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The Uptake of Container Deposit Schemes: A Case Study in Perth, Western Australia

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Abstract: The environmental impacts of single-use plastics are increasing worldwide due to the continual rise in consumption and a lack of appropriate collection and management systems in many countries. Various programs, known as container deposit schemes (CDS), have been implemented to improve the collection and recycling of single-use plastic containers. This research investigated the drivers and barriers of CDS uptake in Perth, Western Australia. The study surveyed over 400 individuals within Perth regarding their engagement with and usage of the local CDS, known as "Containers for Change", which was implemented in October 2020. This research found that there is a high level of public awareness (98%) of the scheme, and it has been widely adopted across Perth within the first year of its implementation; however, logistical challenges and container eligibility were found to be key barriers to the uptake of the scheme. It was noted that there is some skepticism toward waste management practices in Australia, and knowledge of the benefits of CDS appears to be lacking. Recommendations for improving the functionality and uptake of the Containers for Change scheme are to increase the range of bottles accepted within the scheme, create more accessible and convenient drop-off locations for containers, and improve/increase education regarding the benefits of the scheme. This research is limited by a response rate that was dominated by individuals living in stand-alone houses; however, with the majority of Perth residents living in stand-alone houses, this research remains valuable. There is scope for further research into skepticism regarding waste management practices in Australia, as well as the logistical challenges of CDS uptake by apartment dwellers.

Keywords: container deposit scheme; municipal solid waste; environmental behavior; circular economy; Australia

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1. Introduction

The generation of excessive quantities of waste is a growing issue globally, with 7–10 billion tonnes of urban waste generated every year [1]. Some of this waste is single-use and is unnecessarily generated, as many products are now being designed for obsolescence [1]. Worldwide, around 150 million tonnes of single-use plastics are produced annually, with the fossil fuels utilized in this process generating approximately 7 million metric tons of greenhouse gases [2]. The current linear consumption model involves the processes of extraction, manufacturing, consumption, and disposal of products [3]. Scholars have labeled this process "planned obsolescence", and have noted it to be "one of the most environmentally unsustainable production strategies that corporations ever invented" [3]. Research has found that plastic pollution and waste are the outcome of a linear economic model that unidirectionally extracts resources and transforms them into a product to be used momentarily and then discarded [4]. This rapid consumption and the disposal of materials and resources have significant negative impacts on public health and the environment [1]. A paradigm shift is necessary to move toward a circular economy, moving away from the linear consumption model [1,3]. Utilizing circular economy approaches reduces the demand for virgin materials while simultaneously reducing waste that is

sent to landfills or otherwise disposed of [5]. However, it also extends beyond recycling, necessitating that waste should be reframed as a valuable resource [6].

One of the leading circular economy practices for waste management is the implementation of container deposit schemes (CDS). CDS are often government-run schemes whereby the public/users can return empty, eligible beverage containers and receive a refund of a deposit, which is typically 10 cents (10 c) per container in Australia [5]. In an Australian context, Australia's waste generation has continued to increase by 3% per person since 2015, creating a growing waste management problem [5]. Attempting to address some of the country's waste management issues, many states and territories in Australia have introduced CDS. Western Australia (WA) introduced the Containers for Change CDS in October 2020. Western Australians currently dispose of more than 1.3 billion beverage containers that are eligible for CDS annually [7]. The scheme aims to increase the recycling rates of containers and reduce the volume of containers sent to landfill by 5.9 billion units [7]. Five additional states in Australia currently operate a CDS [5]; however, globally, CDS are far more widespread and operate in 38 countries [8]. These schemes have had significant success in increasing recycling rates [8]. Despite these successes, CDS is still being mainstreamed, with many places such as WA only introducing it in recent years.

The aim of this research is to understand how the CDS has been utilized in WA since its rollout in late 2020. Through surveys conducted with users and non-users of the program during 2021, enablers and barriers to individual and household use are investigated. This research contributes to the existing work on circular economy approaches and the importance of effective waste management recovery systems, providing guidelines for policymakers on increasing uptake and improving the functionality of the scheme.

2. Literature Review

2.1. CDS: A Circular Economy Approach

The circular economy model operates on the notion of a value hill model, which is centered around understanding the value that a product provides throughout its lifetime [9]. In a linear economy, waste is quickly disposed of after use, rapidly losing value [10]. However, in a circular economy, once the product has been used, it is able to retain its value through the practices of reusing, refurbishing, remanufacturing, and recycling [10]. Provided that a product remains on the value hill, this practice creates a circular process, consequently resulting in the reduction of waste [9] (Figure 1).

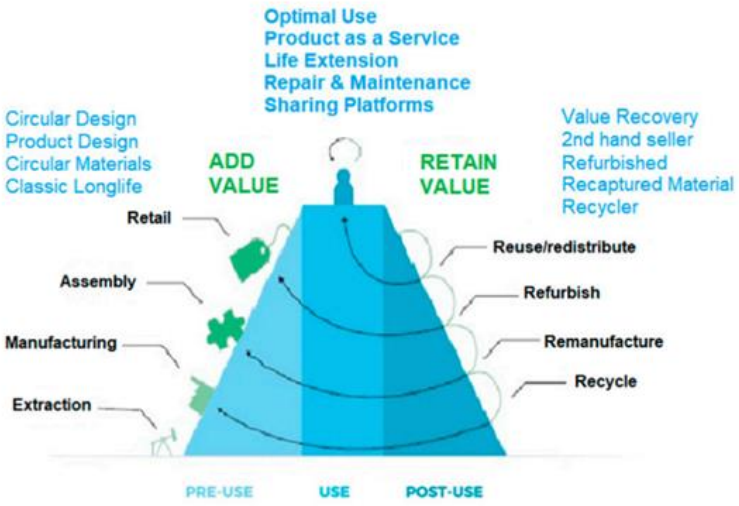

Figure 1. The value hill concept [10].

Waste will always be generated; however, keeping materials and products in use is crucial to assisting in a transition away from a linear economy and toward a circular economy of waste [3]. The implementation of CDS have been observed to increase recycling

rates and in turn reduce contamination rates, littering, and virgin plastics [11]. Furthermore, CDS are preferred over traditional curbside recycling schemes for beverage containers as they create single source streams, reduce litter, and improve material quality [5]. CDS result in better-quality materials being extracted, along with increased recovery rates, as higher-value products can be created [5]. Co-mingled household recycling makes recycling increasingly challenging and reduces the market value of the output as it is of lower quality [12]. Comparatively, as separate streams are created through CDS, this reduces cross-contamination among the different material types and increases the ability of that resource to be recovered [13].

CDS themselves are not an entire solution to waste management; rather, they specifically address the consumption of packaged beverages and are part of a suite of circular economy strategies. An analysis of economic incentives to reduce plastic waste entering the ocean in the United States and Australia has found CDS to be effective in reducing beverage container litter by around 40%, thereby reducing the volume of coastal waste [14]. Research into litter in WA in 2016 found that the largest proportion in terms of litter type is from beverage containers, accounting for 45% [15]. Through the implementation of the CDS, over the next 20 years, it is expected to result in 706 million fewer containers being littered [15]. The consumption of packaged beverages in single-use containers is continuing to rise, with 1 million plastic bottles purchased every minute globally [16]. While reducing the production of unnecessary bottled items such as water is of the utmost importance, there will still be the generation of beverage container waste, either through non-alcoholic or alcoholic beverages, and this waste needs to be adequately managed. Addressing these high volumes of single-use beverage containers, CDS is an effective economic tool that can influence human behavior and can provide an incentive to act in a pro-environmental manner [14].

Analysis of the trade of plastic waste internationally has found that high-income countries have accounted for 87% of all exports of plastic waste since 1988 [17]. This process has allowed countries such as Australia to have strong domestic and local waste management as there are cheaper processing fees in other countries [17]. Australia was so heavily reliant on the exportation of waste that sustainable waste management was largely overlooked in governmental policy until recently, when China banned the importation of some waste [18,19]. In response to these challenges, the National Waste Policy and Action Plan were created as a guiding document for waste management in Australia [20,21]. In 2020, the export of waste plastic, paper, glass, and tires was banned by the Australian Government [22]. However, with their low recycling rates of municipal solid waste when compared internationally [5], Australia must actively work toward improving environmental behaviors and practices.

2.2. CDS in Operation: Nationally and Internationally

All states and territories across Australia are considering implementing circular economy policies; however, there is still significant room for improvement to work toward a "matured circular economy-driven society" [6]. As a circular economy policy, several states across Australia have successfully implemented CDS. The Northern Territory and South Australia have had particularly successful CDS, with return rates higher than 75% [5]. More significantly, perhaps, is the high rate of containers collected per capita in the Northern Territory, which has seen over 450 containers per capita being collected compared to other states, such as the Australian Capital Territory, which sees only 171 containers collected per capita [5]. The highest return rates for CDS in Australia are in the Northern Territory at 84% and South Australia at 76% [5]. Critically, these are both the oldest CDS in Australia, with the South Australia scheme being implemented in 1977 and the Northern Territory scheme being implemented in 2012 [5]. There is scope here for further research into behavioral patterns influencing the usage of CDS that are more well-established.

When examining CDS use in New South Wales, Pickin et al. [5] found that when combined with a curbside collection system, CDS recovers higher rates of recyclables, such as glass, plastic, and aluminum, compared to curbside recycling alone. When utilizing

both curbside and CDS systems, aluminum recycling increases by 8.6 kt, plastic recycling increases by 11.3 kt, and glass recycling increases by 95.3 kt [5]. In addition to this finding, since the implementation of the scheme in 2017, New South Wales has found a 33% reduction in container litter [5]. All of these statistics are consistent with the literature, which has reported that when CDS is effectively utilized, it can reduce pollution, create better waste systems, and more efficiently recover materials [23].

In operation for almost 45 years, South Australia has very successful CDS, with around 600 million containers returned annually [5]. Zaman and Ahsan [3] have noted that within Australia, South Australia has the most successful resource recovery and waste recycling practices. In 2019, the South Australia Environmental Protection Agency conducted public consultations with South Australians regarding the CDS [13]. Respondents to the consultation noted that they would prefer more containers to be covered by the scheme, more convenient recycling options, and more ways to claim back the deposit [13]. South Australia and the WA CDS have similar containers that are eligible through the scheme; therefore, based on this information, it can be hypothesized that respondents to this research may also note the necessity for additional containers to be covered by the scheme. Just over 10 years ago, South Australia increased the deposit rate for containers from 5 c to 10 c, resulting in an increase in container returns [3]. With the WA CDS setting the refund price at 10 c per container, it is rationalized that this will encourage greater uptake of the scheme. In addition to the 10 c refund price in SA, Zaman and Ahsan [3] note that raising awareness of the CDS and creating recycling/deposit depots has proven to be useful in making the CDS successful. It is expected that when analyzing the results of this research conducted in WA, similar themes and challenges may emerge.

CDS have been used widely in many other countries, with some schemes being heavily entrenched in the recycling behaviors of the population. Preliminary research from studies conducted in Europe has indicated that scheme knowledge, concern, and environmentally focused values are key enablers for CDS use [24]. Furthermore, this research concluded that individuals that possess green environmental values are more likely to perceive CDS as a viable waste management solution [24]. Additionally, research undertaken in California, in the United States, has proven to be valuable in assisting survey design, highlighting that the proximity to and availability of opening hours in deposit locations are key factors in the uptake of CDS [25]. These international studies were drawn upon and have informed some of the research questions that were utilized within this study.

2.3. WA Containers for Change

The geographical scope for this research is Western Australia, particularly the capital city of Perth. WA currently generates almost 5 million tonnes of solid waste annually and only 57% of that waste is recovered, highlighting the significant opportunities for improvement in waste management possible in WA [26]. At a household level, there are urgent improvements to be made in terms of municipal solid waste recovery, with Perth only recovering 34% of its municipal solid waste, compared with the target set by the WA Government of 65% [26]. Transitioning toward a circular economy is a particular challenge in Australia as there are smaller and more widely dispersed population centers [27]. Additionally, Perth's urban sprawl extends 150 km from north to south, along the western coastline of Australia [28]. It is expected that this vast distance and the geographical factors will affect the implementation of the CDS as there are significant logistical and infrastructure challenges that are faced by users and managers of the system. The Containers for Change scheme is facilitated by drop-off points located across WA. The scheme features four different refund points: depots, bag drops, reverse vending machines, and pop-up refund points [29]. The Containers for Change process can be seen in Figure 2 [30]. This process, how the scheme is utilized, and any consequential logistical challenges were explored in this research.

