmentally-friendly choice, as less plastic would be consumed. On the contrary, more than one third still prefers smaller bottles mostly because it is less expensive to buy smaller quantities or because there is not enough storage space at their homes.

In regards to material preference of the bottles, despite almost one third of the population preferring glass over other materials like plastic, aluminum and cardboard, the largest part would choose plastic bottles (45%). This fact reflects the more positive attitude of the Balinese towards plastics when given the chance to choose the same product in different beverage materials.

As for single-use plastic bags, the largest part of the population uses a moderate amount of plastic bags per week (between 5 and 10). Nevertheless, it cannot be considered as a strongly significant result since almost the same proportion of population (28% against 32%) consumes less than 5 plastic bags per week, interpreted as low consumption. Still, 18% was unsure of how many bags they consumed per week. Moreover, without exploring the different uses given to plastic bags, almost half of the population affirms that gives at least one more use to these. This last fact, although positive in terms of lowering the environmental footprint, does not mean that the plastic bags will not end up in the landfill or incinerated in any case. In addition, 11% of the Balinese still throw all of them away, 17% store some and throw some away and an outstanding 20% did not respond, perhaps feeling uncomfortable with the question. In this way, there is still possibilities to keep improving the situation, with ideally (but unrealistically) all the Balinese population reusing plastic bags as many times as possible.

Since the core question raised in this research is to determine the social perception of Balinese towards single-use plastic bags and bottles, mainly through their consumption

habits, the researcher can conclude that Balinese seem to have a more negative perception of single-use plastics rather than positive. For example, they prefer to consume bigger bottles, their plastic bag usage is low-moderate in general and roughly half the population reuses them at least once. At this point, it is still unclear whether environmental concerns are the motivating factor for this general negative perception but the fact that environmental issues are "extremely important" for the majority (56%) of the population suggests that this is the case. On the other hand, there is still a relatively fair proportion of the population whose habits are more directed towards a positive perception regarding plastics. Therefore, it can only be concluded with certainty that consumption habits can still be changed for that part of the population in order to keep improving the situation.

Is the Balinese community aware of the environmental impacts of plastic bottles and bags? Contamination of oceans and rivers are the most famous issues among the Balinese people according to the results of this study. As Barnes et al (2009) claimed, marine ecosystems can be harmed due to plastic ingestion and entanglement of animals, and the Balinese population seem to be aware of it. The same situation occurs with rivers, where the Ministry of Environment assures that 52 rivers are currently polluted (The Bali Times, 2013). No literature was found regarding forest or land pollution, which a considerable number of respondents believed to be an issue as well, but it can be assumed that entanglement and ingestion of animals from both ecosystems could also be of concerns.

Interestingly, the second channel from which the Balinese people gain knowledge about this environmental issues is through own experiences. Nevertheless, media is by far the most effective channel in transmitting this issues. It is important, then, to explore possibilities to increase education and to further exploit the media source. This will be tackled in the discussion section, where recommendations will be given.

Thus, it can be concluded that the Balinese community is fairly aware of the environmental issues concerning single-use plastics because these are, in general, extremely important to them, or vice versa. The fact that they are aware of it could make it more important to them.

Lastly, in spirits of giving answer to whether the Balinese population is willing to reduce their single-use plastic consumption, it is important to clarify that there is hesitation

regarding the validity of *question 6* ("Do you use reusable drinking bottles?"). The reasons to suggest this is because the Indonesian version of the survey translates the terms as "bottles that can be reused" instead of "reusable bottles". This might not seem an important difference but it could be if it is taken into account that "reusable bottles" was intended to be understood as bottles than can be reused many times and not single-use bottles that are used more than once, which is not recommended due to higher risks of BPA leaching (Ellsbury, 2012). Therefore, it is not clear which of the two options respondents understood and, in this way, there is a possibility of misinterpreting results since an unexpected 67% of the population claimed to use reusable drinking bottles.

