

**Ryerson University  
Graphic Communications Management  
GCM 490: Thesis  
Instructor: Ian Baitz**

**Reuse: The Canadian Cannabis Industry's next step for Dried  
Cannabis Packaging**

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**December 6th, 2020**

# Acknowledgments

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To Donna Razik, for being my supervisor in this thesis, for continuously inspiring me to learn everything I can about packaging and supporting me along the way.

To COVID-19, for making it socially acceptable to isolate myself in my room for days at a time to finish this thesis

# Abstract

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The amount of packaging waste created by the Canadian cannabis industry is momentous. Over 5.6 million units of cannabis packaging are used each month for dried cannabis alone. In most cases the packaging for dried cannabis is an oversized jar made of plastic, and often difficult to recycle. This study investigates the consideration for a cyclic packaging infrastructure for dried cannabis packaging within the Canadian cannabis industry. To learn about the customer desire and requirements of a cyclic system in the cannabis industry, an online survey was distributed, interviews were conducted with industry insiders and literature on all connected topics were reviewed. The results showed high interest and potential for a cyclic system. Adopting the cyclic system for dried cannabis packaging would be an industry-wide overhaul requiring collaborations across brands and government, changes to every step in the product life cycle, and high levels of focus on consumer education.

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# Introduction

Since legalization in 2018, the Canadian cannabis industry has been selling their dried cannabis product in oversized plastic containers, a sharp contrast to the minimal packaging used in the illicit market, consumers took to social media to express their frustrations at the volume of packaging waste. Most brands use the same packaging aside from some minute changes in size or material, many of which are difficult to recycle. On average there are 5.6 million packages of dried cannabis sold each month, adding to the accumulation of single-use plastic waste the industry is responsible for. Seeing as there is similarity across all brands for their packaging choice for dried cannabis, there is potential for them all to collaborate and use a sustainable solution, one which could be used in a cyclic system much like the nation-wide beer bottle reuse system. In light of Canada's proposal to eliminate all plastic waste by 2030, it would be advantageous for the cannabis industry to start taking steps now to eliminate their waste. While there has been much research on cyclic systems (Chen, 2020, p. 51; Jugend et al., 2020, p. 61; Kunamaneni et al., 2019, p. 260; Matthews, 2004, p. 112; Niero et al., 2017, p. 744), none have focused on its applications in the cannabis industry. By examining consumer interest and knowledge, the scale of the problem, packaging solutions already in the industry, and established cyclic systems I will be able to evaluate what it would take for the cannabis industry to adopt a cyclic system for dried cannabis packaging.

## Literature Review

In this thesis, I am exploring the question "What would it take for the cannabis industry to adopt a closed-loop recycling center like the beer store?". A large component of my work will depend on secondary resources due to the topic of the study discussing a potential industry overhaul of which I am not involved in or have access to insider resources. The Cannabis industry in Canada is less than a few years old, resulting in limited research on its market, its packaging options, and possible methods to practice sustainability. For these reasons, I have allowed my research to include non-scholarly or peer-reviewed sources for the sake of giving myself information to draw conclusions upon. The literature I will review in this section will be organized thematically by the following aspects of the topic: the issue of cannabis packaging, attempts at sustainability, and existing closed-loop models.

## The Issue of Cannabis Packaging

It is widely accepted among consumers that containers

are sized disproportionally to their contents; in some cases with the product taking up less than 25% of the container volume. As discussed in an article published by the Globe and Mail titled "Why the cannabis industry must address the plastics problem", the amount of non-recycled waste in the industry is becoming a large problem. Based on the estimated 95,850 kilograms of dried cannabis flower sales alone in Canada within the first year of legalization, they came to a concluding estimate of between 5.8 to 6.4 million kilograms of plastic cannabis packaging ending up in landfills during this period. The article argues that the industry should turn to greener alternatives before the failure to do so can impact future bottom lines. However, the size of the packaging was largely dictated by government regulations on the labeling size, whereas the material choices can be attributed to how the industry is new and producers were rushing to capture their cut of the market before other brands, leading to quick and cost-efficient plastic choices.

## Existing Closed-Loop Models

Ontario's deposit return system for beer, wine, and liquor containers is one of the largest local examples of a cyclic packaging system. Its success since its start in 2001 has since become a model for adopting cyclic systems in different environments and a focal point of research when applied to the possibility of cyclic solutions in the cannabis industry. In the newspaper article "Ontario's best reuse and recycling program is under threat", the Waterloo Region Record argues that this very system is the "best reuse and recycling program in the province" mentioning that in 2019, 97% of refillable beer bottles were collected back through the system and reused an average of 15 times before being recycled. These numbers are very high and a direct result of the beer industry's decades-long (since the stubby beer bottle was standardized in 1962 (Gray et al., 1983)) establishment of the program, the commitment to the cyclic system improved as they streamlined the process for the consumer with the convenience of numerous locations. The individuals' interest in collecting their deposits raises their chance of cooperation and has shifted the community mindset to the prioritization of this solution over time. It has resulted in the high collection rate that is currently upheld by the program. These same numbers are unlikely to appear right away if there was a cyclic system in the cannabis industry, but it is surely a case of how the commitment to sustainability can lead to great things.

The beer deposit system is not the only existing cyclic system making waves. In January 2019, TerraCycle

launched Loop, a circular shopping platform with products from brands such as Haagen-Dazs, Unilever, and PepsiCo. Volume 75 of the *Plastics Engineering* publication includes an article, “In the Crosshairs: Single-Use, Disposable Packaging”, discussing the Loop platform, its vision, and the economic and material implications within. The article brings up important points about designing packages for reuse, in Loop their goal is for each package to be reused 100 times, and since the upfront cost to produce a package for reuse is much higher than a single-use package, the opportunity to improve the package’s features arises. An example is the double-walled stainless steel Haagen-Dazs container which elevates consumer experience with better insulation for the icecream while still comfortable to hold in the hand. The cannabis industry, being relatively new, has yet to experience any such packaging features, leading to increased interest in the possibility of similar innovations. Slant Jar by Cannasupplies is an example of these innovations, offering an alternative shape of the container which offers consumers to place the container down on a flat surface at a slanted angle which makes the extraction of the product much easier. Another important discussion in the article is the material implication; the company tested different plastic materials and shared their impressions of their potential performance in a cyclic environment. Currently, all containers for dry flower cannabis utilize plastic closures due to the regulatory requirement of childproof packaging. Even though the article provides just a sentence or two on each material discussed on their performance, the insight is valuable provided the current gap of publicly accessible information regarding Cannabis package design for cyclic use.

## Attempts at Sustainability

TerraCycle already has an initiative to tackle the problem of packaging waste in the cannabis industry with their Tweed | TerraCycle Partnership created the first national recycling program of its sorts, taking in all legal cannabis packaging deposited in their collection boxes at dispensaries or shipped by individuals to turn into new plastic objects (Tweed 2019). A program with great potential but it raises concerns if it might enable the industry to continue using hard-to-recycle plastics in their packaging. In another *Plastics Engineering* article “Cannabis Packaging Seeks Novel, Sustainable Options” discusses the interest in more sustainable solutions and the packaging challenges for cannabis which affect the material choices, expressing high interest in the application of hemp plastic for cannabis packaging. The use of bioplastic appears to have

a high interest in the industry. Uncovering some examples floating around the industry (cannasupplies, 2020) the packaging isn’t entirely bioplastic, rather it’s combined with other types of plastic, raising concern about recycling mixed plastics.

The paper “Closed-Loop Recycling of Polymers Using Solvents” by James Sherwood, discusses the advantages and disadvantages of three solvent-based recycling processes, including PLA (Polylactic Acid (a bioplastic)). The conclusion with PLA was that the process produces inferior polymers and that the utilities demand is too high to compete with mechanical recycling (mechanical recycling is not appropriate for PLA). If products require chemical recycling when petroplastic and bioplastic is mixed, partially bioplastic products are rendered potentially less sustainable than pure petroleum-based plastics as the recycling is more difficult (Sherwood, 2020).

Creating and maintaining a circular economy is no simple task. This is established in “Improving Circular Economy Business Models: Opportunities for Business and Innovation” where the conclusion is that circular business models involve changes in the supply, stakeholder networks, and product-service offerings, it would be a massive and far-reaching undertaking. The beer industry in Canada was not standardized until 2001 after decades of independent brewery reuse systems. Chong-Wen Chen was able to bring many examples to support his conclusions, dissecting the complexity of managing a circular economy on different levels. While the article provides insight on the opportunities and challenges of creating a circular economy, it does not touch much on reusable packaging, applying Chen’s framework to this thesis will require the collaboration of other readings to draw fruitful connections.