Figure 2. The Containers for Change process [30].

CDS performance varies between countries and regions; thus, there is a demand for location-specific research to explore how CDS programs have been utilized. This is reflected in emerging research that focuses on the evaluation of existing schemes, system creation, and the theoretical basis for CDS [23]. As the WA Containers for Change CDS has only been in operation for under 24 months at the time of writing, there is limited research and information evaluating the existing scheme. With CDS being identified as a necessary method in working toward both state and national waste management targets [20,31], the success of the Containers for Change scheme will provide valuable information on how CDS can be upscaled and rolled out across Australia in the future. This research aims to fill this gap, providing insight into CDS uptake in cities with large urban sprawls and automobile dependency.

2.4. Extended Producer Responsibility

Eliminating the production of unnecessary waste is central to the circular economy and can be achieved by improving product design [3]. Zaman and Ahsan [3] have noted the challenges of recycling due to impractical and unnecessary product packaging design choices. In 2018, the Australian Packaging Covenant Organization and the Australian Government created the 2025 National Packaging Targets, which include the phasing out of single-use plastic by 2025 [32]. Under Australian Packaging Covenant Organization guidelines, and in an attempt to move away from using opaque PET bottles that have limited or no market value when recycled, some manufacturers may use packaging solutions that are not suitable for CDS, such as plastic shrink sleeves [33]. Despite this, the Australian Packaging Covenant Organization [33] has identified CDS as a "mutually reinforcing" activity and encourages functional container designs that do not interfere with CDS. Therefore, for the CDS to work in WA and more broadly across Australia, there must be more stringent guidelines and enforcement on packaging that allow for the most effective circular economy measures to be successful. The responsibility to make these changes need not lie with the government alone; product stewardship is a concept that must be owned by all parties. For the public to participate in product stewardship through CDS, manufacturers must assist consumers by making product packaging and labeling recyclable and easy to interpret.

Despite South Australia implementing a CDS in 1977, corporate lobbying has prompted over four decades of inaction regarding CDS [34]. Despite this corporate lobbying slowing the implementation of CDS [3], the challenges of waste management are increasingly becoming too difficult for the government and companies to ignore. The introduction of packaging targets by the Australian government is placing this responsibility back onto producers, requiring them to ensure that products can be readily and easily recycled [33]. The recognition of manufacturer responsibility in relation to CDS is being investigated in South Australia; the Environmental Protection Agency is seeking to understand what objectives and targets for recycling and litter reduction are necessary for EPR [5]. On a wider scale, scholars advocate for greater responsibility to be placed on producers as part of their extended producer responsibility and note that participating in return and refund schemes is central to encouraging pro-environmental production practices [35].

Addressing the issue of single-use packaged beverage containers, CDS have been created under extended producer responsibility (EPR) principles [23]. While CDS places the responsibility onto the consumer to recycle the product, in turn, EPR mandates that manufacturers create products from materials that can be easily recycled. EPR demands that producers are responsible for the products they produce, particularly after the product has reached its end-of-life stage [36]. Furthermore, premarket responsibility (PPR) has emerged as a concept that supports a circular economy by ensuring that producers must create products that are durable and can be reused, repaired, or recycled as a last resort [36]. Under a PPR model, non-recyclable waste would be removed, thereby effectively strengthening the CDS as more containers would be eligible for the scheme, resulting in improved economic and environmental outcomes.

2.5. Economic Analysis of CDS

There is much debate over the desired price of a container-refund scheme, with 10 c being widely utilized across Australia [37]. Wales, in the UK, into the proposed CDS has found "10 pence" (19 c AUD) to be the preferred deposit amount [38]. Meanwhile, for much of the USA, only a 5 c deposit (7 c AUD) is utilized; however, there are increases of up to 15 c, depending on container types [14]. The cost to administer the Containers for Change program in WA is, on average, 11.65 c per container; however, this varies from 11.39 c to 11.76 c, depending on the material type, and will also vary over time [7]. This price, with the GST applied, is passed on to consumers, who then receive a 10-c refund for returning the container [7]. Further research should be conducted in the coming years to assess whether any changes to the 10-c refund amount are necessary in WA. Research demonstrates that increasing the deposit is likely to increase the volume of containers returned; however, this is widely opposed by beverage manufacturers and retailers, who believe that this may reduce sales [39]. In a recent report published by the finance company, KPMG, it was noted that "caution is warranted in considering any increase in the refund amount", and increases could result in up to AUD 1 billion in higher prices for products, due to the pass-on costs to the consumer [37]. Critically, this report was funded by the "allied associations representing the food, grocery, and beverage manufacturing industries" [37], demonstrating that the cost of the refund is a highly contentious issue.

Directly contrasting with the findings of the KPMG report, Suwanakul et al. [40] note that increasing the deposit fee will result in increased utilization of the scheme and increased container returns. Furthermore, an economic analysis of the CDS in the Australian Capital Territory (ACT) has found that a price increase is unlikely to affect consumer purchasing behavior, as this increase is deemed not to be significant enough to alter individuals' behavior [41]. Thus, while manufacturers and suppliers may take issue with CDS, due to increased prices being pushed onto the consumer, ultimately, the positive environmental outcomes that CDS provide must be prioritized. Additionally, while CDS provides informal opportunities for income generation [3], research has demonstrated that higher-income individuals are more likely to return more containers as they consume more beverage containers [40]. Importantly, this study did not investigate the role of informal recyclers

who search for containers as an income stream; therefore, the impacts of socioeconomic status on CDS utilization must be researched further.

2.6. Environmentally Significant Behavior

To understand recycling behavior and the factors affecting CDS uptake, it is necessary to understand the motivating factors behind environmentally significant behaviors such as recycling. There is an array of research across the psychology, sociology, anthropology, and economic academic fields, attempting to understand behavioral choices and actions [42]. To explain individual behavior, Wenger [43] established the concept of communities of practice. Communities of practice are a collective of individuals who either have a shared concern, are engaged with, or are interested in a specific topic [43]. Wenger [43] theorizes that communities of practice encourage collective responses and actions. When it comes to environmentally sustainable practices, Hargreaves [44] echoes this concept and has found that communities of practice encourage the exchanging and transformation of ideas. Throughout this case study of CDS in Perth, determining what the communities of practice actually are will be necessary to understand if and how these communities specifically impact environmentally significant behavior, such as CDS. These communities may be local or virtual, or even values-motivated. On a broader scale, previous scholars [45] have identified three main factors that influence an individual's environmental behavior: environmental values, situational variables, and psychological variables. Both Stern [46] and Ajzen [47] propose comprehensive theories that work to explain these factors and how they influence individual behavior. However, the development of social practice theory in recent decades also provides another lens through which to understand an individual's recycling practices.

Stern [46] has defined several types of environmentally significant behaviors: environmental activism, nonactivist behaviors in public, and private environmentalism [46]. To explain the motivation behind these behaviors, Stern [46] pioneered the value-belief-norm (VBN) theory of environmentalism. VBN posits that an individual's values, beliefs, and personal norms (sense of obligation) influence their behavior [46]. While this theory explains why individuals engage in pro-environmental behavior, alternate studies have demonstrated that despite motivating factors, individual actions do not always align with their intentions [45]. This research into waste minimization behaviors in Europe has found that while some individuals fully intended to reduce their waste generation, these intentions did not result in tangible waste reduction [45]. This phenomenon is known as the value–action gap and is a common occurrence when researching pro-environment behaviors [45]. Interventions to change individual behavior must also remove barriers to change in order to reduce the value–action gap [46]. Therefore, identifying what barriers must be removed to change an individual's behavior is critically important.

Another crucial theory in understanding individual behavior is the *Theory of Planned Behavior*, which is centered on the concept of an individual's intention to demonstrate a particular behavior [47]. This intention to act is supported by the individual's attitude toward that behavior, the subjective norm, and the individual's perceived behavioral control [47]. According to this hypothesis, should an individual have strong intentions to engage in a behavior, that individual is more likely to make a significant effort to act on those intentions and perform the desired behavior [47]. However, individuals also need to possess the ability to control the action, meaning that they must have the required opportunities and resources in place to assist them in doing so [47]. Using the *Theory of Planned Behavior* and applying it within a CDS capacity, it can be hypothesized that individuals who are heavily motivated to act in a pro-environmental capacity may be less discouraged by the logistical challenges and the availability of CDS refund points. However, importantly, they must still have adequate access to the scheme and have the means to engage with the scheme (for example, in terms of transportation).

Looking on a broader scale than just the motivators of an individual's actions, social practice theory seeks to explain the actual practice itself and the context in which it is

performed [44]. Social practice theory hypothesizes that all actions and practices consist of three key elements: skill, technology, and meaning [48]. These elements are requisite to one another; for an individual to engage in this action, they must all be in place [49]. Critically, rather than just looking at unsustainable, individual behaviors, social practice theory presents systemic questions around curbing unsustainable production and consumption practices and how they are reproduced throughout society [44]. Furthermore, Shove and Pantzar [50] demonstrate that both producers and consumers reproduce consumption practices. Therefore, when seeking to understand the CDS and its operation in WA, the recognition of manufacturer responsibility, as well as individual behavior, is necessary.

3. Methodology

Due to the recent nature of the Containers for Change program in WA, there is limited published literature on the program itself. Despite this, there is widescale research on CDS, both interstate and internationally. A literature review was conducted across three databases—Scopus, Web of Science, and Pro-Quest—to review the importance of the circular economy, manufacturer responsibility, environmentally significant behavior, CDS overviews on different scales, and the Containers for Change program in WA. After gaining the approval of the Curtin University Ethics Approval process (approval no. HRE2021-0473), surveys of users and non-users of the CDS in WA were undertaken. The geographical area to which the survey was limited is the greater region of Perth, with survey participants providing their postcode to indicate their location. Almost 80% of WA's population lives within the greater Perth area (Perth and Peel region) [51]; therefore, limiting the research to the greater Perth region was necessary. The survey was administered online through Qualtrics and was distributed through snowball samplings and community outreach on social media, targeting adults over the age of 18. At the time this research was conducted, the COVID-19 pandemic was ongoing; thus, the survey was completed entirely online.

The survey asked numerous questions that focused on individual actions linked to the WA Containers for Change program and to recycling behaviors in general. There were five main sections in the survey: demographics and background, participation in CDS, behavior and practices, geography and transportation, and feedback. Conducted over 5 weeks in late 2021, the survey obtained 414 eligible responses, comprising the data pool for this research. This particular data collection period was utilized as the research was conducted as part of studying for a Master's degree research project. Additionally, this collection period allowed for a sufficient response rate to be generated through snowball samplings. With a wide distribution of responses across ages, incomes, and locations, the survey was generally a good representation of the population of greater Perth (see Section 4.1). For the data analysis, based on their response to the "participation in CDS" section of the survey, the participants were split into one of four question streams: a current user of CDS, a previous user of CDS, a non-user of CDS but who was thinking about using it in the future, and a non-user of CDS. Using cross-analysis, responses were compared between the streams to understand interactions with CDS and recycling behaviors, depending on the respondent's utilization of the scheme. Thematic and statistical analyses were conducted, depending on the response type [52–54].

4. Results and Discussion

After excluding data that did not meet the parameters of the research, 414 responses (N = 414) were analyzed. The results will show the overall uptake of the Containers for Change scheme, broader recycling practices, motivation to use CDS, and barriers to CDS uptake. It will explore the pricing structure of the scheme and provide recommendations for the Containers for Change program.