In regards to reusable shopping bags, it can be stated that 69% of the population makes use of reusable shopping bags in one degree or another, since 47% affirmed that they sometimes use them, 16% always, and 6% often. Among those who do not use reusable shopping bags at some point, the most common reasons are that they often forget to bring theirs and that supermarkets do not offer them. Recommendations in the discussion section of this research will be described offering possible solutions.

The largest part of the population would agree to the implementation of a Container Deposit Scheme (CDS), with 42%. This system will not necessarily reduce the consumption of plastic bottles, but will reduce the risk of spreading them into the environment and raise recycling rates among other benefits, as discussed in the literature review (Clean up Australia, w.y.; New Zeland's Zero Waste Plan, 2002). Conversely, a similar proportion of the population (30%) would not support a CDS while the rest was unsure. Thus, the implementation of a CDS is not strongly supported and its viability in Bali is not certain.

It is not clear whether a plastic bag ban or voluntary actions are the most effective methods to reduce plastic bags usage. Only a few more responses were obtained in favor of a ban. Contradiction is found since this two strategies are completely opposed by definition and, therefore, cannot be combined. Charging per bags used in supermarkets in considered unviable. In this sense, a larger sample size could throw more light into this matter, hence further exploration should be done. On the contrary, the researcher can state with certainty, if assuming that the attitude-behavior gap discussed previously by d'Astous and Legendre (2009) does not take place, that the great majority of Balinese people (73%) is

willing to reduce their consumption of both plastic bottles and bags.

In general, all the results gathered in this study are limited to the relatively short number of samples (102 responses) considering that these intend to represent the views of the whole local population in Bali. In this sense, financial and time resources to utilize a questionnaire that would access to a much larger group are two constraints for this study that should be taken into account for further research in the future.

6. Conclusions

Bali is experiencing an uncontrolled booming in tourism during the past few years, going from 1.968.892 tourists in 2008 to 3.766.638 in 2014 (BGTO, 2015). This fact is creating enormous pressures in the island related to space planning, water resources, energy resources and increasing pollution. While it is probable that the neighbor island of Java, the most populated in Indonesia with 58% of the country's total population 237,424,363 inhabitants (World Population Review, 2014), contribute to the debris arriving to the Balinese coastline, it is undeniable that internal pressures coming from the local population also occur as a result of their own development and habits.

The more contaminated and overdeveloped the island is, the less income the local economy would receive due to less tourist visiting it. Hence, the Government, noticing such counterproductive development decided to launch the "Bali Clean and Green Program" in 2010. According to the BCGP (2011) the program aims to make "with all components of the Balinese people… a clean, healthy, comfortable, sustainable and beautiful for present and future generations towards the achievement of Bali, an advanced, secure, peaceful and prosperous" (BCGP, 2011). And to fulfill its goal it thrives to increase awareness in conservation areas, to carry out a sustainable development and to maintain a clean and healthy environment (BCGP, 2011).

In line with the goals set by the BCGP, this research ultimately aspires to serve as a source of information for any interested party, by presenting the actual challenges that the island is facing in regards to single-use plastics, habits around them and proposing suggestions for achieving a cleaner Bali.

Firstly, more initiatives boosting the use of reusable bags would be highly recommended. The recycling rates in Indonesia in general are low and, although there are organizations and private companies developing a recycling infrastructure, this is still hugely underdeveloped. For this reason, the researcher believes that a focus in reducing and reusing rather than recycling would be more effective in the short-term given the actual context. Already some organizations and companies are taking actions towards this. For instance, Greeneration Indonesia has developed a reusable bag that can be easily folded and carried, which decreases the chances of forgetting the bag at home (baGOES, 2015).

Moreover, efforts should be made in regards to availability of reusable bags at supermarkets and stores. Economic incentives could be granted to those supermarkets that sells reusable bags.

Secondly, the fact that the Balinese people is aware of the environmental problems through own experience could imply that they are affected directly or that it is something they often witness. Media sources like internet, television, newspapers and radio should be used more wisely and provide enough attention to raising awareness. This is, mass education to drive the local community towards more sustainable practices. In the same way, environmental education at schools should pay a more important role than it nowadays does.