In conclusion, drawing small pieces of information from my collection of literature together to make applicable conclusions for the research question at hand is a crucial part of this thesis. Taking information about the market volume and consumers within the industry and relating those numbers to the methodology provided in literature regarding the system of beer bottle reuse to provide an idea of the energy requirements for creating such a system. Reviewing the material choices in Loop’s system will assist in picking a suitable path for the cannabis industry, depending on the requirement of the packaging outlined in “Cannabis Packaging Seeks Novel, Sustainable Options”. Utilizing Chen’s framework that defines the potential barriers and referring to industry information to theorize how they may be overcome, my research will draw on these



existing theories and methods to fill the gap of research regarding sustainable cannabis packaging as well as the gap in research in how-to apply circular economies to new industries.

## Methodology

My overarching research question was “What would it take for the cannabis industry to adopt a closed-loop recycling center like the beer store?” Seeing as this is a largely unexplored area of research I broke the question down into five sections to make it easier to tackle and later bring together. The five sections are The Problem, The Need/Want, What Steps Have Been Taken Already, Framing the Solution, and lastly Proposing the Solution. I then broke up each section further into smaller questions to find relevant information in those areas. Most of the data I needed was qualitative, such as information about the industries and methods of creating and maintaining circular economies. I garnered a collection of articles and research papers to read and find relevant information to relay into my thesis. Not all resources are scholarly, however, they were all from reputable sources.

## Qualitative research

Since there was limited information publicly available about creating a reuse system for packaging, the Canadian Cannabis Industry, or their packaging choices beyond labeling requirements, I reached out to industry professionals to conduct interviews via Google Meet to gain first-hand insight. These interviews were with Paul Weaver who was the Director of Innovation at Canopy Growth, a leading cannabis brand in Canada, Rachel Morier, the Director of Sustainability at The Beer Store, which runs the largest circular economy in Ontario, and Mark Finkelstein, the VP of Sales and Strategic Development at Cannasupplies, a leading cannabis packaging supplier, Lindsey Swartzman and Annika Greve who work at TerraCycle Canada, a global leader in sustainability. These interviews lasted under an hour each and were semi-structured with some prepared questions depending on the interviewee’s specialty. During my research, there was a live webinar from PAC I participated in called “Do You Need a Refill?” which discussed examples of circular economies and how they work and some issues they may come across.

## Quantitative research

One of the critical numbers I needed was to find out how many dry flower containers are consumed each

year in Canada. I couldn’t find this number through online resources so I conducted an online survey to help determine this number as well as provide other pertinent data. This survey was formatted to have 8 sections divided thematically to help maintain the participant’s focus; consent page, preliminary and demographic questions, cannabis usage, participating in other cyclic programs, rating sustainability and other packaging features, rating material choices, interest in a cyclic program for cannabis packaging, questions about financial flexibility for alternate packaging solutions, and lastly a page for residual opinions.

The survey was designed with efficiency in mind, the goal was to minimize the time internet strangers would need to spend answering the questions in order to not lose their interest before their response could be collected. Most questions only needed a single click to answer as they were multiple-choice or Likert scales. There were four open-answer questions, one was asking about how users deal with their empty cannabis products to give room to describe their process, and the other three were from respondents to share additional thoughts on the topic if they had any.

There were four questions I wanted to answer with the survey:

- 1) What is the consumption rate among Canadian residents?
- 2) What are the consumer’s perceptions of the industry?
- 3) What are the respondent’s priorities with cannabis packaging?
- 4) How interested/knowledgeable are the respondents in sustainability efforts?

The first question was to help me estimate the total number of packaging units used each year for dried cannabis to see how many reusable packages would need to be created to sustain the market. For this, I asked multiple-choice questions about the type and monthly quantity of their primary and secondary method of consuming cannabis. I used 5g ranges up to 30g as the multiple-choice for the quantity, and categories based on Ontario’s online cannabis store (ocs.ca) for the type. After distributing the survey I discovered Statistics Canada’s information about this topic and will use their data in-line with my own for comparison.

The second question was to seek support in explaining the need for industry change in my thesis. These questions in the survey used 5 or 10 point Likert scale ratings on their interests or opinions. This format allowed for the respondents to rank their beliefs on a



quantitative scale which they would be familiar with. Using the Likert scale also allows me to create a mean average number which could truthfully represent the respondent's beliefs in my thesis.

For question three I asked respondents for their preference of materials, how they value particular functions of cannabis packaging, their interest in a reuse system in the industry, and their financial flexibility for alternate packaging solutions. For materials I had the respondents rank the four options in direct comparison with one another using a multiple-choice grid from most to least preferable. This would help me propose which material to use for a cyclic packaging solution. For recording how consumers value particular features the questions were framed with 5 point Likert scales for the respondents to pick and choose which spot suits them best. This data will assist in seeing what the priorities should be when it comes to the packaging design. Ranking their interest in a reuse system was also placed on a 5 point Likert scale for the same reasons, there were two parts both of the same question and format but the second with a potentially negative condition to see how it affects their interest in participating in a reuse system. The purpose of these questions helps gauge the room for a new but less convenient package if required for the circular environment. For the respondent's financial flexibility the survey presented an image of an example product and price to be referred to as a basis for the next three questions asking how much would they pay additionally in different situations. These questions were made with four multiple-choice options of different price ranges for respondents to pick which extent they are comfortable with. This data could help create statements about how much financial support could be garnered to create a more sustainable system.

The fourth question was answered using both multiple-choice and open-ended formats. I had the respondents type their answers for how users deal with their empty cannabis products since in my prior personal experience there are a myriad of methods. I later read the responses and created categories (if they tried to recycle, just sent it all to landfill, reused independently or participated in some cyclic system) based on the trends I saw. The survey asked if the participant was aware of the TerraCycle X Tweed recycling program, and then if they participated in it previously as well as if they have participated in the beer bottle reuse program. These were all formatted in multiple-choice with Yes/No/Maybe answers due to the simplistic nature of the question. These questions were to help gauge how likely they would participate in another CE

program. A concern with these questions is that Tweed X Terracycle has been minimally accessible during the last nine months of the pandemic, as well as a regular consumer of cannabis might be less likely to participate in collecting alcohol bottles for reuse since they substitute alcohol for cannabis.

Due to the ethical consideration of asking about a controlled substance, the participation was purely voluntary all questions except three (asking for consent, if they are a resident in Canada and if they consume Cannabis). The participant can withdraw consent at any time since it is online by just exiting the window as responses are only collected at completion. Questions also include the option to answer "Prefer Not to Say" if the participant does not wish to disclose that information. This survey was created using Google Forms, and does not require an email address to participate, and was distributed across social media platforms such as Instagram, Reddit, and Twitter during November 2020. The survey was closed at 500 participants and most questions garnered at least 480 responses, whereas the written questions garnered about 220 responses each. The data was analyzed in Google Sheets. The full questionnaire can be found in the Appendix.

## Results

In total there were 500 individuals participating in my survey. 133 identifying with she/her, 318 identifying with he/him, 32 identifying with more diverse pronouns such as they/them or alien fighter, and 17 undisclosed. Over 45% of respondents were born during the 1990s, 11.4% in the 2000s, and 28.3% in the 1980s. Of these participants, 490 (98%) responded that they do consume cannabis (answered "Yes" or "On Occasion") as shown in Figure 1.

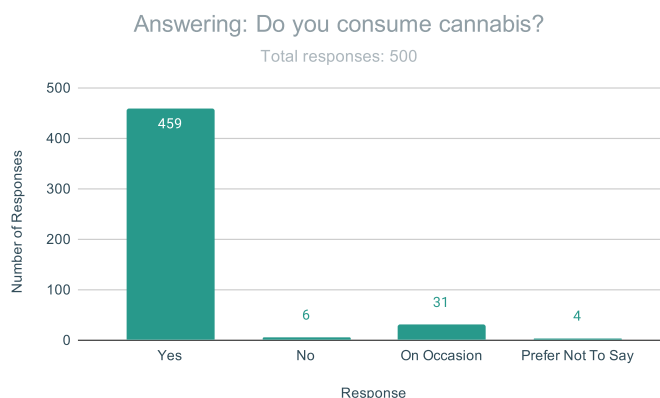


Figure 1  
Respondents Participating in Consuming Cannabis

Due to the nature of the survey, not all respondents responded to all questions, leading to an inconsistent number of responses within each table or figure. Averages will be used for comparison across tables or figures.