4.1. Demographics

The demographics of Perth were well represented in this research, as there was a wide range of ages, incomes, and employment statuses represented. Survey responses ranged

from individuals over the age of 18 up to 85 or older; however, the majority of respondents were between 25 and 54 years of age. Individuals aged between 35 and 44 represented the largest percentage of respondents, accounting for almost 30% of the total responses. Significantly, most respondents to the survey were female, with 336 (N = 414) respondents (81%) identifying as female. In total, 50% of the respondents are employed full-time, and the most commonly occurring income range was AUD 70,000–99,999; however, the median income range was between AUD 40,000 and 69,999. With the Australian median income being AUD 49,805 [55], this dataset captures individual incomes in Australia well. In terms of education, 35% of the survey respondents possessed a bachelor's degree as their highest level of education, which is slightly above the Australian average of 22% [56].

The most common house type was a standalone house, which reflected 84% of the participants' household types. While not statistically significant, this is indicative of households in greater Perth, where 77% of households are "separate houses" [51]. With such a high percentage of respondents living in standalone houses, the findings of this research can be best applied to individuals in standalone houses. Further research is required to understand CDS uptake in higher-density areas and with other house types. Participants' households had a range of densities, with households ranging from one individual to more than five people living there on a weekly basis. All postcode responses were recorded, allowing for any geographical barriers to CDS uptake to be considered. A map demonstrating the locations of the respondents to the survey, based on these postcodes, can be seen in Appendices A and B. This map highlights that there was a scattered distribution of survey responses; however, there are a few clusters of responses. These clusters of responses were in Mosman Park, East Perth, Subiaco, Bibra Lake, and Armadale.

4.2. Containers for Change Uptake

At a household level, of the 414 (N = 414) responses analyzed, over two-thirds (68%) of respondents currently use the Containers for Change 10-c deposit refund program at home (Figure 3). For the purposes of analysis, survey respondents were grouped based on their response to this question as a user, previous user, non-user, and non-user (future).

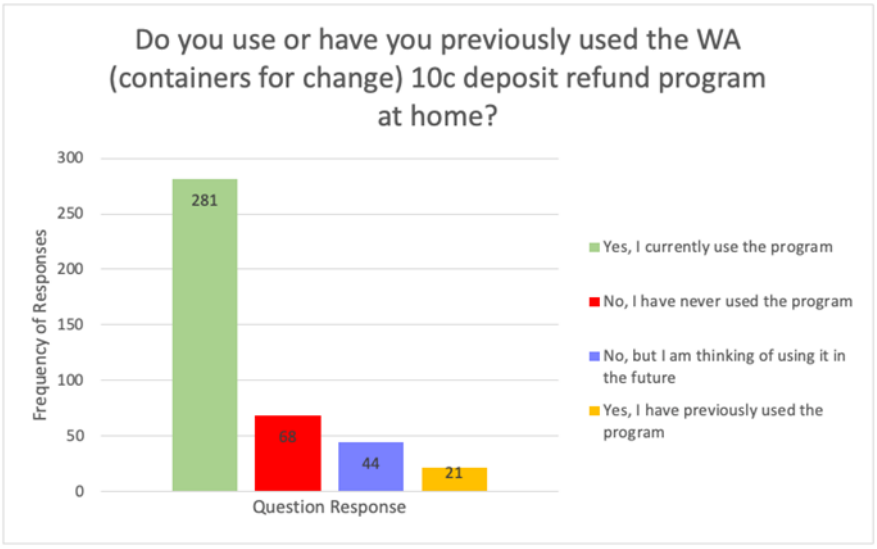

Figure 3. Responses to the question: "Do you use or have you previously used the WA (Containers for Change) 10-c deposit refund program at home?".

These data indicate that CDS has been widely adopted by residents across Perth. The uptake of the Containers for Change program appears to be correlated with demographic factors. Males tend to use the scheme less; of the men who participated in the survey, 27% of them do not use the scheme, compared with 14% of females. Additionally, females appeared to be more open to the prospect of using CDS, as 12% of females selected "non-

user that is thinking of using the scheme in the future", compared to 4% of men. This indicates that women appear to be more engaged and utilize the scheme more than men; however, as the survey responses were heavily skewed toward females, further research is required to determine if this correlation is a contributing factor to CDS usage. There was a slightly higher percentage of non-users of the scheme that worked full-time (59% non-user, 49% current user); however, most significantly, 71% of previous users of the scheme worked full-time. This presents several key questions to be explored further, such as the logistical barriers to CDS uptake and whether these barriers would affect an individual who works full-time and is, therefore, more likely to be bound by time constraints.

The uptake of the Containers for Change program did not appear to be affected by education level or age, as there were no trends between CDS usage and the highest level of education of participants or their age range. This is an important finding as research on an international scale has found that CDS uptake is affected by education levels; individuals with a higher level of formal education were less likely to use the CDS program in California, USA [25]. This discrepancy between these findings and the research conducted in California demonstrates the importance of this research into CDS in Perth, as research findings cannot always be applied in a different context. Additionally, it has been noted elsewhere [25,40] that income affects the uptake of CDS; however, from this research in Perth, it appears that income does not affect the uptake of CDS, as users of the program ranged across all income levels (Table 1). All user streams had respondents across all incomes, ranging from annual incomes of less than AUD 10,000 to more than AUD 130,000.

Table 1. CDS user stream and income level.

CDS User Stream and Income Level	No Response	Low Income (<AUD 40,000)	Medium Income (AUD 40,000–99,999)	High Income (>AUD 100,000)
No, I do not use the program, but I am thinking of using it in the future	2%	25%	52%	20%
No, I have never used the program	0%	16%	47%	37%
Yes, I currently use the program	1%	23%	48%	27%
Yes, I have previously used the program	0%	14%	28%	48%
Total across all user streams	1%	22%	48%	29%

4.3. Exposure to the Containers for Change Program

Understanding how the scheme has been perceived by the public is necessary when exploring the successes and failures of the scheme. Reflecting this finding, the survey participants were asked if they had heard of the Containers for Change 10-c refund program, with 98% of survey participants having heard of the scheme. For those with knowledge of the Containers for Change scheme, they were exposed to the scheme through numerous methods.

The most commonly selected methods of exposure to the scheme were social media, word of mouth, and online advertisements. Additionally, as shown in Figure 4, almost 84% of users (both previous and current) know of other individuals that participate in the Containers for Change scheme. This response was consistent across most response streams; however, only 65% of non-users knew of other individuals that participated in the CDS. Furthermore, when asked if they knew of any CDS drop-off points in the vicinity, non-users (including those thinking of using it in the future) were evenly split. In total, 50% of respondents selected "no", signifying that they were unaware of any CDS drop-off points nearby. While exposure to the scheme is generally high; exposure to the logistics and details of the scheme is slightly lower for non-users. To understand whether previous interactions with other CDS programs increase uptake, survey participants were asked if they had previously used a CDS elsewhere. Several respondents noted that they had used such schemes previously, with South Australia's CDS program being mentioned by 16 respondents. Numerous other respondents have previously utilized schemes in Sweden, the USA, Canada, Germany, and Denmark. Indeed, 25% of non-users of the scheme and

34% of users of the scheme had used a CDS elsewhere. There is not enough of a trend here to support the hypothesis that previous exposure to CDS has an impact on CDS uptake in Perth. However, there remains scope to further explore the impact that exposure to CDS and interaction with an established CDS program may have on the uptake of schemes.

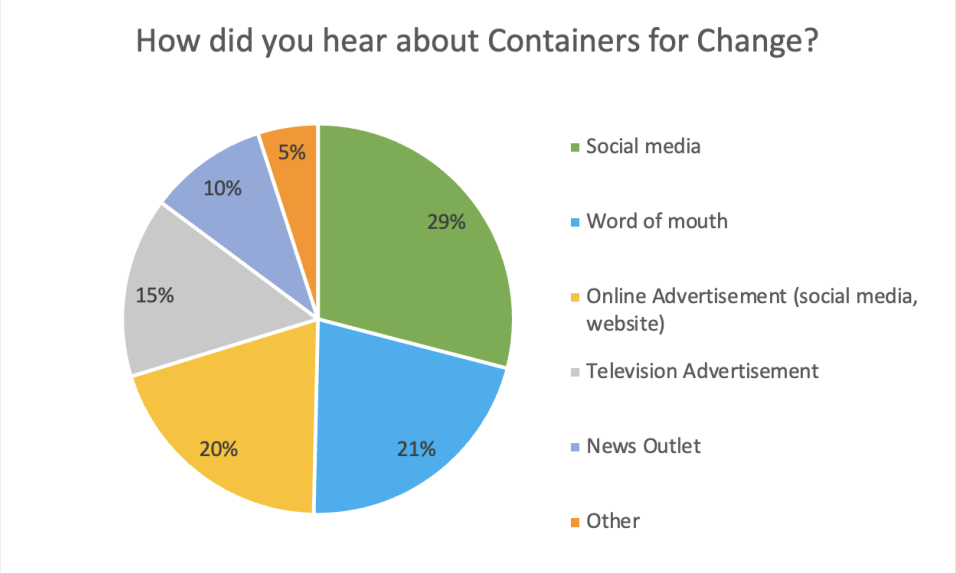

Figure 4. Responses to the question, "How did you hear about Containers for Change?".

To understand the utilization of the scheme and recycling behaviors more fully, all participants were asked how they usually disposed of empty bottles and cans at home. Understandably, responses differed, depending on whether they were a user of the CDS; however, the two most common responses were to "take [the containers] to a 10-c refund drop-off point" and "household recycling (council collection)". For non-users of the scheme, the most commonly selected option was "household recycling". Some individuals that selected "other" explained that they used informal methods of recycling, such as giving eligible containers to friends, family, and neighbors, who then recycle them through CDS. This finding presents an interesting proposition that CDS usage in Perth may be higher than the 68% identified in this survey, as individuals may participate in the CDS through informal methods or outside the home. Just over a quarter (26%) of respondents use the 10-c refund program outside their homes (e.g., in workplaces, schools, etc.). However, crucially, 37% of non-users of the scheme at home (including those thinking of utilizing it in the future) have utilized the scheme outside the home. When further questioned, it was noted that individuals who use the program outside their home utilize the scheme in workplaces, schools, community groups, and sporting clubs. Thus, while these individuals may not utilize the Containers for Change scheme at home, they may utilize it in another facility, indicating that interaction with the CDS can take place through informal and unidentified methods.

4.4. Recycling Practices

Several questions throughout this survey were directly targeted toward understanding individuals' recycling habits, waste behaviors, and practices. All survey participants were asked if they brought home containers to recycle if they had consumed the contents outside of the house, to which 67% of survey participants responded yes (N = 414). There was a difference between users and non-users of the scheme in response to this question. For non-users of the scheme, 56% of them noted that they did not bring home containers to recycle; however, 77% of current users did so. With over three-quarters of the CDS users bringing home containers to recycle, the main aim of the CDS is achieved, in that littering volume would be significantly reduced because of the CDS. When asked to provide the

reasoning behind their response, numerous participants noted that their response to this question depended on the facilities that are available. Key themes emerged across the responses; for those that responded "yes", many noted that they did this as the containers they consumed were often eligible containers for the CDS (Table 2). Additionally, many wanted to reduce landfill where recycling was not provided or was inadequate. For those that responded "no", it was noted that taking containers home to recycle was inconvenient and they were happy to utilize the existing recycling facilities that were in place (Table 3).

Table 2. Motivating factors for bringing containers home.

Motivations for Bringing Containers Home	Percentage of Responses
10 c refund	36%
To reduce landfill and to ensure it is recycled	33%
Distrust of recycling options available	17%
Environmental benefits	6%
Habit	6%
To reduce litter	3%

Table 3. Motivating factors for not bringing containers home.

Motivations for Not Bringing Containers Home	Percentage of Responses
To use recycling facilities in place of consumption	52%
Cannot be bothered	14%
Inconvenient to do so in the place of consumption	13%
Do not have many containers	9%
Do not want to carry rubbish	7%
Have not considered it	5%

To understand how the CDS is utilized and implemented at a household level, current and previous users of the scheme were asked who was responsible for operating the scheme at a household level. Many respondents noted "me" or the "adult" of the household as the individual responsible. Around 10% of respondents noted that the children were responsible for facilitating the scheme at home and were then accompanied by an adult to the drop-off centers. Another 10% of respondents noted that all household members were equally responsible for the scheme, indicating that it was a shared responsibility among housemates/family members. However, with most respondents selecting the option that one individual was responsible for operating the scheme at a household level, it appears that the responsibility for CDS predominately falls on a specific household member. The household structure and the roles of individuals within the household is vital in behavior change interventions [57]. Scholars have noted that "social leaders and champions" are able to influence practices at a household level [57]; therefore, this needs to be considered when implementing strategies to increase CDS uptake.