The Green School in Bali is a successful example of environmental education from early stages of human development. Recently, a group of students from that school engaged in an initiative to implement a plastic bag ban which so far has managed to make Governor Bapak Made Mangku Pastika "to sign a Memorandum Of Understanding to take measures that will see the use of plastic bags minimized on Bali by January 1, 2016" (Green School, 2014). However, the results of the present research indicate that, although the Balinese agree that a plastic bag ban is the most effective strategy to follow, voluntary actions were considered to be almost equally effective. Then, local consensus needs to be reached with high community participation in order to develop further one of the strategies.

Lastly, the implementation of a Container Deposit Scheme should still be researched more thoroughly despite the results obtained in this paper being somewhat favorable. The division of opinions did not allow to strongly conclude that the Balinese community

would agree on a CDS. However, increasing knowledge among the population about the benefits of this system and other types of incentives, like discounts in the total purchase, could imply higher acceptance. A CDS could provide a formal bottle recycling infrastructure that would substitute the current informal sector (Chaerul et al, 2006).

All in all, these recommendations previously mentioned would contribute to steer the Balinese sociality towards more sustainable practices with aims to preserve their environment and own health in line with the island's economic interests.

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APPENDIX I

Resin types by code

Plastic Identification Code	Type of plastic polymer	Properties	Common Packaging Applications
	Polyethylene Terephthalate (PET, PETE)	Clarity, strength, toughness, barrier to gas and moisture.	Soft drink, water and salad dressing bottles; peanut butter and jam jars
	High Density Polyethylene (HDPE)	Stiffness, strength, toughness, resistance to moisture, permeability to gas	Milk, juice and water bottles; trash and retail bags.
	Polyvinyl Chloride (V)	Versatility, clarity, ease of blending, strength, toughness	Juice bottles; cling films; PVC piping
	Low Density Polyethylene (LDPE)	Ease of processing, strength, toughness, flexibility, ease of sealing, barrier to moisture.	Frozen food bags; squeezable bottles, e.g. honey, mustard; cling films; flexible container lids.
	Polypropylene (PP)	Strength, toughness, resistance to heat, chemicals, grease and oil, versatile, barrier to moisture	Reusable microwaveable ware; kitchenware; yogurt containers; margarine tubs; microwaveable disposable take-away containers; disposable cups and plates.
	Polystyrene (PS)	Versatility, clarity, easily formed	Egg cartons; packing peanuts; "Styrofoam"; disposable cups, plates, trays and cutlery; disposable take-away containers;
	Other (often polycarbonate or ABS)	Dependent on polymers or combination or polymers	Beverage bottles; baby milk bottles; electronic casing.

APPENDIX II

Mismanaged plastic waste ranking

Waste estimates for 2010 for the top 20 countries ranked by mass of mismanaged plastic waste (in units of millions of metric tons per year).
Econ classif., economic classification; HIC, high income; UMI, upper middle income; LMI, lower middle income; LI, low income (World Bank definitions based on 2010 Gross National Income). Mismanaged waste is the sum of inadequately managed waste plus 2% littering. Total mismanaged plastic waste is calculated for populations within 50 km of the coast in the 192 countries considered. pop., population; gen., generation; ppd, person per day; MMT, million metric tons.