The survey was posted across many platforms such as Instagram and Reddit. The posts on some Reddit pages which have more devout cannabis users likely garnered the most responses since those posts gained many more 'upvotes' leading to the survey reaching more individuals.

## What is the consumption rate among Canadian residents?

### Table 1

Dried Flower Cannabis Sales in Kilograms over 12 month period (as reported by StatCan (Canada, 2020))

Year-Month	Medical Sales (kg)	Non-Medical Sales (kg)
2019-09	1,215	11,707
2019-08	1,210	11,762
2019-07	1,640	10,054
2019-06	1,535	8,480
2019-05	1,697	7,818
2019-04	2,129	6,735
2019-03	1,698	5,928
2019-02	1,698	4,985
2019-01	1,779	5,528
2018-12	1,816	5,784
2018-11	1,795	5,490
2018-10	1,941	4,405

The total medical sales in this 12 month period are 20,153kg and the total non-medical sales are 88,676kg. The total sales for both categories during this period is 108,829kg. To find the amount the average cannabis consumer consumes within a month according to Health Canada (2020):

(Total kg of cannabis sales in Canada in a year)/12months=Mean average amount of sales per month (kg)					
108,829	kg	/	12	=	9069.08 kg
Mean sales per month (kg) / population of cannabis consumers = kg per consumer each month					
9069.08	kg	/	6,346,874	=	0.001429 kg
					1.43 g

Therefore, according to Health Canada (2020), the average cannabis consumer goes through 1.43g a month.

### Sourced from the survey:

### Table 2

#### Respondents Consumption of Dry Flower Cannabis

Total responses in Table 2: 431

This table uses data from the survey to determine the average amount of dry flower cannabis consumed in a month per individual. The top section counts the users which consume dry flower cannabis, either as their primary or secondary method, and the amount consumed each month. The percentages in Row 4 designate a percentage of how many of the responses fall into that amount category. Since the amounts are in ranges to determine a number I used the mean average number from those ranges to calculate the total consumption within that range using the following formula: (Primary users in category + secondary users in category)\*average # in range = Total consumption in category. These values were added up to determine the "Total Consumed per month (g)" which was then divided by the total number of responses in the table (431) to determine the Mean Average of dry flower consumed per month in grams (16.03g)

### Table 3

#### Primary method of obtaining Cannabis for dry flower consumers

Total responses in Table 3: 438

This table tallies how the respondents which consume dry flower primarily obtain their cannabis. 66.21% of respondents use legal channels that require packaging. 8.45% of those who "Growing my own" are also considered a legal source, but do not require packaging as the stores do.

### Table 4

#### Respondents Consumption of Dry Flower Cannabis and Primarily source from Online or In-store

Total Responses in Table 4: 283

Table 3 has a total of 290 users using online and instore methods, however, there are 7 fewer responses in this table due to inconsistent filling of answers in the survey. The maths of this table is the same as Table 2 just with different source data. The final average consumed per month for dry cannabis consumers which source through legal stores (Online and Instore) is 14.86g.

	Less than 1g a month	1-5g a month	6-10g a month	11-15g a month	16-20g a month	21-25g a month	25-30g a month	More than 30g a month
Primary	9	59	48	45	26	21	58	85
Secondary	17	18	16	10	6	2	6	5
	11.91%	19.65%	16.84%	12.66%	7.45%	4.24%	12.01%	15.23%
Mean Avg Amount consumed per month (g):	0.5	2.5	7.5	12.5	17.5	22.5	27.5	30
	13	192.5	480	687.5	560	517.5	1760	2700
				Total Consumed per month (g)				6910.5
				Mean Avg Consumed per month per individual (g)				16.03

*Table 2*  
Respondents Consumption of Dry Flower Cannabis

	Online	In-store	Illegal means	Growing my own	Prefer not to say
Dry Flower	188	102	98	37	13
	42.92%	23.29%	22.37%	8.45%	2.97%

*Table 3*  
Primary method of obtaining Cannabis for dry flower consumers

	Less than 1g a month	1-5g a month	6-10g a month	11-15g a month	16-20g a month	21-25g a month	25-30g a month	More than 30g a month
Primary	8	45	33	30	14	17	32	51
Secondary	11	15	13	5	2	2	2	3
	12.12%	23.93%	19.44%	11.24%	4.93%	5.58%	8.84%	13.92%
Mean Avg Amount consumed per month (g):	0.5	2.5	7.5	12.5	17.5	22.5	27.5	30
	9.5	150	345	437.5	280	427.5	935	1620
				Total Consumed per month (g)				4204.5
				Mean Avg Consumed per month per individual (g)				14.86

*Table 4*  
Respondents Consumption of Dry Flower Cannabis and Primarily source from Online or In-store

Year-Month	Sales of Dried Cannabis (packaged units)		
	Medical	Non-Medical	
2019-10	343,840	5,204,955	
2019-11	332,750	5,327,990	
2019-12	327,640	5,736,725	
2020-01	338,493	5,513,535	
2020-02	299,754	5,229,083	
2020-03	386,877	5,729,118	
2020-04	378,829	5,199,858	
2020-05	343,126	5,368,421	
2020-06	377,373	5,895,382	
2020-07	360,486	6,567,647	
2020-08	345,475	6,752,938	
	Total Medical Units	Total Non-medical Units	Total Units
	3,834,643	62,525,652	66,360,295
Adjust for 12 months			
	4,183,247	68,209,802	72,393,049
Mean Average Per month			
	348,604	5,684,150	6,032,754

Table 5

Number of packaged units of dried cannabis sales (as reported by Health Canada (2020))

## How many individually packaged units of dry flower cannabis are consumed each month?

Table 5

Number of packaged units of dried cannabis sales (as reported by Health Canada (2020))

Health Canada (2020) only provided 11 months of data so to adjust for 12 months the totals were divided by 11 and then multiplied by 12. Resulting in 72.4 million units sold over a year with a mean average of 6 million units sold per month.

According to Canada (2020), the Canadian population is 38,005,238. Health Canada (2019) claims 16.7% of Canadians used cannabis in the fourth quarter of 2019. 16.7% of the total population is 6,346,874. Meaning that there are an estimated 6,346,874 cannabis consumers in Canada. Health Canada (2020) also claims 71% of units sold were for dried cannabis. Using the above statistics and values, approximately 71% of the cannabis consumers in Canada choose dried cannabis. Therefore, the potential reuse dried Cannabis packaging market is just over 4.5 million consumers.

With the average amount of 14.8g of dried cannabis consumer per individual through legal commercial methods and considering that the most common

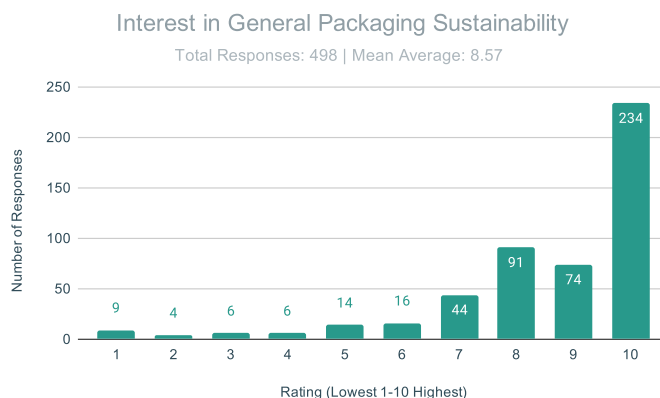
packaged unit size contains 5g, the average individual monthly consumption volume is 2.96 units. The average amount of units consumed multiplied by the total consuming population makes for 13,338,590 individually packaged units of dried cannabis used per month according to survey responses. This statistic is 2.2 times larger than the monthly units sold as reported by Health Canada.