Focusing on user behavior, users and previous users of the scheme were asked if they consciously purchased containers that are eligible for the scheme (e.g., 4 × 250 mL bottles instead of 1 × 1 L bottle). The vast majority (88%) selected "definitely not" (52%) and "probably not" (36%). When provided with the scenario, some survey respondents questioned this principle, with one respondent asking:

> *"Does it reward or motivate people to keep buying plastic bottles when we should be encouraging people to not buy plastic bottles?"*

However, as the data demonstrates, individuals appear to only be recycling the containers that they are currently using or that they find. Therefore, they are not seeking out additional containers to "add into" the CDS stream. This is an important component of circularity as reducing inputs into the system is the first step in working toward a circular economy approach to recycling.

4.5. Motivation to Use CDS

To provide insight into the reasoning behind individuals' choices and behavior, survey participants were asked about their motivation to use the CDS or their reasonings as to why they did not use the CDS. Current users and previous users of the Containers for Change program were asked why they currently used or previously used the scheme (N = 302). Respondents were able to select all options that applied to them; the most selected response was "environmental benefits", followed closely by the "10 c refund" (Figure 5).

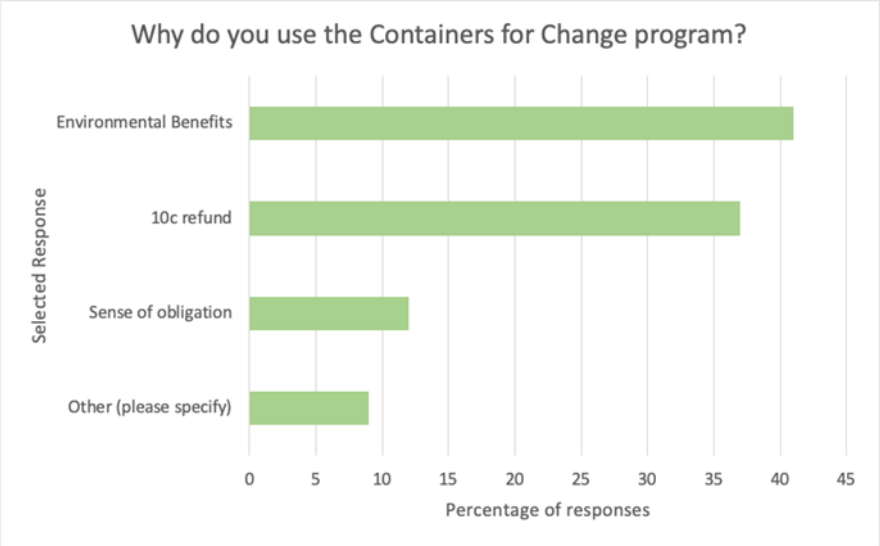

Figure 5. Responses to the question, "Why do you use the Containers for Change program?".

Some users noted that they utilized the scheme for fundraising purposes, identifying that it is a great way for charities to raise funds. This was a theme that emerged throughout the research as many participants utilized the scheme to raise funds for specific charities.

To ascertain whether having a goal was a motivating factor for using the CDS, users were asked if they had a target or goal that they were working toward achieving with the 10 c refund. Just over a quarter of CDS users and previous users had a target that they were working toward achieving with the 10 c refund (27%). There was a range of targets that were specified; most notably, generating donations for specific community groups was frequently mentioned. This was followed closely by "pocket money" for children and "savings". This response indicates that there is no significant motivating factor or correlation between individual goals and the desire to use CDS. However, the impact of community groups, donations, and charity appears to be a key driver in individuals' behavior and their desire to participate in the CDS. Charities and community groups are an example of "communities of practice", as identified by Wenger [43]. With several survey participants indicating that they participated in the CDS for charity or because of community-motivated reasoning, it is evident that communities of practice are a significant motivating factor for CDS usage. Consequentially, there is scope for further research into the role that charities and community groups play as a motivating factor for CDS uptake.

When ranking how important the reasons or motivating factors were in encouraging the use of the Containers for Change program, similar results were found. For both current and previous users, the environmental benefits were the most important motivating factor, followed by the 10 c refund (see Table 4). From a sustainability perspective, the environmental benefits were the most important aspect for respondents, followed by the economic aspect (10 c refund) and the social aspect (a sense of obligation). This finding is unsurprising and is consistent with the Containers for Change consultation report that was completed in 2018 [58]. This report was completed prior to the rollout of the CDS and asked survey participants several questions related to the CDS [58]. Participants were asked what the most important benefit of a CDS would be to them; most survey respondents indicated

that "environmental protection" was the most important benefit [58]. This demonstrates that individuals see the environmental aspects (either benefits or protection) as central to their motivation for using the CDS. Therefore, ensuring that the public is aware of the environmental benefits of a CDS is crucial to improving and maintaining CDS uptake. Notably, among all CDS users, there does not appear to be a great sense of obligation toward the scheme, indicating that there is more work to be done on educating individuals about the responsibilities and impacts of consumer behavior and waste management practices.

Table 4. Averages of the motivating factors to use CDS (out of 10).

Motivating Factors to Use CDS	10 c Refund	Environmental Benefits	Sense of Obligation
Current user average	7.2	9.1	5.6
Previous user average	7	8.4	5.1
Overall average	7.2	9.1	5.6

Focusing on understanding individuals' perceptions toward recycling and on individual behavior and reasoning, all survey participants were asked how interested they were in recycling, with the average across all streams being 7.9 out of 10. There was no significant difference in recycling interest between each of the user groups. Respondents were also asked how much attention they paid to their household waste, with the average score across all streams achieving 7.7 out of 10. There was a deviation between whether individuals used the scheme and their response to their household waste attention. In total, 41% of the current users of the scheme rated their consideration of household waste at 10 out of 10, while only 25% of non-users rated it at 10 out of 10. With participants of the scheme more likely to consider their waste management choices, this perhaps indicates that attentiveness to household waste results in more pro-environmental actions, such as participation in CDS. Encouragingly, less than 1% of survey participants put their recyclable goods into landfills on a household level, highlighting that there is a strong base level of household waste management. However, the data [31] highlights the finding that there is still significant room for improvement in recycling behaviors at a household level.

4.6. Barriers to CDS Usage

4.6.1. Distrust of Waste Management Practices in Australia

To gauge individual sentiments towards recycling, CDS, and sustainability, users were asked to rank how much they agreed with a series of statements. The responses can be seen in Figure 6, where a higher score indicates that individuals strongly agreed with the proposition, while a lower score indicates that they strongly disagreed with the statement. Most survey participants recorded similar averages across all participant streams. Generally, most survey participants believed that "recycling is a worthwhile task", that it is "my waste, therefore it is my responsibility" and that "acting sustainably is very important to me". Most survey participants agreed that "using the 10-c refund scheme helps protect the environment"; however, non-users did score lower for this statement, with an average rate of 7, compared with 8.5 for current users.

There is noticeable distrust of waste management practices in Australia, with an average score of 4.8 in response to "Australia has good waste management practices". This indicates that individuals slightly disagreed with the statement but generally remained neutral on the subject. However, this finding was supported by feedback throughout the survey, which indicated strong skepticism, not only of CDS but also of recycling within Australia across all participant schemes. One user of the scheme commented:

> *"I'm not so sure WA actually recycles all the plastic we put in the recycling though, so I find it all a bit pointless, but I do it anyway."*

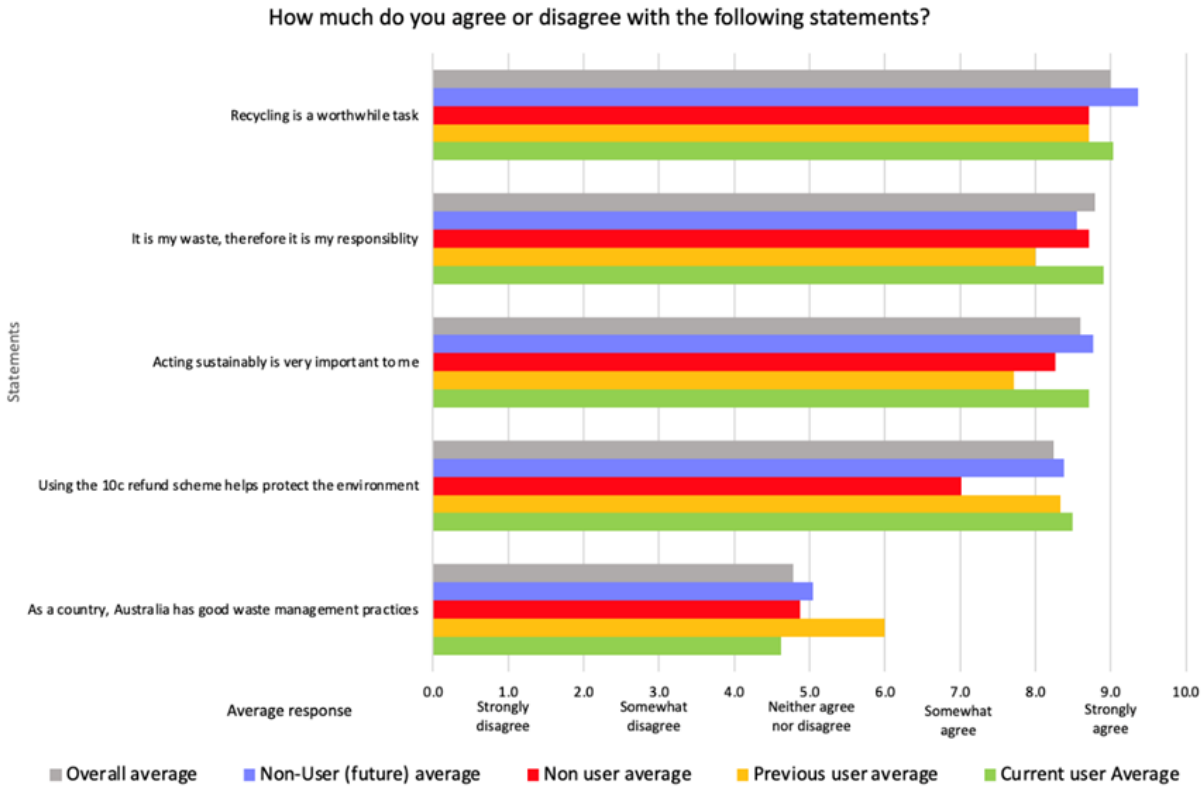

Figure 6. Responses to the question, "How much do you agree or disagree with the following statements?".

Another user of the scheme noted:

> *"I would like more transparency about what happens to the containers. My confidence in if they actually get recycled and if so, is it done locally (so the environmental impact of transport) is very low."*

This skepticism of the CDS extended to previous users of the scheme as well, with one previous user noting:

> *"I wonder if this program is doing anything to help the waste situation".*

Furthermore, for some users, this distrust of Australia's waste management program extended further into ethical questions:

> *"The materials travel thousands of kilometers on ships to countries that do not have adequate infrastructure to process the materials safely. This causes both environmental and social impacts on the countries receiving the waste... The Containers for Change system will only be an ethical service when we can close the loop locally. Until then, I participate but remain conflicted as to the ethics of the service."*

This skepticism and distrust of waste management in Australia is unsurprising, as recent research has also found that 39% of Australians do not believe or trust that their recycling will be adequately recycled [59]. Effectively managing this skepticism not only of the CDS but also of waste management in Australia is crucial to the success of the CDS. This is a key barrier toward CDS uptake, while also being a key opportunity for improvement and success.

4.6.2. Knowledge as a Barrier to CDS Uptake

To identify what the specific reasons were for individuals not engaging with the Containers for Change scheme, non-users (including those considering using CDS in the future) were asked why they did not use the Containers for Change program (Figure 7).