Rank	Country	Econ. classif.	Coastal pop. [millions]	Waste gen. rate [kg/ppd]	% plastic waste	% mismanaged waste	Mismanaged plastic waste [MMT/year]	% of total mismanaged plastic waste	Plastic marine debris [MMT/year]
1	China	UMI	262.9	1.10	11	76	8.82	27.7	1.32–3.53
2	Indonesia	LMI	187.2	0.52	11	83	3.22	10.1	0.48–1.29
3	Philippines	LMI	83.4	0.5	15	83	1.88	5.9	0.28–0.75
4	Vietnam	LMI	55.9	0.79	13	88	1.83	5.8	0.28–0.73
5	Sri Lanka	LMI	14.6	5.1	7	84	1.59	5.0	0.24–0.64
6	Thailand	UMI	26.0	1.2	12	75	1.03	3.2	0.15–0.41
7	Egypt	LMI	21.8	1.37	13	69	0.97	3.0	0.15–0.39
8	Malaysia	UMI	22.9	1.52	13	57	0.94	2.9	0.14–0.37
9	Nigeria	LMI	27.5	0.79	13	83	0.85	2.7	0.13–0.34
10	Bangladesh	LI	70.9	0.43	8	89	0.79	2.5	0.12–0.31
11	South Africa	UMI	12.9	2.0	12	56	0.63	2.0	0.09–0.25
12	India	LMI	187.5	0.34	3	87	0.60	1.9	0.09–0.24
13	Algeria	UMI	16.6	1.2	12	60	0.52	1.6	0.08–0.21
14	Turkey	UMI	34.0	1.77	12	18	0.49	1.5	0.07–0.19
15	Pakistan	LMI	14.6	0.79	13	88	0.48	1.5	0.07–0.19
16	Brazil	UMI	74.7	1.03	16	11	0.47	1.5	0.07–0.19
17	Burma	LI	19.0	0.44	17	89	0.46	1.4	0.07–0.18
18*	Morocco	LMI	17.3	1.46	5	68	0.31	1.0	0.05–0.12
19	North Korea	LI	17.3	0.6	9	90	0.30	1.0	0.05–0.12
20	United States	HIC	112.9	2.58	13	2	0.28	0.9	0.04–0.11

*If considered collectively, coastal European Union countries (23 total) would rank eighteenth on the list

APPENDIX III

Survey (English version)

Survey No. _____

- *The purpose of this survey is to measure Balinese's opinions regarding the consumption of two **single-use plastic** products: plastic bottles and plastic bags.*
- *Your response will be strictly confidential.*
- *The results of this survey will be used in a bachelor's thesis for Novia UAS.*

1. What is your gender?

a) ☐ Male b) ☐ Female

2. What is your age?

a) ☐ < 25 b) ☐ 25-35 c) ☐ 36-45 d) ☐ 46- 55 e) ☐ > 55

3. What is your educational level?

a) ☐ No studies b) ☐ Elementary school c) ☐ Junior high school
d) ☐ Senior high school e) ☐ University f) ☐ Other: _____

4. When buying drinks for home, do you prefer to buy a bigger bottle or smaller ones?

a) ☐ Smaller bottles b) ☐ Bigger bottle c) ☐ I do not know d) ☐ I do not care

5. *Answer ONLY if you selected "a" in the previous question*.

Why do you prefer to buy the smaller bottles when buying drinks for home?

(Select all that apply)

a) ☐ They weigh less
b) ☐ I prefer to buy smaller bottles more often
c) ☐ I do not have enough storage space at home
d) ☐ I drink it faster and it does not spoil
e) ☐ It is less expensive
f) ☐ Other: _____

6. Do you use reusable drinking bottles?

a) ☐ Yes b) ☐ No

7. If the same drink is offered in different packages, I would buy the one in:

a) ☐ Glass bottle b) ☐ Plastic bottle c) ☐ Can d) ☐ Cardboard brick

8. Would you take back your empty bottle to the supermarket if they returned you some of the money that you paid for it?

a) ☐ Yes b) ☐ No c) ☐ Maybe
d) ☐ Depends on the amount of money I would get back
e) ☐ Depends on: _____

9. How many plastic bags do you use per week?

a) ☐ None b) ☐ < 5 c) ☐ 5 – 10 d) ☐ > 10 e) ☐ I do not know

10. *Skip this if you answer "a" in the previous question*.
What do you do with the plastic bags once you have used them for carrying your shopping home?

a) ☐ I throw them away b) ☐ I reuse some and throw some away
c) ☐ I reuse all of them d) ☐ I sell them
e) ☐ Other: _____