## What are the consumer's perceptions of the industry?

Figure 2

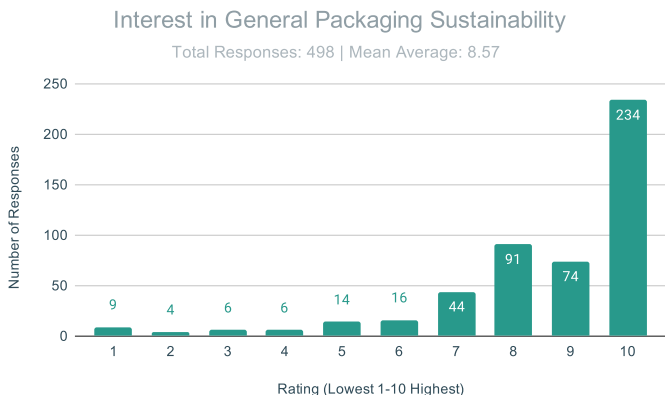
Rating of the Cannabis Industry as a whole

Total Responses in Figure 2: 499



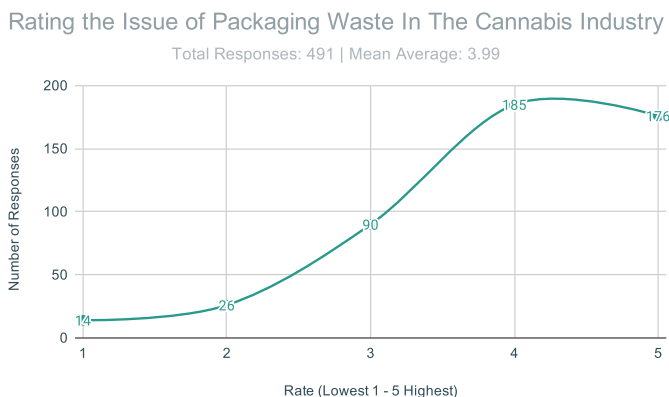
This question had the respondents rate the industry on a ten-point scale, most (153) answered 7 out of 10, followed by 6 out of 10 (103). The mean average rating for the industry is 6.19 out of 10. Even though the preference leans towards the higher side, 9 and 10 out of ten have some of the least responses (14 each).

**Figure 3**  
**Interest in General Packaging Sustainability**  
Total Responses in Figure 3: 498



This table shows how interested the respondents were in packaging sustainability. With 498 responses the mean average of the results is 8.57 out of 10. Only 7.83% of respondents rated their interest 5 or less. Having a total interest (10 out of 10) was the most popular with 47% (234) of the responses.

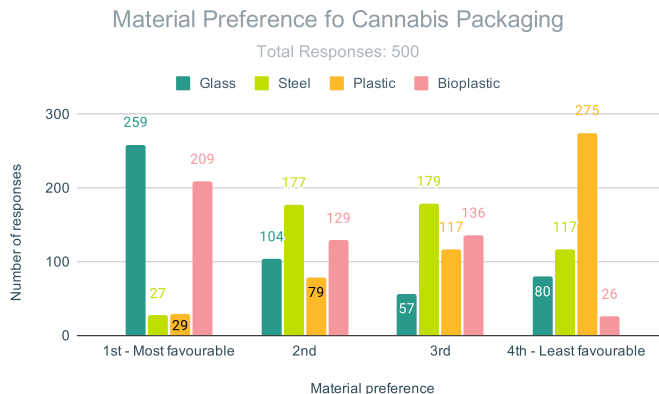
**Figure 4**  
**Rating of the Issue of Packaging Waste in the Cannabis Industry**  
Total Responses in Figure 4: 491



This question has the participants rate, in their own opinion, the issue of packaging waste in the cannabis industry. With 491 responses the mean average result is 3.99 out of 5, five being the largest issue. 73.52% (361) of the respondents rated the issue highly (choosing 4 or 5 out of 5).

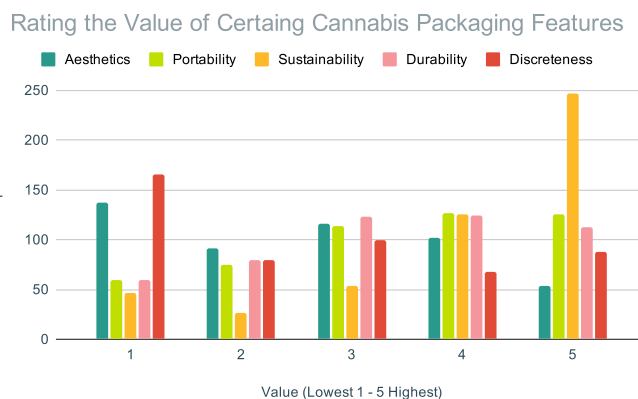
## What are the respondents priorities with cannabis packaging?

**Figure 5**  
**Material Preference in Cannabis Packaging**  
Total Responses in Figure 5: 500



This question had the participants rank their preference in certain cannabis packaging materials. The final ranking of these values is as follows: Glass, Bioplastic, Steel, and Plastic. 89% of the respondents chose either glass or bioplastic as their most favourable material from the selection.

**Figure 6**  
**Rating the Value of Certain Cannabis Packaging Features**  
Total Responses in Figure 6: 499-500



This figure is a compilation of five questions, directly comparing the results to one another. Participants rated (out of 5) how much they value particular features in packaging. Respondents valued sustainability highly whereas discreteness and aesthetics ranked low. The value of durability and portability remained quite level with a slight upward trend.



	Value of certain feature				
	Aesthetics	Portability	Sustainability	Durability	Discreteness
Total Responses	499	500	499	499	499
Mean Average	2.69	3.37	4.00	3.30	2.67

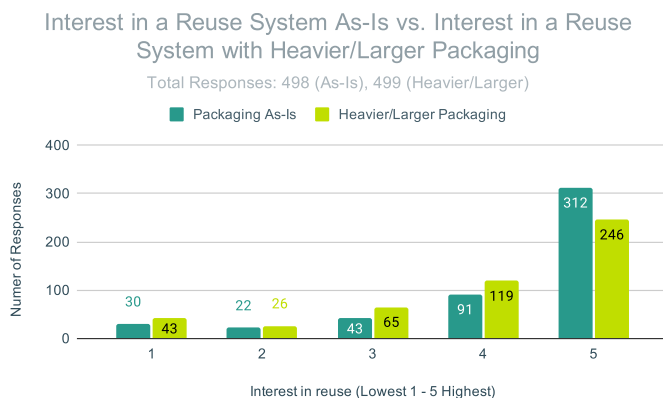
**Table 6**  
Rating the Value of Certain Cannabis Packaging Features

**Table 6**  
Rating the Value of Certain Cannabis Packaging Features

Total Responses in Table 6: 499-500  
This table is created in tangent with Figure 6, providing additional insight for the mean average values for each packaging feature type. The features in descending order are as follows: Sustainability (4.00), Portability (3.37), Durability (3.30), Aesthetics (2.69), and Discreteness (2.67).

**Figure 7**  
Interest in a Reuse System As-Is vs. Interest in a Reuse System with Heavier/Larger Packaging

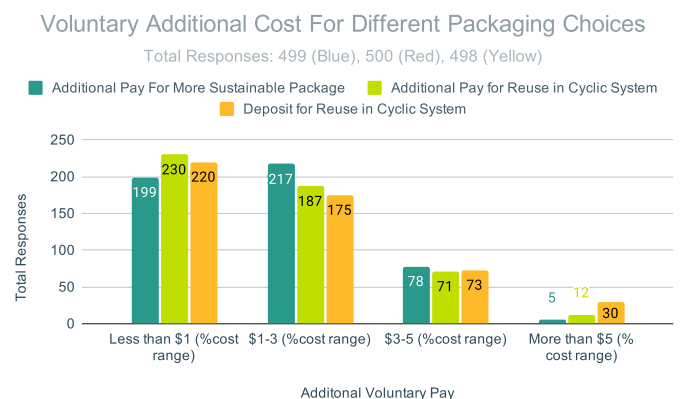
Total Responses in Figure 7: 498 (As-Is), 499 (Heavier/Larger)



Participants were asked to rate their interest in a reuse system on a 5 point Likert scale, and then the same question again but with the condition that the packaging may be heavier or larger. Participants were still highly interested in both options however the interest if it was heavier/larger, was slightly weaker. The mean average of the interest in a reuse system as-is was 4.27 and decreased to 4.00 for heavier/larger packaging.

**Figure 8**  
Voluntary Additional Cost for Different Packaging Choices

Total Responses in Figure 8: 498-500



This figure directly compares the responses to three similar questions about how much additional cost would the participant be willing to pay for different packaging circumstances. Responses remained level within each price range. 60% would pay over a dollar extra for a more sustainable package, 54% would pay >\$1 for a package that could be reused in a cyclic system, and 56% would pay >\$1 as a deposit for reuse in a cyclic system.