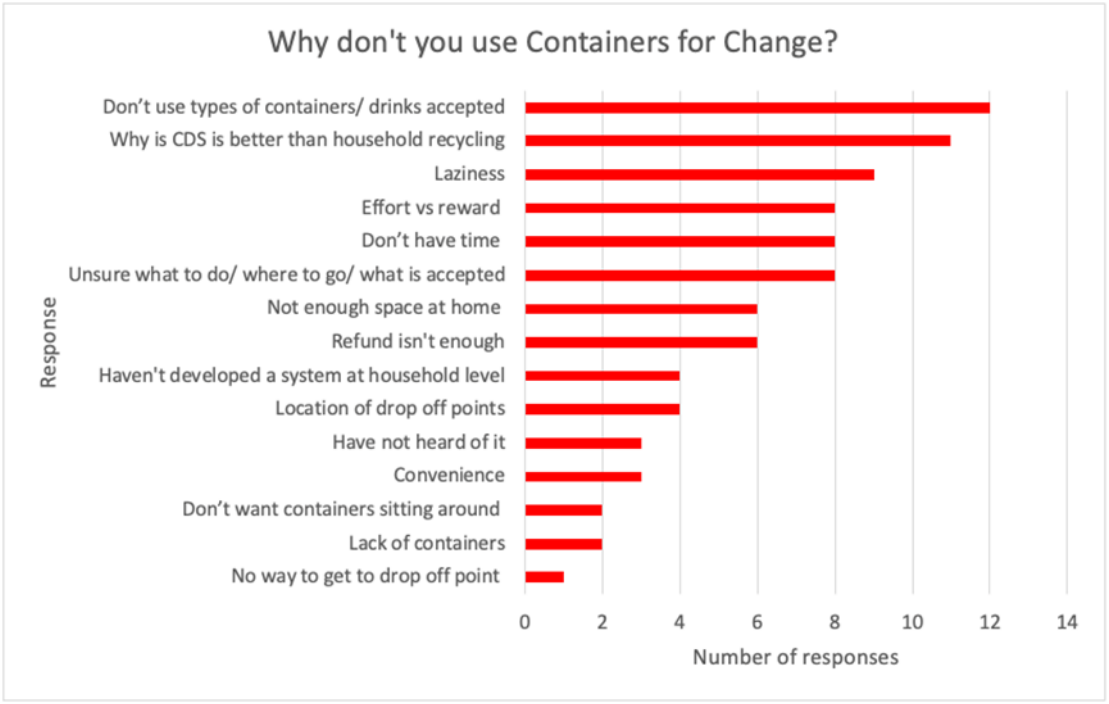

Figure 7. Responses to the question, "Why don't you use Containers for Change?".

The two most common reasons for not using the CDS were a lack of container eligibility and a lack of understanding as to why CDS is better than traditional recycling. One non-user noted:

"If the council is recycling adequately, why should we need a financial incentive to recycle?"

Another non-user of the scheme commented:

"Maybe more information about why the scheme is better than curbside recycling. If not motivated by money—why go to the additional effort. Where are the locations? What are the benefits—other than money?"

From analyzing this data, it appears that greater education about the benefits of CDS, alongside improving awareness of the scheme, would greatly assist in improving CDS uptake in Perth. Previous users of the scheme were asked why they stopped using the Containers for Change program. Almost half of the survey participants did not respond to this question; however, for those that responded, there was a range of mixed reasons. The most common response was that of container eligibility, as can be seen in Figure 8. These findings reiterate the statements made by non-users of the scheme. Both previous users and non-users identified a lack of eligible containers, laziness, a limited quantity of containers, and the location of drop-off points as reasons for not utilizing the CDS. To improve the uptake of CDS, solutions need to be provided to combat these challenges.

4.6.3. Container Eligibility as a Barrier to CDS Uptake

Greater container eligibility was a recurring theme throughout the survey and a key barrier to CDS uptake, with many participants taking the opportunity to express their frustration at the lack of eligible containers. Overall, 87% of survey participants would participate more in the 10-c refund scheme if wine bottles, milk cartons, cordial/syrup containers and alcoholic spirits were eligible for a 10-c refund (Figure 9). This response was split evenly across the respondents, regardless of their past, current, or non-existent use of the CDS. This reflects the demand and the need for including more items to motivate individuals to participate in CDS. This challenge was also mentioned by non-users and previous users of the scheme, as can be seen in Figures 7 and 8.

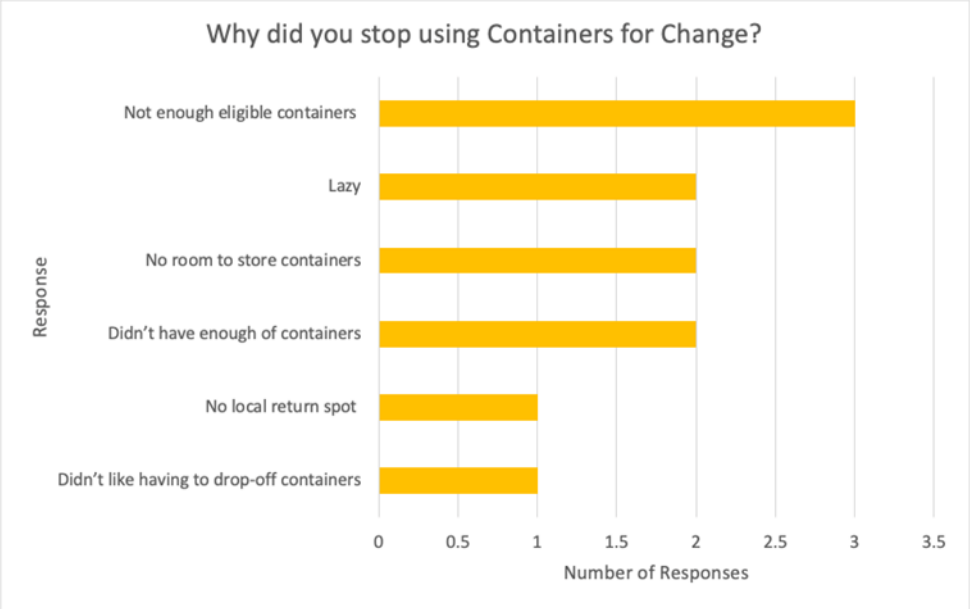

Figure 8. Responses to the question, "Why did you stop using Containers for Change?".

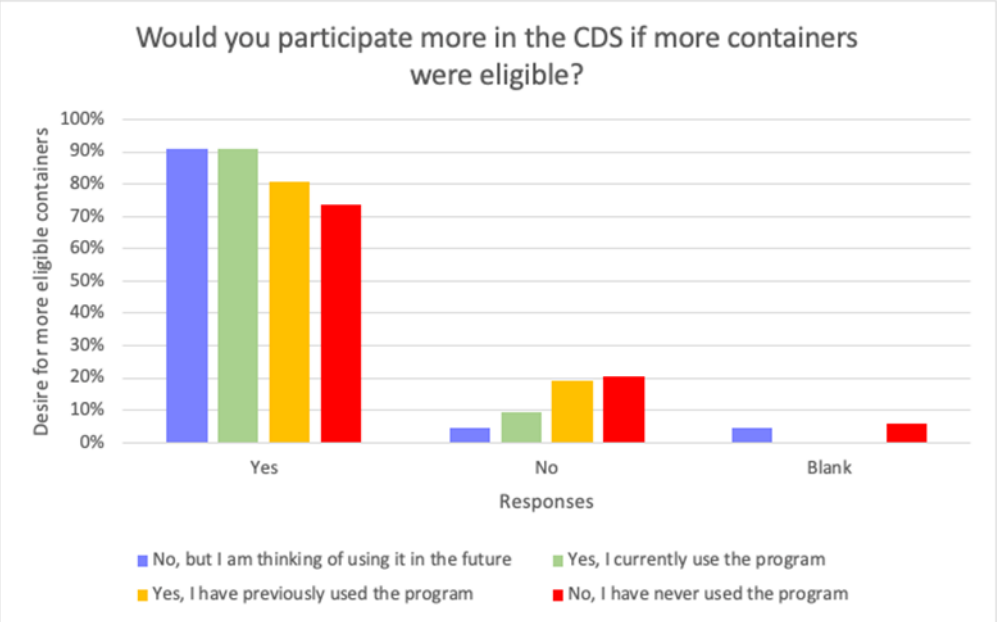

Figure 9. Responses to the question, "Would you participate more in the CDS if more containers were eligible?".

This lack of eligible containers is a key deterrent to uptake of the scheme, with one survey participant who has never used the Containers for Change program noting:

> *"I would prefer, and 100% participate in the scheme if more containers were eligible. Sorting through the waste is hard enough—I have 5 bins already!"*

Another survey participant wrote:

> *"The type of bottles eligible is too limited, which is why I don't take part."*

The Containers for Change scheme only accepts containers of up to 3 L in volume [29]; however, studies demonstrate that larger containers generally have a lower environmental impact as they optimize transportation size and minimize product loss [60]. It would be reasonable to assume here that to achieve a circular economy, encouraging the production

(and, in turn, recycling) of containers that have the lowest carbon footprint would be desirable. The West Australian Government [15] has noted that the containers excluded from the CDS are excluded because they are "more likely to be consumed in the home and are therefore less likely to be littered". However, as this research has demonstrated, container eligibility is a key barrier to CDS adoption. Hence, incorporating a greater range of containers should indirectly increase the volume of traditional "littered" containers since more people will be participating in the scheme. The eligibility of containers is a key issue for survey participants, regardless of their use (or not) of the scheme; therefore, increasing the eligibility of containers should have a tangible impact on the uptake of CDS.

4.6.4. Household Demographics as a Determinant of CDS Usage

Household type does appear to affect the uptake of CDS, as there was less uptake of the scheme by apartment dwellers. Therefore, the finding that the uptake of CDS in Perth is reasonably high remains true for individuals living in standalone houses; however, further research is required to determine whether the same level of CDS uptake is reflective of apartment dwellers. In total, 18% of non-users of the scheme live in apartment blocks, and 16% of non-users who may use the scheme in the future live in apartment blocks. Comparatively, only 10% of current users of the scheme live in apartment blocks, and 85% of them live in standalone houses. Despite most survey respondents living in standalone houses, there is an evident correlation between CDS usage and household type. This highlights the challenges of encouraging CDS uptake in high-density areas, specifically for those with limited space for container storage such as apartment blocks.

In addition to this finding, there appears to be a link between the number of people living in a household and CDS usage. Current users of the scheme had a wide range of people living in their household in a usual week; however, 63% of non-users of the scheme had two people or fewer living in their household in a usual week. Additionally, 44% of non-users who may use the scheme in the future had two people or fewer living in their household in a usual week. This finding presents a central challenge for increasing the uptake of this scheme, as individuals may not be participating in the scheme if they have a small number of containers (see Section 4.5). Therefore, if these household-related challenges can be addressed, this would bring new users into the scheme and increase the uptake of the Containers for Change program. To further understand the distribution and users of the CDS, a series of maps were created to demonstrate the location of each respondent and into which of the four user groups they were placed (current user, previous user, non-user (future), or non-user). These maps can be seen in Appendices C and D, and Figure 10. While it cannot be extrapolated to a trend, it does appear that individuals in the Perth central business district use the scheme less frequently.

This finding presents questions about the accessibility of the scheme and uptake in high-density areas; however, further research is required to explore this correlation. Figure 10 demonstrates the gaps in the current program. Both state and local government officials in these areas should consider a specific action plan to motivate people in these areas to participate in the Containers for Change program.

Users of the scheme were asked at what stage they sorted their eligible containers to be recycled through the scheme. They were provided with 3 options: immediately, before going to the outside bin, and other. In total, 80% of respondents sorted their containers immediately. When separated into streams, this response was slightly lower for previous users of the scheme, with only 67% of them sorting the containers immediately, and the remaining 33% sorting containers before going to the outdoor recycling bin (intermediately). This challenge of effectively sorting containers at a household level seemed to be a recurring theme throughout the survey. This was noted by one survey participant who did not use the scheme, explaining that they had not yet "implemented a system for retaining empties in a clean and organized way".