11. Do you use reusable shopping bags?

a) ☐ Always b) ☐ Often c) ☐ Sometimes d) ☐ Never

12. *Skip this if you answered "a" in the previous question.*
I do not use reusable shopping bags because:

a) ☐ I did not know they existed b) ☐ They are not available at my most visited supermarket
c) ☐ They are too expensive d) ☐ I often forget to bring mine
e) ☐ I prefer plastic bags f) ☐ Other: _____

13. Do you think that single-use plastics (bottles and bags) can harm the Environment?
(Select all that apply)

a) ☐ No b) ☐ I do not know c) ☐ Yes. Rivers are polluted
d) ☐ Yes. Oceans are polluted e) ☐ Yes. Forests are polluted
f) ☐ Yes. Other: _____

14. *Skip this if you answered "a" or "b" in the previous question.*
How do you know about these Environmental issues? *(Select all that apply)*

a) ☐ Own experience b) ☐ Friends and/or family c) ☐ School or University
d) ☐ Media (internet, newspapers, magazines, TV, radio) d) ☐ Other: _____

15. How important are these environmental problems to you? *(On a scale from 1 to 5)*
(not important at all) 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ (extremely important)

16. Would you like to reduce your consumption of plastic bottles and bags?

a) ☐ Yes, of both of them b) ☐ No c) ☐ I do not think it is possible
d) ☐ Only bottles e) ☐ Only plastic bags

17. What would be the most effective way to reduce the use of plastic bags?
(Select all that apply)

a) ☐ A ban that prohibits supermarkets and stores to give plastic bags, so customers would have to bring their own reusable bags
b) ☐ Supermarkets and stores would sell each plastic bag for a small fee
c) ☐ Voluntary actions
d) ☐ None of them
e) ☐ Other: _____

If you wish to receive a summary of the results, please indicate your e-mail: _____

Thank you for your participation.

APPENDIX IV

Survey (Indonesian version)

Survei no. _____

- *Tujuan dari survei ini adalah untuk mengukur besarnya opini Masyarakat Bali mengenai konsumsi produk plastik yang sekali pakai seperti: botol plastik dan kantong plastik.*
- *Tanggapan Anda akan dirahasiakan.*
- *Hasil survei ini akan digunakan dalam tesis untuk Novia UAS.*

1. Apa jenis kelamin Anda?
a) ☐ Laki-laki b) ☐ Perempuan

2. Berapa usia Anda?
a) ☐ < 25 b) ☐ 25-35 c) ☐ 36-45 d) ☐ 46- 55 e) ☐ > 55

3. Apa tingkat pendidikan Anda?
a) ☐ Tidak pernah sekolah b) ☐ Sekolah dasar c) ☐ Sekolah Menengah Pertama
d) ☐ Sekolah Menengah Atas e) ☐ Universitas f) ☐ Lainnya: _____

4. Ketika anda membeli minuman untuk dirumah, apakah Anda lebih memilih untuk membeli botol yang lebih besar atau botol yang lebih kecil?
a) ☐ Botol kecil b) ☐ Botol yang lebih besar c) ☐ Tidak tahu d) ☐ Tidak peduli

5. *Jika Anda memilih opsi "a" pada pertanyaan sebelumnya.*
Mengapa Anda lebih memilih untuk membeli botol kecil untuk minuman di rumah? (Pilih beberapa opsi berikut dibawah)
a) ☐ Mereka beratnya kurang
b) ☐ Saya lebih memilih untuk membeli botol kecil lebih sering
c) ☐ Saya tidak memiliki ruang penyimpanan yang cukup di rumah
d) ☐ Saya minum lebih cepat dan minuman tidak merusak
e) ☐ Hal ini lebih murah
f) ☐ Lain-lain: _____

6. Apakah anda menggunakan botol minuman yang dapat digunakan kembali?
a) ☐ Ya b) ☐ Tidak

7. Jika minuman yang sama ditawarkan dalam paket yang berbeda, saya akan membeli:
a) ☐ Botol kaca b) ☐ Botol plastik c) ☐ Kaleng d) ☐ Lertas kartun