## How interested/knowledgeable are the respondents in sustainability efforts?

**Table 7**  
Consumers Knowledge and Participation in Sustainability Efforts

Total Responses in Table 7: 455-499

This table collects information on consumers' knowledge of and participation in sustainability efforts. The first question "What do you do with your empty cannabis packaging?", was originally asked as an open-ended answer and was then later sorted into four categories. Many participants try to recycle what they can (47%)

What do you do with your empty cannabis packaging?		
Response	Number of Responses	Percentage of Response in Category
Recycle What I Can	212	46.59%
Garbage	168	36.92%
Reuse Independently	52	11.43%
Participate in some cyclic system	23	5.05%
<b>Total Responses</b>	<b>455</b>	
Have you heard of TerraCycle's Cannabis Recycling Program?		
Response	Number of Responses	Percentage of Response in Category
Yes	67	13.43%
No	432	86.57%
<b>Total Responses</b>	<b>499</b>	
Have you returned containers to the TerraCycle program before?		
Response	Number of Responses	Percentage of Response in Category
Yes	30	6.07%
No	452	91.50%
Maybe	12	2.43%
<b>Total Responses</b>	<b>494</b>	
Do you partake in the beer bottles collection for reuse system?		
Response	Number of Responses	Percentage of Response in Category
Yes	260	52.31%
No	207	41.65%
Maybe	30	6.04%
<b>Total Responses</b>	<b>497</b>	

*Table 7*  
Consumers Knowledge and Participation in Sustainability Efforts

or reuse them independently or as part of a system (16%). A small percentage (13%) of respondents were aware of TerraCycle's Cannabis recycling program, additionally only 42 out of 494 participants might have participated in this program before. In comparison, 58% of respondents participated in the collection of beer bottles.

## Summary of Commentary from Qualitative Answers

Question from Survey: Are there any other particular things you find interesting in cannabis packaging?

Respondents were interested in seeing more of the following features: accessible openings, smell proofing, fun colours, higher moisture retention, description of terpene profiles, a window to see the product inside the



container, if the product was organically grown, what nutrients were used, the dry and cure times.

Question from Survey: Any other changes you would like to see in the packaging of cannabis products? (Such as in areas of accessibility, sustainability, branding, feel, and others)

Respondents mentioned an interest in the following changes: Inclusion of accessories in the packaging like rolling papers or grinder, easier opening for seniors, different colours for different products, as small packaging as possible, a “packaged on” and a “harvested on” date on the package, more branding to feel less clinical, the option to bring in own containers to be filled in-store, if the packaging could be treated more like alcohol is, and more boveda packs.

## Results of Interviews

Paul Weaver shared insight from his experience in the industry. Many packaging solutions come from china, picking on what is cheapest and fastest. Currently, the industry is leaning to move to Ziploc style bags since they are cheaper to buy, lighter for transport, and can fit more on a pallet. Cannabis itself is very light and easy to move, making it likely that instead of packaging the product at various cites they might have just one center for packaging. He raised claims that no cannabis packaging gets recycled due to how the government described the safe disposal of cannabis to mix with cat litter and throw into landfill. When it comes to sustainability, the industry would claim they care but might not when it comes to acting on it. The industry itself is closer to pharmaceuticals, sold like alcohol, and marketed like tobacco. When it comes to a closed-loop, the industry would likely have to be forced by something like the government to concede, even then the government does not like to stifle competition. Glass beer bottles are amortized so it is good for CFOs. Paul described three buckets for the CE; better for the environment, better consumer experience, and making it justifiable.

Rachel Moirier provided insight into how the beer bottle reuse system came to be and functions. The beerstore collaboration came before the concern of GHG was a thing, there were already cyclic solutions in place in breweries such as Molson and Labatt. The collaboration was all about cost savings, on the material itself but also in manufacturing and transport, and it evolved over time. The program was that breweries would subscribe to the Industry Standard Bottle pool to get

bottles. The system is purely funded by the industry - extended producer responsibility. The bottle is stronger due to its participation in the system and doesn't break as easily as American bottles might.

Mark Finkelstein provided his insight from the packaging distribution side of the cannabis industry. He does not believe that a cyclic solution is viable today citing a few reasons; cannabis is harder to sterilize due to its sticky nature, there's too much variety in cannabis when compared to beer, and that the industry is too focused on surviving tomorrow rather than long-term solutions. He estimated that there are 15-20million dry flower cannabis packaging units in the market this year, over 30million when including other product types. The Slant Jar designed as a custom product for The Green Organic Dutchman to be perceived as eco friendly, the jar is green glass with an unknown coating on the inside to help with opacity and a polypropylene child-resistant lid. Mark claims that about 30% of PP gets recycled and is currently still the most sustainable alternative when looking at the macro level. Glass is 100% sourced offshore because not a lot of producers are making wide mouth style jars in north America. Using domestically sourced solutions cut on the transportation footprint and around 70% of plastic is made domestically. Hemp bioplastic infused solutions are not in the market yet but are looking to be about 20-33% bioplastic. For 100% bioplastic, the cost and testing are difficult, there are heavy contamination considerations, and is currently looking to be more viable in the USA. These are mostly buzzwords in the industry. When asking about the possibility of including additional features such as NFC, Mark responded that NFC inclusions would be too expensive and it is more viable to include QR codes where consumers could pull up terpene and other information about the product.

Lindsey Swartzman and Annika Greve provided valuable insight on how Loop and TerraCycle X Tweed functions. Loop is largely an online platform offering various consumer goods working on smaller scales and slowly growing since the program is new. They are planning to pilot their program in Toronto soon in partnership with Loblaws. Most of their cleaning of packaging is manual and they will not be cleaning them in canada but ship the empty dirty packaging to a cleaning center in the USA. Any residual product within the containers has regulated disposal methods, which is important for Cannabis as a controlled substance. They do not transport containers with residual cannabis across the canadian/american border so for TerraCycle X Tweed it has to all be domestic. For their collection boxes in cannabis stores the boxes are

sealed and then a shipping label is printed and stuck to the collection box to be shipped to a center. When asking about their thoughts on the possibilities of a glass cannabis package they raised concerns about how it may affect shipping costs.

## Discussion

### The Problem

No matter what the brand may be, their packaging solution for dried cannabis is most likely going to be an oversized plastic jar with a plastic child-resistant lid where the only sense of branding is on the sticker label wrapped around the jar. This choice is dominating the market and currently it makes sense as follows. The moisture retention requirements of the product omit materials such as paper. Additionally, the structure and size of the packaging is dictated by the regulations set by the Canadian government. There are significant labeling requirements, which lead to the egregious size of the container compared to the volume of product within and with the mandate for child proof packaging on all cannabis products it is difficult for the brands to utilize different solutions.

The Canadian cannabis industry (CCI) is still very young, meaning customers aren't aware of brands, let alone be loyal to any particular brand. Companies wanted to get out and into the market fast, they had limited time to think of the products end of life and coined with the instability of the market, there isn't much room to invest into nicer packaging solutions, leading to the saturation of these basic wide mouth plastic jars in the marketplace.

Recent amendments to the federal regulations permit smaller packages to use "accordion" or peel-back type labels, to help reduce the amount of waste created by cannabis product packaging (Marijuana Business Daily, 2020). This largely reduced the number of secondary packaging previously required to serve the labeling regulations, but has yet to make an impact on dried cannabis canisters themselves. They are still oversized and company executives estimate that 3.5 grams of flower, on average, comes with up to 78 grams of plastic packaging (Marijuana Business Daily, 2020). Based on the estimated 95,850 kilograms of dried cannabis flower sales alone in Canada between October 2018 and August 2019, and assuming between 70-78 grams of plastic packaging are generated for every one gram of flower, an estimated 5.8 to 6.4 million kilograms of plastic cannabis packaging still ended up in Canadian landfills during their 11 month time period (from dried

cannabis flower containers alone)(Wallis, 2020).

In many cases, consumers assume that the packaging is recyclable, that is what 47% of survey respondents do with their empty cannabis packaging. But even if they place it in their recycling bin, Canada only manages to recycle 9% of their plastic waste. During the 11 month period from October 2019 to October 2020, 66,360,295 total packaged units of dried cannabis were sold in Canada and the chances are that only 9% of that gets recycled, sending 60,387,838 of these plastic containers to landfills. There is an upward trend of cannabis sales in Canada during that same 11 month period, the sales have increased by 30%, meaning that the amount of waste the cannabis industry is creating is growing exponentially.

### The Need for Sustainable Cannabis Packaging

As a whole, consumers rate their overall opinion of the cannabis industry as a whole a 6.19 out of 10 where just under 6% of consumers rated the industry highly at a 9 or 10 out of 10, meaning that most consumers agree that it could be better. There are two issues consumers often complain about in the legal cannabis market, the price and packaging waste. Luckily, prices on cannabis have been steadily decreasing making it more accessible and comparable with the grey-market prices. However the packaging waste problem persists. On a scale from one to five, five being the highest, consumers rate the issue of packaging waste in the cannabis industry a 3.99, 73% of respondents rated the issue highly (choosing 4 or 5 out of 5). The consumers see the issue and are actively seeking change. Cannabis consumers are extremely interested in packaging sustainability with an average interest of 8.6 out of 10.