Users were asked how often they deposited containers into the CDS, with most survey respondents depositing containers into the CDS on a regular basis (Figure 11). While a

third of users sporadically deposited containers, just over 60% of respondents deposited containers into the scheme on a weekly, fortnightly, monthly, or bi-monthly basis. Since many users used a drop-off point on a monthly basis, this required users to have a location to store these containers for at least a month. This is a key logistical challenge of the CDS, as apartment dwellers may not have sufficient space to store containers until they can take them to a drop-off point, making the scheme inconvenient. This challenge could be addressed through the implementation of more conveniently located drop-off points that are able to accept smaller volumes of containers. The regularity of this behavior indicates that CDS usage generally becomes a part of the routines and habits of users. As Stern (2005) theorizes, individual behavior can be affected by habit and routine; thus, creating a habit at a household level is necessary to ensure that CDS is adopted widely. Additionally, the theory of social practice to explain individual behaviors requires three elements: technology, skill, and meaning [48]. To participate in the CDS, users must have the means to store containers and to transport them to a drop-off point; therefore, addressing the challenge of convenience is crucial. It is evident from this data that users of the scheme interact with it through a range of different methods; thus, having a CDS that is accessible to all users is essential to the success of the scheme.

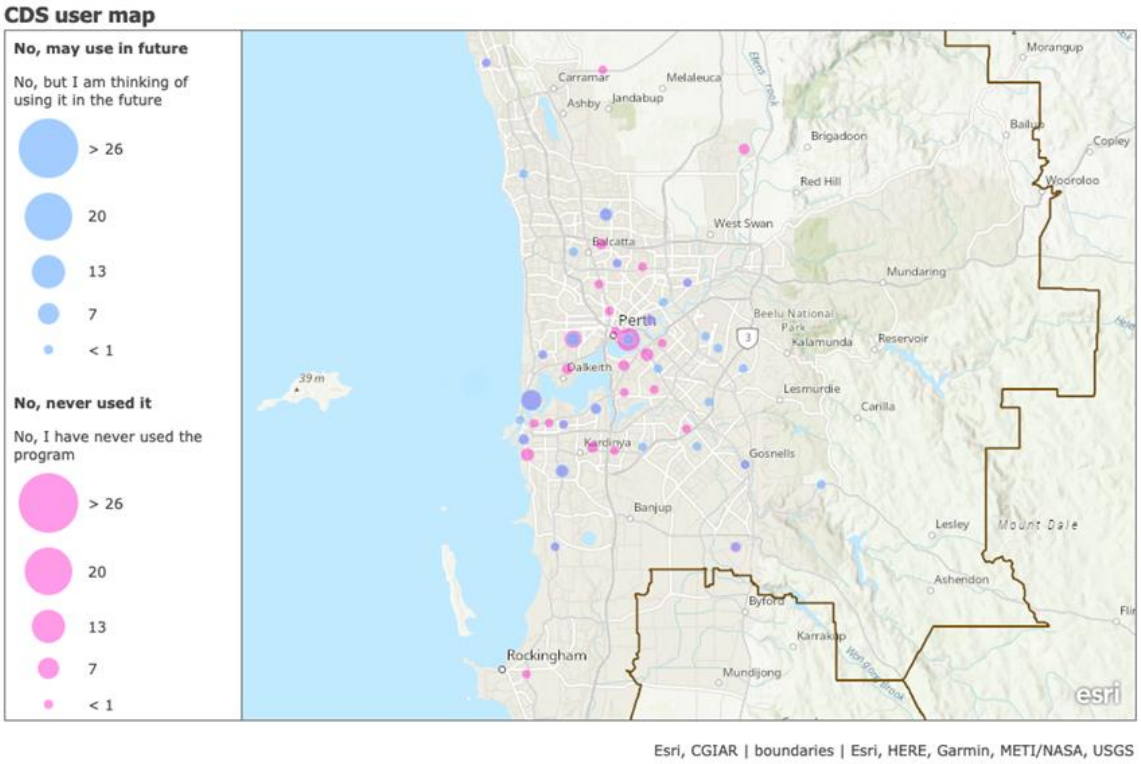

Figure 10. Map indicating those survey respondents who do not currently participate in the Containers for Change scheme.

4.6.5. Drop-Off Logistics as a Barrier

Numerous questions were asked of survey participants about their understanding of and interactions with the logistics of the scheme (e.g., transportation and location). Survey participants were asked what type of Containers for Change drop-off point they used; most users of the scheme indicated that they predominately use the Containers for Change depots (drive-through or walk-in) to dispose of their containers. The second most commonly used CDS drop-off point was the reverse vending machines (RVMs). This correlates with the preferred deposit type, with 42% of participants preferencing a direct EFTPOS transfer. Some respondents selected "other"; for those that selected "other", many noted that vouchers to use in a supermarket were a viable alternative to the other options

for refund credits provided. Currently, retail vouchers are utilized in the Containers for Change program; however, these can only be collected at RVMs and there are only six RVMs operating across Western Australia [29]. There is some demand for donations to continue to be included in the scheme, with 15% of survey participants noting that donations were their preferred credit form. These findings may affect the types of CDS drop-off points chosen by participants, as some users expressed a preference for specific refund types. Furthermore, this finding highlights the importance of diversity in refund types; to be successful, the scheme must cater for a range of refund methods.

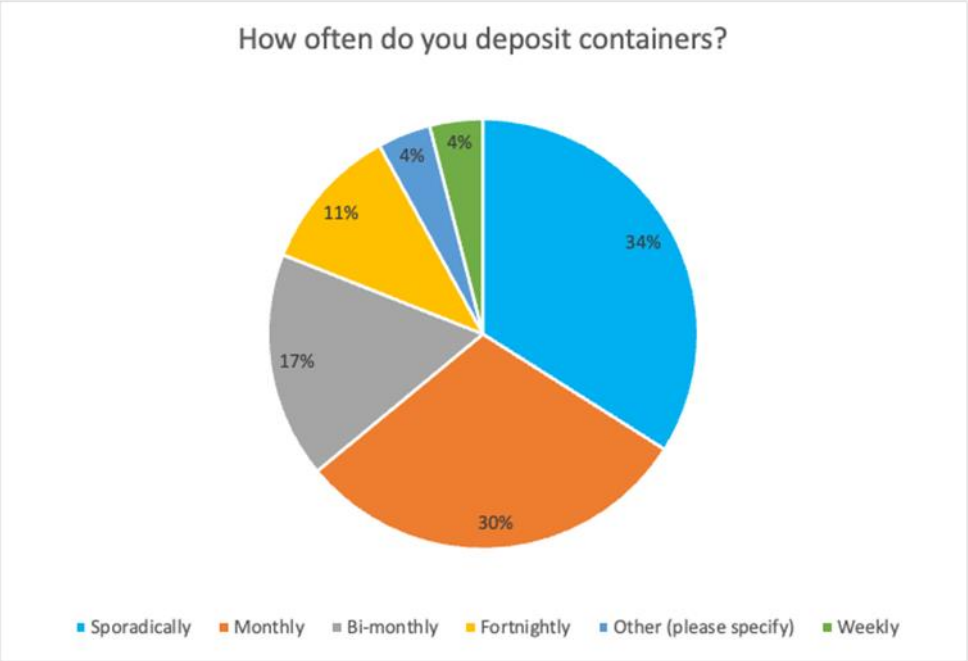

Figure 11. Response to the question, "How often do you deposit containers?".

With both current users and previous users of the scheme predominately using the Containers for Change drop-off point that is closest to their house, there is a logistical challenge in providing enough drop-off points. To this question, 78% of users responded that yes, they used the closest drop-off point to their home. When users were asked for their reasoning as to why they used a specific drop-off point, the importance of accessibility of the CDS and of drop-off points were evident (Figure 12).

Proximity to the CDS drop-off point is the most important factor for users, followed by convenience and then ease of use. If Containers for Change were able to provide more accessible drop-off points to address the convenience and ease barrier, this should increase the uptake of the CDS. Furthermore, 95% of CDS users (previous and current) used the same drop-off point each time, indicating that habit plays a significant role in the utilization of CDS.

To better understand accessibility, users were asked how they traveled to the CDS drop-off points. In total, 94% of users traveled via private transportation (car or motorbike) to the drop-off point. This finding is unsurprising, given the challenges of Perth's urban sprawl and the implementation of such a scheme. The reliance on private transportation, such as cars, is engrained into the urban fabric of Perth, as it remains a predominately low- to medium-density city [61]. Thus, overcoming the reliance on private transportation to CDS drop-off points will be challenging. One user of the scheme was unsure as to whether they would continue their use of the scheme because:

" . . . the few cents you get is just not worth the petrol money."

Conversely, one survey participant, who has never used the scheme, commented:

"The facility in my area is not located in a convenient place—it is not connected to the nearest shopping center or supermarket and can only be easily accessed via car . . . it is too far to walk from the main shopping complex."

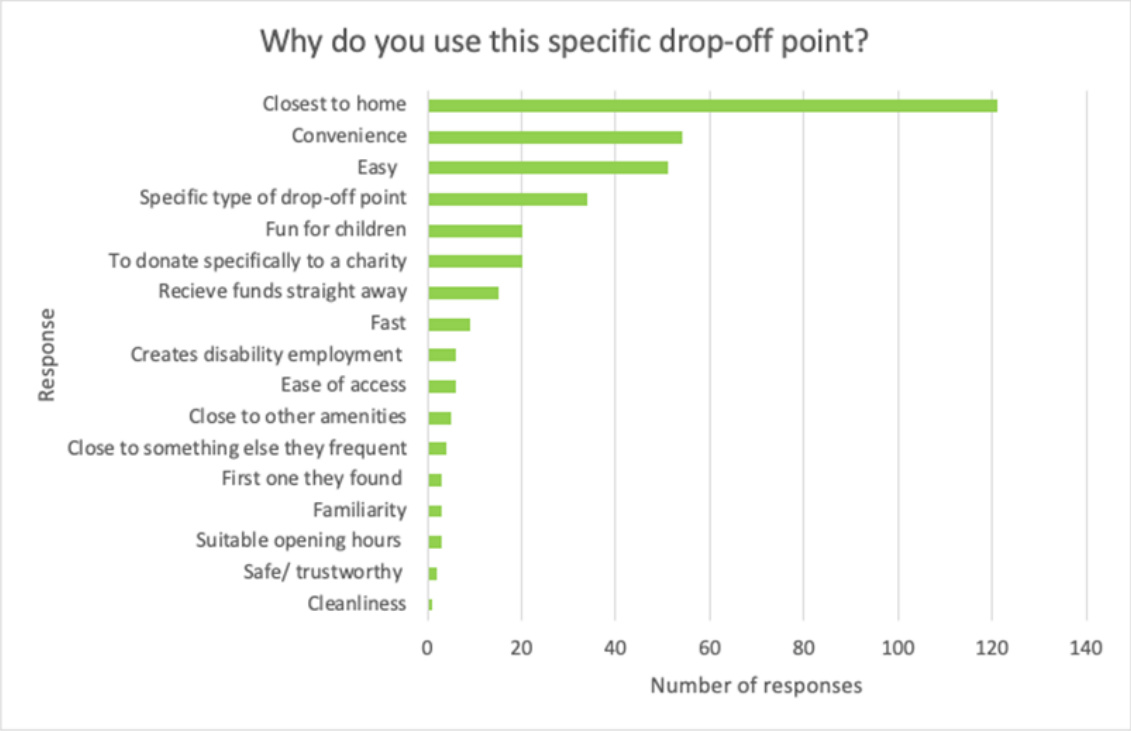

Figure 12. Response to the question, "Why do you use this specific drop-off point?".