8. Apakah Anda mengambil kembali botol kosong yang anda gunakan di supermarket jika mereka mengembalikan beberapa uang anda dengan menukarkan botol yang anda gunakan sebelumnya?
a) ☐ Ya b) ☐ Tidak c) ☐ Mungkin d) ☐ Tergantung pada jumlah uang yang saya akan dapatkan kembali e) ☐ Tergantung: _____

9. Berapa banyak kantong plastik yang Anda gunakan dalam waktu seminggu?
a) ☐ Tidak ada b) ☐ < 5 c) ☐ 5-10 d) ☐ > 10 e) ☐ Tidak tahu

10. *Lewati pertanyaan ini jika Anda menjawab opsi "a" pada pertanyaan sebelumnya.*
Apa yang Anda lakukan dengan kantong plastik tersebut setelah Anda menggunakannya untuk membawa pulang belanja Anda?
a) ☐ Membuangnya b) ☐ Menggunakannya kembali dan membuangnya sebagian
c) ☐ Menggunakan kembali kantong plastik tersebut d) ☐ Menjual kantong plastik tersebut
e) ☐ Lain-lain: _____

11. **Apakah Anda menggunakan tas belanja (berbahan kain) yang dapat digunakan kembali?**
a) ☐ Selalu b) ☐ Sering c) ☐ Kadang-kadang
d) ☐ Tidak pernah

12. *Lewati pertanyaan ini jika Anda menjawab opsi "a" pada pertanyaan sebelumnya diatas.*
Saya tidak dapat menggunakan kembali tas kain tersebut karena:
a) ☐ Tidak tahu apa yang itulah
b) ☐ Mereka tidak tersedia di supermarket yang saya sering saya kunjungi
c) ☐ Biaya terlalu mahal
d) ☐ Sering lupa untuk membawanya
e) ☐ Lebih memilih menggunakan kantong plastik
f) ☐ Lain-lain: _____

13. Apakah Anda berpikir jika anda menggunakan bahan plastik (botol plastik, tas plastik dan paket makanan) dapat merusak Lingkungan? (Pilih semua opsi yang berlaku)
a) ☐ Tidak b) ☐ Tidak tahu c) ☐ Ya. Dapat mencemari sungai
d) ☐ Ya. Dapat mencemari lautan e) ☐ Ya. Dapat mencemari hutan
f) ☐ Ya. Lainnya:_____

14. *Lewati ini jika Anda menjawab opsi "a" atau "b" pada pertanyaan sebelumnya diatas.*
Bagaimana Anda mengetahui tentang masalah-masalah lingkungan? (Pilih semua yang berlaku)
a) ☐ Pengalaman Sendiri b) ☐ Teman-teman atau keluarga c) ☐ Sekolah atau Universitas
d) ☐ Media (internet, koran, majalah, TV, radio) e) ☐ Lain-lain:_____

15. Seberapa pentingkah masalah-masalah lingkungan bagi Anda? (Pada skala 1 sampai 5)
(Tidak penting sama sekali) 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ (sangat penting bagi saya)

16. Apakah Anda ingin mengurangi penggunaan bahan yang terbuat dari botol plastik dan kantong plastik?
a) ☐ Ya, keduanya b) ☐ Tidak c) ☐ Tidak mungkin d) ☐ Hanya botol saja
e) ☐ Hanya kantong plastik saja

17. Bagaimana cara yang paling efektif untuk mengurangi penggunaan kantong plastik? (Pilih semua opsi yang berlaku)
a) ☐ Larangan supermarket dan toko-toko untuk menyediakan kantong plastik, sehingga pelanggan harus membawa tas daur ulang sendiri
b) ☐ Supermarket dan toko-toko akan menjual setiap kantong plastik dengan biaya yang murah
c) ☐ Tindakan sukarela (dengan kesadaran sendiri)
d) ☐ Jawaban "a", "b", dan "c" semua salah
e) ☐ Lain-lain: _____

Jika Anda ingin menerima hasil survey ini (dalam bahasa Inggris), silahkan menuliskan e-mail Anda:
_____

Terima kasih atas partisipasinya.