The industry is wary of this and makes claims to care about sustainability as well. Mark Finkelstein from Cannasupplies is often asked for a sustainable packaging solution, but they end up with the basic plastic choice due to macro factors such as the ecological footprint of transporting materials across the sea or just cost. These companies don't have the luxury of thinking about the long term impact their packaging choice may have, they're too busy on thinking about how to survive in the competitive market tomorrow. However, according to a 2018 article published by the Stanford Social Innovation Review, more than 90% of CEOs state that sustainability is important for their company's success.

To add, Canada is currently a global leader in Cannabis. The world has its eyes on how a country manages an economy where cannabis is legal and as legalization is rampant across the globe it is critical for the country to set an example. The industry needs to move on from plastic and not just because they're a role model for other emerging cannabis economies, but since Canada plans to have zero plastic waste by the year 2030.

Canada is currently on the path to eliminating all single-use plastics starting in 2021 with products such as cutlery, straws, stir sticks, and takeaway containers. Even though plastic cannabis packaging may be far from being banned anytime soon, it is an important consideration when it comes to seeing how the industry may look ten years from now. Plastic is being shunned, not just by consumers but by governing bodies.

## What Steps Have Been Taken Already ■

For many cannabis products, plastic use has gone down. An example of which is the current packaging for the Hexo disposable vape, the packaging is totally made out of paper, including the child-resistant closure. In the realm of dried cannabis, Organigram changed their packaging to a lighter alternative, cutting %% of their plastic need.

Most licensed cannabis producers in the country will be using post consumer resin (PCR) containers by mid-2020 (Berkow, 2020). The interviewee only started talking to companies to switch to PCR in the past few weeks (originally published in september 2019). By mid 2020 he hoped to see 50% of their customers using PCR. Their company offers 25-100% PCR packaging solutions. PCR is 5-10 % more expensive than virgin options. Brands using this solution havent been found yet, COVID-19 may have affected the adoption of this solution.

Currently there is a shift occurring where some brands are using plastic and mylar resealable pouches, while these do reduce the amount of plastic being used there is still a large concern as they aren't easily recyclable, many municipalities instruct these be sent to landfill, including the city of Toronto.

Currently there is one brand in the market using glass containers to package their dry flower cannabis, The Green Organic Dutchman. TGOd cites environmental consciousness for the reason why they chose glass jars. "We've said no to plastic containers from the very beginning, instead choosing to go green with recyclable glass packaging" (Adcann, 2019) Their

container was custom made, using green-tinted glass with an additional coating to reduce the transparency of the container to appeal to Health Canada guidelines. (M. Finkelstein, personal communication, November 17, 2020)

Bioplastic alternatives are currently in accelerated development but still remain a few years from commercial viability. (Berkow, 2020) Bioplastic made from materials such as hemp or corn is an alternative with a lot of attention currently as it provides similar properties to plastic without the negative image plastic has when it comes to sustainability. One of the main barriers preventing the industry from using this material is cost, according to Lapsansky (2019), "bioplastics are on average 50% more expensive, even if (manufacturers) can come up with a solution, people can't use them". Canada lacks the recycling infrastructure to handle bioplastics appropriately, leading to most municipalities directing them to landfill.

A Canadian-leading cannabis packaging solution provider, [cannasupplies.ca](http://cannasupplies.ca), is soon to begin offering a stock dry cannabis jar made with bioplastic, however, only 20-33% of the material will be bioplastic, whereas the rest would be polypropylene, an already difficult to recycle petroleum-based plastic. While this solution will lead to a footprint that could be 20-33% smaller, the mixing of plastic with bioplastic makes these products difficult to recycle, likely sending all of these packaging units to the landfill as well.

Recycling processes for most types of materials produce an inferior product that enters lower value applications, known as open-loop recycling or downcycling (Sherwood, 2020). Coupled with poor collection rates, this means 95% of the economic value of the plastic is lost after a single-use (Sherwood, 2020). The staggering statistic is a testament that creating products that are recyclable is not anywhere near a solution if only 5% of the value remains after the single use.

There have been developments in recycling technologies, such as dissolving plastic waste in a solvent to purify and maintain its material properties. In some cases it is also possible to depolymerize polymers into monomers that can be used to remake virgin-grade material (Sherwood, 2020). This technology supports the ideology that "plastic recycling doesn't mean lost value", but the electricity and other resource demand of solvent recycling are too high to compete with mechanical recycling, rendering the technology an unattainable solution for plastic recycling.



Additionally, bioplastic currently isn't recyclable in most municipalities in Ontario. The material does promise a more environmentally friendly end of life with its shorter decomposition time when disposed of improperly, and a relatively rapid degradation process when the material is in a bio-active environment with suitable conditions. So while bioplastic is less polluting than petroleum based plastics, it is still a choice that continues to generate waste and supports the single-use culture that can encourage consumers to continue generating waste without worrying about the end-life sustainability. Additionally, bioplastic products are rarely purely made of bioplastic, rather they are being mixed with petroleum based plastics which render the product near-impossible to recycle into another material currently, leading it to be sent to landfills where the bioplastic components will decompose within a decade or two, but the petroleum based plastic (that could have likely been recycled in its pure state) will remain to pollute the earth as its decomposition time lasts over a thousand years.

Currently, there is a program in Canada in which consumers can return their empty cannabis packaging in order to ensure that they get recycled with higher certainty than curbside recycling offers in most provinces. This program is a result of a partnership between Tweed and TerraCycle, Tweed being a long-time leading cannabis brand and TerraCycle a global leader in hard-to-recycle waste. It is the first national recycling program in the Canadian cannabis industry (Tweed, 2019). The program accepts all LP brands and forms of cannabis packaging, including the plastic and mylar resealable pouches. After enough is collected at TerraCycle's facility, they clean it and melt it down into plastic pellets that can be transformed into new products such as watering cans and park benches (Tweed, 2019). They have collection boxes in 435 retail locations, mostly brick-and-mortar dispensaries making it convenient for consumers to return their packages as they go to purchase more. Since the launch of the program in October 2018 they have collected 2,603,058 pieces of cannabis packaging, diverting 52,073 pounds of waste from landfills (Tweed, 2019). While this program is successful in reducing the footprint of all of these containers, it is a band aid solution that potentially encourages LP's to keep using plastic heavy packaging. Additionally, only a small portion of the 66 million pieces of cannabis packaging being produced each year (Health Canada, 2020). This could be attributed to how only 13.4% of consumers are aware of the program's existence.

When it comes to bending the linear life of a product, TerraCycle does a great job of bending it into a cycle but it's still allowing for the continuous use of disposable packaging. In Colorado, there is a group called "Green for Green" which claims to be the first reuse network for cannabis packaging. However there is no immediately available information anywhere on their website regarding where to participate or how the program works.

## Framing my Solution

Historically, business to consumer models employed more linear concepts, where once the products were delivered to the consumers, it was out of the producers mind as it was up to the consumers to decide if and how to maintain and dispose of the product. Today this is still a relevant predicament when end-of-life is largely the consumer's responsibility. Since waste management varies from municipality to municipality it can be difficult for a consumer to know what they can and cannot recycle locally, especially when there are 444 different municipalities in Ontario alone.

When reviewing the variety of alternative sustainable options as well as going back to the basics of "Reduce, Reuse, Recycle", it is clear that a cyclic system where containers are reused (thereby reducing the need of producing new containers) is the most sustainable direction the industry could head towards.

Cyclic systems (CS) have a history of success, one example of which is Ontario's deposit system for beer wine, and liquor containers. This program is reported to be the best reuse and recycling program in the province, it routinely achieves more than double the recycling rates of the blue box, the local curbside recycling program (Wallis, 2020). In 2019, 97% of used refillable beer bottles were collected through the deposit system and reused an average of 15 times before being recycled. In addition, their collection system saw a return rate of 83% for nonrefillable bottles and 78% of aluminum cans, whereas less than 50% of containers with no deposit were collected and recycled (Wallis, 2020). The beer bottle reuse system is a model to look up to when creating new CE products, and is evidence that recycling rates upwards of 90% are achievable with a deposit system.