An interstate parliamentary inquiry into waste management in Victoria, which currently has no CDS, has found that when a CDS is implemented, it should include accessible points across Victoria, and specifically notes, "for example, in supermarkets and at petrol stations" [62]. This presents a central challenge for the uptake of CDS and its sustainability in terms of individuals that are having to make specific trips in their vehicles to dispose of the containers. Including CDS drop-off points at locations whence individuals are already traveling (e.g., supermarkets, shopping centers, etc.) could be a viable solution to this barrier. It is evident that scheme operators are aware of the necessity for accessible drop-off points, as the Government of Western Australia [63] has created minimum network standards for the refund point locations. These network standards outline the distance to the nearest drop-off point, how many drop-off points are required per region, and the minimum hours of operation per drop-off point [63]. For the Perth and Peel regions, 95 full-time refund points are to be operating by 12 months into the commencement of the scheme and they must not make a user travel more than 5 km to their refund point [63]. However, not all of these refund points are open at accessible hours [64] or are located in accessible and convenient locations; thus, improving this situation is crucial to increasing the uptake of the CDS.

Of the CDS users, the majority of users live between "5 min or less" and "5–10 min' driving time to a CDS drop-off point". Crucially, only half of the non-users knew where a drop-off point was located, and several non-users were unsure of where the nearest drop-off point was; one respondent even commented:

"No idea. Probably not that close, as I am in the central business district, and I imagine it is more a suburban thing."

This survey participant has identified that to them, engaging with the CDS is a suburban task; however, this respondent was also an apartment dweller. There are two drop-off

points for the CDS in the immediate central business district and there are additional drop-off points in neighboring suburbs [29]. This comment further highlights the research that is required to study CDS uptake in apartments, as it appears that several factors may affect CDS uptake in high-density areas.

This research demonstrates that there are inherent logistical challenges for those individuals who do not drive to CDS locations. With most CDS users employing private transportation to access the scheme, there is significant work to be done on encouraging more active modes of transportation to make the scheme more sustainable. The car-centric nature of the scheme presents challenges to improving and maintaining usage of the scheme, as individuals need to be able to readily access the drop-off locations, regardless of their mode of transportation. Non-users of the scheme were asked if a conveniently located drop-off point would encourage their usage of the Containers for Change program and 80% of survey respondents felt it would encourage them to utilize the scheme. This data demonstrates that addressing this 'drop-off location' barrier would have tangible outcomes for the uptake of Containers for Change.

4.7. Scheme Pricing

Enquiring about the financial motivating factor of CDS, all respondents were asked whether they felt that 10 c was enough of an incentive to use the Containers for Change program. There were four themes that were common across the text responses: "yes", "no" and "money shouldn't be the focus", along with "it depends (yes for me but it may not be enough for others)". The majority (74%) of respondents noted that yes, 10 c was enough of an incentive. Conversely, 10% responded no, it was not enough of an incentive, and the remaining respondents were split between not focusing on money and that it depended on the situation. Further research into motivating factors for recycling in general [59] has found that 19% of individuals that describe themselves as "poor" recyclers would recycle more if there were a monetary incentive. Thus, the financial refund remains a motivating factor for CDS usage; however, deciding on the specific price of this refund is not as straightforward. Respondents were provided with the opportunity to express their reasoning regarding their position on the 10 c refund, with many users mentioning the eligibility of containers alongside their "yes" response. For example, one user of the scheme noted:

> *" . . . 10 c is fine, but a lot more containers should be eligible. It's ridiculous that wine bottles and juice bottles aren't included. It makes the whole system needlessly complex and deters people from participating."*

This sentiment was echoed by several other participants, with some proposing a price increase to 20 c for bottles with a larger capacity (over 1 L volume). Notably, one user of the scheme did not believe that 10 c was enough of an incentive; however, they acknowledged the logistical challenges associated with increasing CDS usage:

> *"No . . . 10 c is not enough to get people to do it. There should be a higher* [refund value] *for bigger bottles, e.g., 20 c–50 c, all depending on what it is. Then people will have a bigger incentive to do so. You'll also need way more locations to drop off the bottles. If it's out of the way, it won't happen. Every supermarket should have a machine."*

This was echoed by a non-user of the scheme, who agreed that 10 c was not enough, writing: "This is probably the main reason I don't participate".

Despite this, several users noted the pricing structure of the scheme, expressing that an increase in the refund would involve an increase in the upfront cost of the item, potentially creating resentment toward the scheme. While agreeing with the 10-c price in the scheme, numerous users raised concerns about trying to motivate those that do not find 10 c enough of an incentive. Improved education and understanding of the program were mentioned by participants as potential methods of increasing the usage of the scheme. The necessity for strong education on waste management was identified by the WA Government in the 2030 Waste Avoidance and Resource Recovery Strategy [31]. This strategy identified the importance of communicating the benefits of resource recovery and recycling, and that it must

be applied across all levels of government and the wider community [31]. Furthermore, interstate research into the South Australian CDS has acknowledged that education on the CDS needs revitalization to assist in maintaining CDS use and diverting containers away from landfill and into the CDS stream [13]. Therefore, the implementation of educational strategies regarding the CDS should generate an improvement in CDS uptake.

4.8. Recommendations for the Containers for Change Program

This research has demonstrated that while the Containers for Change scheme has had good utilization across Perth, several key barriers to engaging with the scheme have emerged. While awareness of the scheme was high, there was a lack of understanding of the benefits that the scheme provided. However, when compounded with logistical barriers, this makes the scheme untenable for some individuals. Engaging with the recommendations discussed in this research and providing an adequate infrastructure to support the increased uptake of the CDS is vital in working toward a circular economy of waste in Western Australia. The recommendations that are made from the findings of this research are to: (i) broaden the container eligibility, (ii) improve the drop-off locations and types, and (iii) improve education regarding the scheme.

i. Container eligibility and a lack of containers accepted were key issues identified in the data analysis. Based on the results from this survey, it is recommended that the Waste Avoidance and Resource Recovery (Container Deposit Scheme) legislation [65] be broadened to include a wider range of containers. This would require changing the definition of "container" as described in the legislation [65]. To do so, further research is required to understand what economic model would suit this extended producer responsibility. With most states and territories across Australia having similar container eligibility for CDS [37], further research would be required to determine how container eligibility can be increased without significantly altering the costs of items or burdening the consumer. Based on this research, the inclusion of containers that would have the most significant impact on CDS uptake is wine bottles and milk cartons. Wine bottles are accepted across many CDS internationally, with regions in the United States and Europe readily accepting wine bottles [66]. Thus, the inclusion of wine bottles in the WA CDS is currently plausible. However, the inclusion of milk cartons into the CDS would be challenging, as milk is widely excluded from CDS internationally [67]. The exclusion of milk cartons internationally is due to sanitary reasons and ethical reasons around ensuring that a basic "food" such as milk is readily accessible and at a low cost [67]. Therefore, while there may be challenges in including milk cartons, cartons of a wider range of scales and wine bottles could be included in the WA CDS. Finding an economic model that enables this change to occur without placing the entire burden on primary producers is necessary.
ii. The barrier of accessible and convenient drop-off locations was evident throughout the research. To alleviate this barrier to CDS uptake, there needs to be more accessible and convenient drop-off locations for containers. These drop-off points need to "bridge the gap" between dropping off numerous bottles or just a few, allowing individuals who do not generate enough containers to store them around the house to participate. For example, if RVMs were located at major supermarkets across Perth, individuals would be able to participate in the scheme while completing other errands, such as grocery shopping. Research in Wales has also identified the preference for return points at supermarkets, or other alternative locations (e.g., public transport stations and smaller shopping centers) [38]. The implementation of RVMs in more convenient locations addresses the "effort vs. reward" barrier that was identified by non-users of the scheme. Furthermore, for current users, this would make the scheme more accessible and convenient. With only eight RVMs across Western Australia [29], there is a necessity to improve and increase the presence of convenient drop-off locations. Research into RVMs for container deposits has found them to be highly effective and convenient [68]. RVMs have been in place in many Scandinavian countries since the

1950s and are conveniently located in "most grocery stores" [68]. Furthermore, with scholars [68] noting that many schemes with RVMs in place also have high recycling rates, improving the accessibility of drop-off locations and introducing more RVMs in Perth would be beneficial. To facilitate this recommendation, an investigation into the plausibility of RVMs in more centralized locations is required. Based on the findings from this research, if RVMs were to be introduced in shopping centers, supermarkets, or community hubs, this should increase the uptake of the scheme while simultaneously improving user experience.

iii. This research identified that individuals have knowledge of the Containers for Change scheme; however, understanding of the benefits of the scheme and why it is a preferred method of recycling appears to be lacking. Additionally, with survey participants demonstrating skepticism toward the waste management industry in Australia, there is significant work to be done on improving this perception. It appears that both users and non-users of the scheme want to understand where the containers go when they are recycled and the logistics of the scheme. Non-users of the scheme seem to lack an understanding of why they should engage with CDS when they already perform household recycling; therefore, improved education, advertising, and understanding of the benefits of and the necessity for CDS are required. This finding was also obtained in research internationally [38], with scholars recommending that governments place a "strong emphasis in communications on the environmental benefits of recycling through the DRS (CDS) compared to alternatives (e.g., curbside and on-street recycling)". With AUD 2,278,603.60 spent on advertising the WA Containers for Change program from 1 July 2020 to 30 June 2021 [64], a more targeted approach toward educational advertisements should prove beneficial. This research recommendation for the Containers for Change program is to engage in an educational campaign exploring the CDS and the recycling process that occurs. Through this advertising, an investigation should be completed to monitor the impact of this informative education process on CDS uptake across Perth.

5. Limitations

There are some minor limitations that emerged as part of this research process, many of which were associated with the data that was collected. One abnormality that was detected in the data was that there was an uneven gender ratio, with 81% of respondents identifying as female. This may be an indication of the demographic of individuals utilizing the CDS program; however, with such an uneven gender ratio, further research would be valuable to investigate the role of gender in terms of the uptake of recycling programs, such as CDS. Additionally, the majority of respondents involved in this research were in standalone houses; thus, the results from this research are best applied to standalone houses. In addition to the challenges around response diversity, a limitation of this research was the effect of participation bias. Individuals that do not currently use the scheme may be less interested and be less inclined to respond to the survey. Participant bias can reduce the viability of the research and prevent it from adequately representing the wider population [69]. Consequentially, if a participation bias is present, the finding that 68% of survey respondents use the CDS may not be accurate when it is generalized across the entire Perth population. With previous research [69] demonstrating that participation bias is largely disregarded by many scholars, caution was taken in the survey design and distribution to limit this impact. To limit this bias, the survey was designed with clear, concise questions and one central question, separating survey respondents into certain streams. It is necessary to note that this study did not consider the impact of the COVID-19 pandemic on the consumption of plastic waste and the consequent impact on CDS. Further research is required to determine if and what the impact of COVID-19 has been on the consumption of single-use beverage containers that are eligible for CDS.

6. Conclusions

Consumption practices have led to the creation of unnecessary waste and, consequently, have created substantial waste management issues for governments globally. Looking to the persistent issue of single-use drink containers, this research focuses on the Containers for Change Container Deposit Scheme in Perth, Western Australia, implemented in October 2020. By analyzing 414 responses (N = 414), this research has provided insights for policymakers on how the scheme has been adopted and utilized across Perth. This research has found that there has been a good uptake of the scheme across Perth, particularly by standalone households. There are strong levels of awareness of the scheme, with 98% of survey respondents having heard of Containers for Change previously. Despite the strong awareness of the scheme, there is a lack of understanding of the benefits of CDS, and this remained a key barrier in CDS uptake. This was reflected in the many non-users of the scheme noting that they do not understand why CDS is better than household recycling (N = 11). Another barrier to CDS uptake in Perth is the broader skepticism and distrust of recycling and waste management in Australia. This was consistent among all user streams and was reflected throughout the survey by a high prevalence of skeptical comments toward waste management in Australia. This highlights the necessity for an intervention to increase the uptake of the CDS and improve recycling behaviors in general. The other major barrier to CDS uptake was the eligibility of containers, as milk and wine bottles are currently unable to be refunded through the scheme. This was demonstrated, with 87% of survey participants noting that they would participate more in the scheme if there was broader eligibility of containers.