Most of the processing for the beer bottle reuses is done within the breweries themselves (Riddell, 2016). Once the Canadian Industry Standard Bottle (ISB) is separated from the rest of the collections they are sent to bottling plants at breweries. The skids of empties are

unloaded from the trailers, depalletized, and placed on conveyor belts, machines separate the broken ones and divert them to be turned into cullet to make new bottles. The bottles that passed move onto cleaning, where a large machine with a rotating drum takes in 60 bottles at a time and washes them thoroughly with detergent, rinses them out and removes the labels (Riddell, 2016). After that the bottles file down the line to a filler stage, before which an electronic detector scans each bottle with a strobe light looking for any possible defects that could affect the durability of the bottle later on, rejects are spat out and sent to be recycled too. The good ones move onto a filling machine which will also cap them. The filled bottles go into another scanner to ensure quality. After filling the bottles get pasteurized, Molson Brewery does this by heating them up to 61C for ten minutes which kills off any microbial life that could affect consumers health as well as increasing the beer's shelf life (Riddell, 2016). The bottles come out of pasteurization at 28C (Riddell, 2016).

TerraCycle is also making moves in CS with Loop. Launched in January 2019, The system uses UPS to ship a variety of food, household cleaning and personal care products in reusable and collapsible padded containers called the loop tote (Grace, 2019). The loop platform was created by TerraCycle to transform the relationship between consumers and packaging by providing the consumers with the option to borrow the package from the brand owner and upon its return to the brand it can be reused. They have created a CS with brands such as Pantene, Crest and Haagen-Dazs where they haven been able to reimagine packaging for some of their products for reuse in the Loop system. (Mohan, 2019) Since brands were already investing into more expensive packaging, they had the opportunity to enhance the package with additional features. For Example, Hagen Dasz created a canister for their ice cream that was double-walled stainless steel, which kept the ice cream cold longer, adding convenience and quality for the consumer without changing the product itself (Grace, 2019).

Loops general goal is for each package to be reused at least 100 times (Grace, 2019). The per-unit cost decreases with each use, lowering the cost to brand owners over time. At three to four uses the average container cost reaches break even with its disposable counterpart, and at 10 uses it becomes 50 to 75 percent better for the environment (Grace, 2019). The environmental benefits would only exponentially grow. When it comes to the Canadian cannabis industry, "the inhibitor right now is simply the fact that everyone is racing to get everything done and once you've got

a problem solved, you don't necessarily want to go revisit it tomorrow...So if you've just figured out your packaging and got all your equipment and put that to bed and moved on to project number two, then I have to wait until the dust settles and people can catch their breath, but then it is a very easy sell." (Berkow, 2020). The dust has long settled on the single-use plastic containers for cannabis, it is time to move on from the disposable mindset and move on to a CS. 85% of consumers are interested in a reuse system, it's time to deliver.

## Proposing my Solution

One of the main goals of a cyclic system (CS) is to maintain the value of products, materials and resources in the economy for the longest time possible, in consideration of waste minimization.

In a CS, Consumers are no longer the final position in the supply chain, but serve as an important, decision-making factor within the supply chain (Hazen et al., 2020, pp. 69-75). The success of the system is dependent on their efforts to collect and return packages for reuse. Viewing the success return rate in the beer store, there is little to doubt about cannabis consumers providing a similar result when considering their high interest in sustainability and the increased ease of returning cannabis packaging as their collection is a lower quantity than that of alcohol bottles.

According to Circular Economy: Recent Technology Management Considerations (2020), CS can be implemented to produce a win all for all stakeholders involved, consumers via lower prices; environment via lower resource usage; producers via lower production costs. In order to ensure systemic success, collaboration, visibility, and transparency across processes and between organizations is necessary to react faster to supply chain disruptions, increase efficiency, improve integration, and to better monitor product life cycles. The transition to CS will only be successful only if all parties involved in the supply chain (including the consumer) are involved and committed, seeing as how passionate the industry is about achieving a greener way and the surveys respondents enthusiasm to participate, there is a high potential for success.

Transition to a CS is no small endeavour, it involves changes to the whole production process and consumption behaviour, stakeholder networks and product-service offerings, and even governmental interventions. It could be a long-range undertaking.

The need for interconnection and collaboration between all stages of the life cycle, not only at the upstream level, but also downstream for managing and controlling used materials and products for reuse by the brands. Since this is a cyclic system, each step is important in order to execute the circle instead of falling back into a linear system. A systems approach is required, with connections among all the stakeholders in the value chain, from suppliers to recyclers, and with repercussions at different levels, from technology to logistics to the different actors such as consumers.

The article, “Combining Eco-Efficiency and Eco-Effectiveness for Continuous Loop Beverage Packaging Systems: Lessons from the Carlsberg Circular Community” (2017), outlines steps to be taken when undertaking a continuous loop for beverage packaging systems. While the industries aren’t the same, for purposes of this thesis they are similar enough to be able to relay this same structure to that of creating a CS for dried cannabis containers.

At the micro level, The first step is identifying the optimal environmental life cycle scenario for the packaging, both in terms of defined use and reuse. Second, the two requirements at material level of the C2C (Cradle to Cradle Certified, a globally recognized measure of safer, more sustainable products made for the circular economy) certification process, Material Health and Material Reutilization criterion are used to identify the limiting factors for the continuous use of materials in multiple loops. Material Health is based on a material assessment rating based on the hazards of chemicals in products and their relative routes of exposure during the intended (and highly likely unintended) use and end-of-use product phases (C2C 2020). Material Reutilization is the quantitative measure of the product’s design for recyclability and/or compostability. As a third step, alternative LCA (Life Cycle Assessment) scenarios of C2C certification are built to quantify the environmental impacts of different option for the improvement of the packaging, encompassing different improvement strategies, such as change in material composition, use of renewable energy in product manufacturing and supply chain, increase of recycled content and recycling rate. Lastly, given that the circular economy is not only about resource scarcity and environmental impact, but also economic benefit, the business model of a closed-loop supply has to be included in the procedure (Niero et al., 2017).

Roll out times for a CS need to be extremely generous. Even if all parts may be ready to do, there will inevitably

be hitches - from delays in getting the quantity of product available to customers not being ready to receive it yet (Matthews, 2004). Staying in touch with customers to keep them in the loop is critical. While nation-wide may be the goal, the initial roll out should not be to that scale. Starting small by experimenting in a lower-volume area will provide opportunities for identifying the problems in the execution, making subsequent rollouts less painful. Even minor disruptions due to defective packaging or accessing a collection location could have serious implications when it comes to sustaining the program (Matthews, 2004).

At the macro level, working with governments and different sectors, making good use of incentives and engaging in cooperative initiatives are needed to change production and consumption patterns as well as behaviours and attitude towards circular lifestyles (Chen, 2020). The government in particular is an important function in making a CS in the CCI work. With their ever changing regulations, it would be advantageous for the CCI to additionally collaborate with the government in the designing the CS to ensure longevity validation.

Getting multiple licensed producers to collaborate together to agree on one jar type will be no easy undertaking. However there is evidence that brands within the industry have the capacity to collaborate. One example of which is from AHLLOT, a cannabis curation company that teamed up with five producers: 7ACRES (The Supreme Cannabis Company), Edison (Organigram), Saturday (Starseed), Symbi (Emblem) and Haven St (TerrAscend) to create a value pack. Each LP contributed one strain per combo pack to allow consumers to try one gram of each of their offerings. This collaboration may have taken place with the priority of getting consumers to try their product to raise the possibility of them purchasing from one of the brands again but the fact that they were able to collaborate to create one cohesive product is testament that the industry is collaborative and could take the challenge on if they were interested.

When it comes to material choices it’s necessary to use materials that can withstand high temperatures during the washing, sanitizing, and drying processes (Grace 2019). The Federal Cannabis Act also requires for the package to be opaque or translucent, keep the cannabis dry, child-resistant closures, and a security seal to provide assurance that the package hasn’t been tampered with previously (Health Canada, 2019). These demands immediately rule out fibres. Similarly, multilayer multi-material packages will be omitted



because they cannot be easily recycled back into a similar product.

In the Loop platform, the three most common types of materials being used for Loop packaging are, in order, stainless steel and aluminium, glass and engineered plastics such as polycarbonate (Grace 2019). So far, materials such as flexibles, disposable plastics, fibers, or leathers have not shown up in any Loop packaging (Grace 2019). Since these materials have not come up in any loop packaging, and seeing as those created the packaging are professionals and have their reasons for not using such materials, they will also be dismissed from consideration in creating the CS.

Reviewing all materials Loop products are made of, the Canadian ISB, in hand with the requirements of cannabis packaging, I have concluded that glass would be the optimal choice for creating a standard dry herb jar for the cannabis industry. Glass has a long history as a preferred cannabis packaging solution, 73% of consumers still chose it as their preferred material as shown in Fig. 5. Glass may be heavier and less durable than plastic and metal but consumers value sustainability 20% higher than these features. Consumers still hold high interest in a CS even if the packaging may be heavier or larger with their interest only dropping by 7% in this situation. As for the concern of clinking jars limiting discreteness, this feature held the lowest value for consumers at 66% of their perceived value of sustainability.