Many of the findings in this research are similar to findings from the 2019 review on the South Australia Container Deposit Scheme [13], indicating that CDS uptake across Australia faces similar challenges. The recommendations that have been made from this research to improve CDS uptake and experience with the scheme across Perth are to: (i) broaden container eligibility, (ii) improve drop-off locations, and (iii) increase education regarding the scheme. With substantial evidence and understanding of the opportunities and barriers to CDS uptake in Perth discussed in this research, it is hoped that adequate changes can be made to increase the utilization of CDS and streamline the transition toward a circular economy approach to waste management in Western Australia.

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Institutional Review Board Statement: The study was approved by the Ethics Committee of Curtin University (HRE2021-0473 on 11 August 2021).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are openly available in ArcGIS at https://arcg.is/5qWaK and https://arcg.is/PLC4P0.

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Appendix A

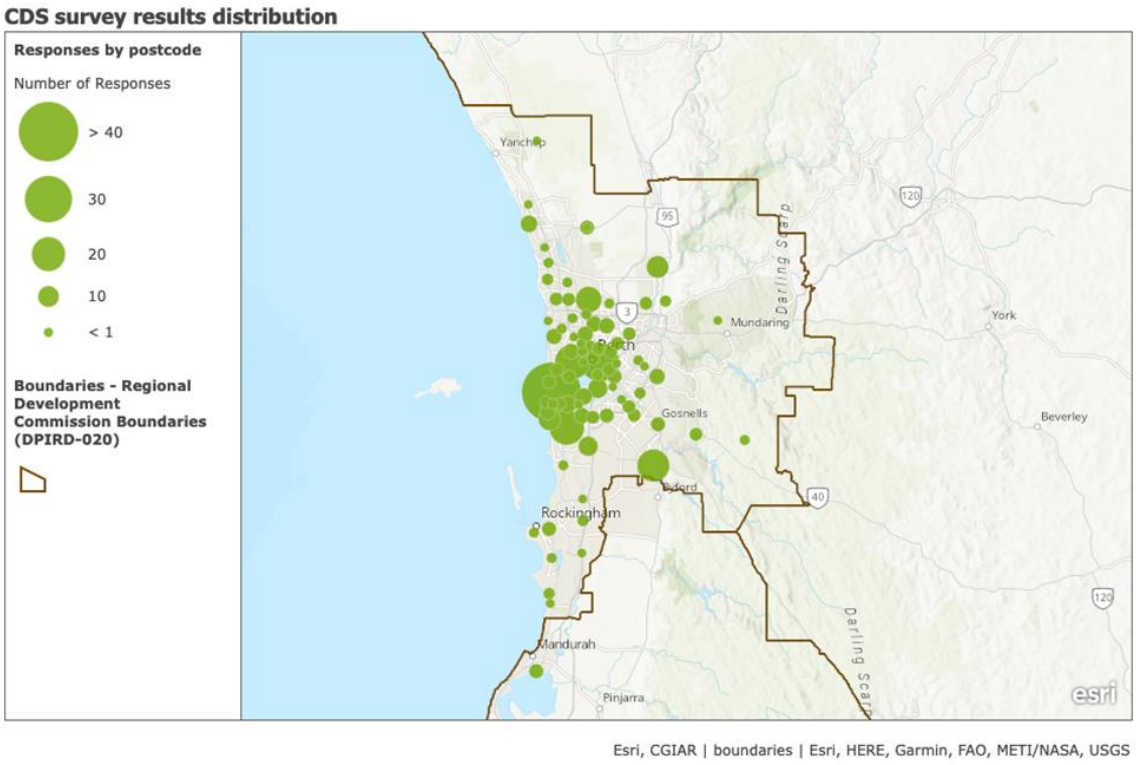

Figure A1. Survey Response Map Large Scale. To zoom in/out and view the map in greater detail, the digital copy of this map can be viewed at: https://arcg.is/5qWaK (Author created).

Appendix B

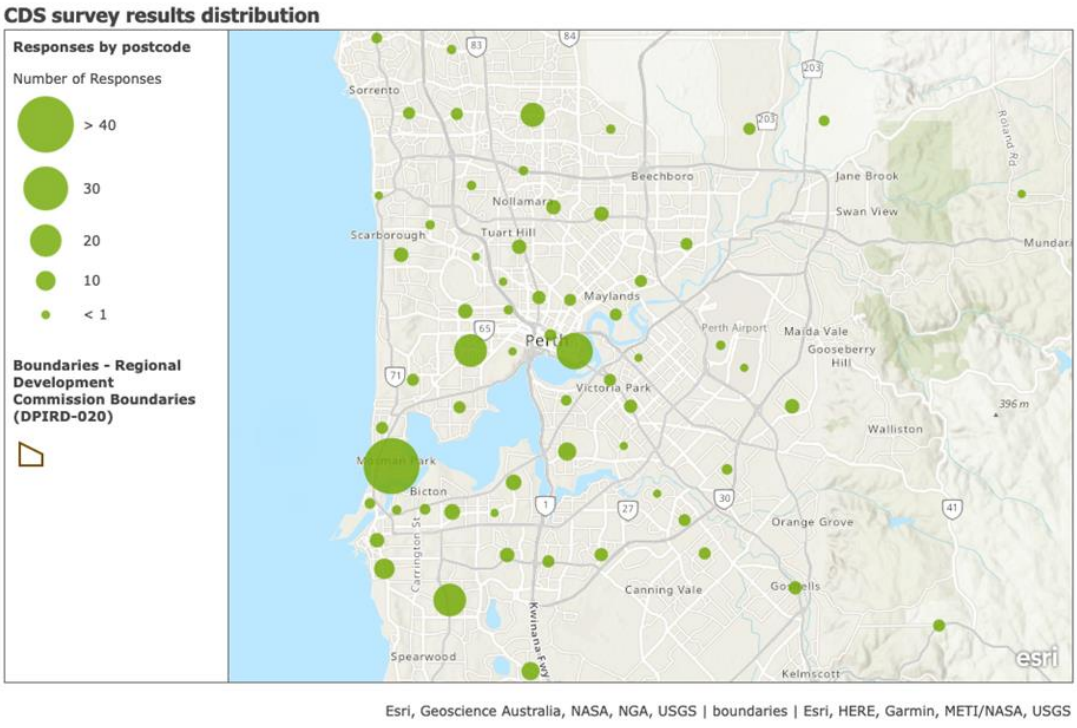

Figure A2. Survey response map small scale. To zoom in/out and view the map in greater detail, the digital copy of this map can be viewed at: https://arcg.is/5qWaK (Author created.)

Appendix C

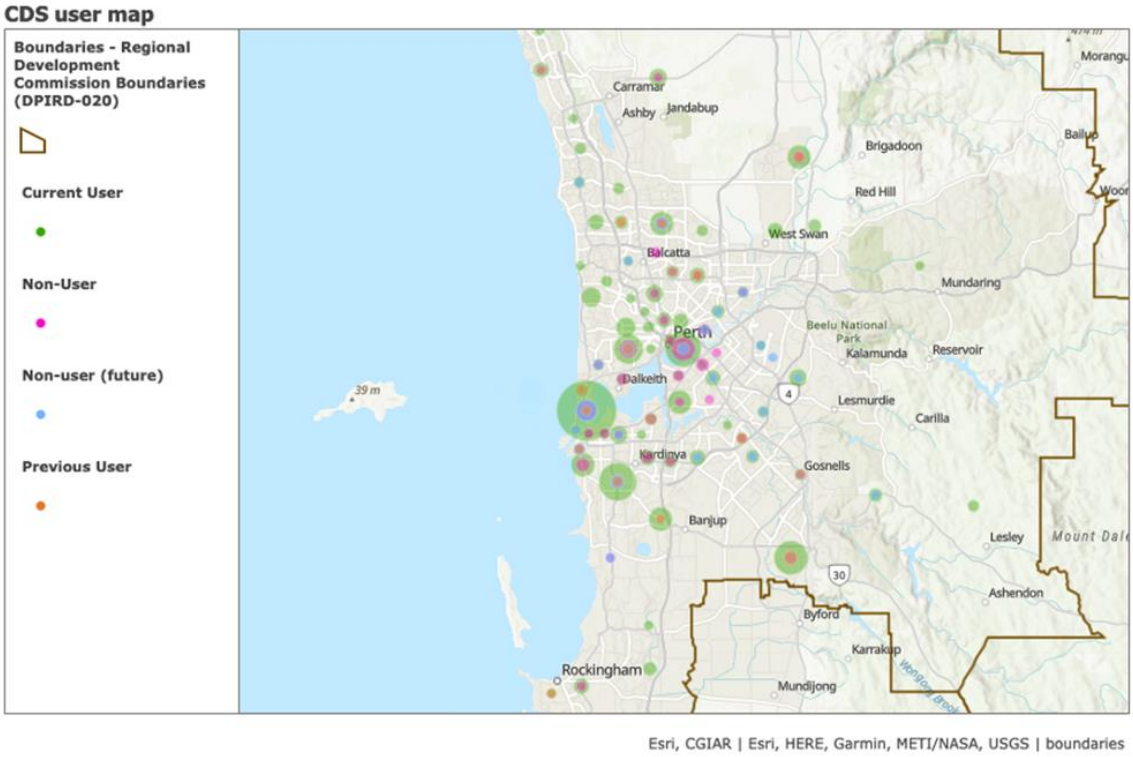

Figure A3. Survey response and CDS user type map all streams. To zoom in/out, and add/remove layers, the digital copy of this map can be viewed at: https://arcg.is/PLC4P0 (Author created).

Appendix D

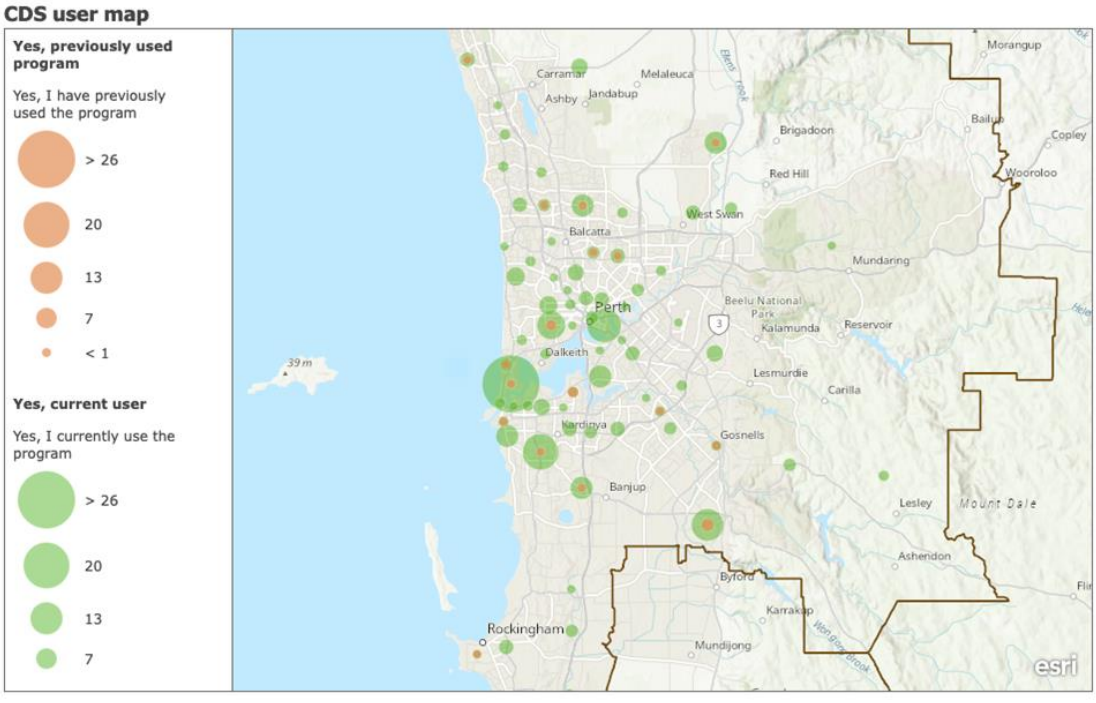

Figure A4. Survey Response and CDS User Type Map (Current and Previous) Response Distribution. To zoom in/out, and add/remove layers, the digital copy of this map can be viewed at: https://arcg.is/PLC4P0 (Author created).

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