Glass can be made from readily-available domestic materials and collecting these materials is more sustainable than the methods to produce metal and plastic which come from (Ourgoodbrands, 2020) Using recycled cullet provides additional benefits aside from reducing virgin material use. Recycled cullet requires less energy to form, meaning the energy intensive furnace required to make glass doesn't have to work so hard. For every 10% of recycled cullet used in the manufacturing process, the energy costs drop about 2-3% (Glass Packaging Institute, 2020). Reducing the energy footprint but also providing the manufacturer the benefit of a lower energy bill and extending the life of plant equipment due to less rigorous needs.

As for the child-resistant lid, I propose it be made of polypropylene as there are solutions available for these closures readily available, it is what they used for The Green Organic Dutchman glass jar package and Loop has had polypropylene show "good promise in testing" (Grace 2019).

With 90% of consumers not being wary of the TerraCycle recycling system, there is a rising concern that users will not be wary of the CS for dried cannabis packaging. There will need to be a focus on the education and training of consumers for the CS. According to "A new framework for businesses to create a truly circular economy" (2020), low consumer awareness and a lack of proper take-back systems will generate difficulties in material identification and separation, ensuring purity, distribution and transportation, which are great challenges for resource recovery. To deal with those barriers, design and systems thinking with collaborative networks should be built to generate appropriate circular business models.

To tackle low consumer awareness and a lack of proper take-back systems, I would propose that all storefront dispensaries have collection boxes for the foot traffic already going into the store, as well as training workers at the store to inform customers of the new system. As for online stores such as the OCS, I would propose that they advertise the return option as well as provide a page to find the nearest collection center. Since all online packages contain at least one printed product such as a packing list, it would be helpful when it comes to informing the consumers to include a page about how to return their packages for reuse while the CS is nascent. Additional marketing campaigns to raise awareness of the CS would also aid in this issue.

Since most Canadians are well aware of how to return their alcohol bottle such as the ISB for reuse or recycling (as shown by the high collection rates), it would be advantageous to work with the collection agencies for these products as they already have the infrastructure and training for sorting products for CS. If these agencies were also collecting cannabis containers, there would be an added convenience for the customer to deposit all their empties in one place, regardless of whether it is alcoholic or cannabinoid.

Even if the consumer wasn't aware or able to return the package to a collection center, glass has a long history of recycling and reuse. When compared to other materials, the likelihood that the consumer will dispose of their package into a recycling system that accepts the material instead of sending it to landfill is much higher.

When it comes to inspection to ensure the container is at the right quality for reuse, glass is still the most viable option as there have been systems for decades now to inspect glass beer bottles for reuse. The translucent properties of glass allow for camera and



light technology for quality control. After inspection they would need to be sterilized, due to the sticky nature of cannabis the process will likely contain different steps than in sterilizing glass beer bottles.

For beer bottles they have a 'pool' of bottles breweries can pull bottles from to use (R. Morier, personal communication, November 2, 2020). In order for the cannabis industry to be able to sustain the needs of the market I would recommend they have at least 72 million units of packaging, the amount of units used within a year. With two different sizes to correspond with different quantities of product. Consumers are already used to the jars having a lot of empty space within, so using a jar which usually contains up to 8g of dried cannabis content can also be used for smaller quantities. For the larger sizes I propose making the container taller with the same width and length so that they may all use the same closures.

The start-up cost is expected to be very high. The cost can be subsidized in a slight product price increase as over half of consumers are willing to over a dollar extra for a more sustainable package, additionally a deposit could be placed upon the package. The deposit should be primarily used as collateral to ensure that the package is returned but the uncollected deposit and the slight increase in price should go a long way. The Government is also providing incentives for sustainable programs which could be used to support the program. "Disrupting Cannabis Packaging: When Big Packaging Companies, Hemp-Bioplastics Enter The Space" (2020) also claims that the cannabis industry is two to three times more willing to pay for sustainable packaging materials than traditional industries. The beer bottle CS is purely funded by the beer industry, this same characteristic should be applied to the cannabis industry. With collaboration across brands, there is a higher opportunity to achieve this.

Over the long-term, instilling a CS can produce savings. The packaging can be amortized on a balance sheet, meaning the cost per unit can be divided by the number of years it is in use (P. Weaver, personal communication, November 2, 2020). On average, Loop's packaging cost reaches break even with its disposable counterpart after three to four uses (Grace, 2019). Seeing as glass bottles are reused an average of 15 times, a glass cannabis container has the potential to be five times cheaper throughout its life.

As a start, the industry should pilot the CS in a dense area which would have more brick-and-mortar stores to serve both for informing the consumers and as

collection centers. A collaboration with TerraCycle would be advantageous as they are well rehearsed in transitioning products to CS, they also already have the infrastructure in place for collection. The sanitization process for a pilot program should be largely manual as a custom automatic system would be very expensive.

## Limitations

The generalizability of the results is limited by the source of where most of the respondents came from: cannabis subreddits. These platforms are for cannabis enthusiasts which consume larger quantities of cannabis and participate in purchasing and sales of illegal cannabis. The effects of such groups certainly increased the monthly individual consumption rate for dried cannabis to 16g, whereas when using numbers provided by Statistics Canada the average consumer used just 1.43g of dried cannabis a month. Since the illegal market is still able to provide cannabis at a lower cost than the legal market, the data on how much would they additionally pay for certain features on top of the \$35 for 5g of dried cannabis was also affected. Respondents shared their beliefs that \$35 for 5g is already expensive for cannabis rendering them unwilling to pay more, even though it's a common price in the legal industry.

## Review & Recommendations

Looking back, I would change the wording of some of my questions as some respondents commented that they weren't sure what I meant when asking questions about ranking the value of certain features. A critical error of mine was the exclusion of "\$0" as a choice when asking how much consumers would pay additionally for certain features, using "Less than \$1" does include nothing at all but the data was surely affected by the lack of both choices. There were also a few unnecessary questions, the data of which was not considered usable for this thesis. The omission of the redundant questions would aid in respondents convenience.

Further research is needed to explore how to execute a CS for cannabis products, including but not limited to; sanitization processes, design and production of viable packaging, consumer awareness and participation in CS, effects of CS within online distribution channels of cannabis, and industry interest in CS.

## Conclusion

This research aimed to identify what the Canadian cannabis industry would need to do in order to adopt a reuse program for their dried cannabis packaging. Based on a quantitative and qualitative analysis of available documents, interviews and survey responses, it can be concluded that there is a need for a more sustainable change as current solutions aren't enough, with high interest within consumers to see and partake in these changes. In order for the cannabis industry to adopt a CS for their dried cannabis packaging they would need collaboration between brands and the government to find a solution that works for all parties. This package should primarily be made with glass; the consumers prefer the material, it can be made using domestically available resources, and has great product protection properties which would lead it to serve well in a CS. The material is highly recyclable and can be converted into the same product, using recycled cullet is more energy efficient than virgin materials. The child-resistant closure should be made of a plastic like polypropylene that can also endure the sanitization process and multiple reuses while still being functional. As per survey responses, consumers are wary of the amount of waste being produced by the industry and want change. These consumers are willing to pay more for sustainable alternatives and show high interest in partaking in a CS. Starting a CS would be a long-term undertaking as it requires changes at all levels of the product life cycle. The industry will need to analyse possible solutions in detail using methods like LCA's and seek how to improve them to ensure systemic success. Seeing how uninformed consumers are about existing solutions in the CCI, there would have to be a special focus on educating and training consumers about the CS in order for it to succeed. The start-up cost will be very high as new infrastructure will be needed to put in place, but over time savings are to be expected as the packaging life cycle renews through additional uses. Transitioning the entire nation to a CS for dried cannabis packaging is the end-goal, the industry could trial a dense urban area to minimize the start up cost and troubleshoot any bumps which may occur before expansion.

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## Appendix

### Supplementary Data File

Description: The accompanying Excel spreadsheet shows the data collected from the survey which was distributed for this thesis.

Filename: BajicDorotea\_SurveyResponseData.xlsx

### Survey Questions Consumer Cannabis Packaging Survey

Survey Description:

A 5-10 minute survey about consumer use, interests and priorities in cannabis packaging to support research into a more sustainable model for the industry. This survey is purely voluntary, anonymous, and you can withdrawal consent at anytime by exiting the survey page.

Consent to Participate in Research

My name is Dorotea Bajic. I am an undergraduate student at Ryerson University in the School of Graphic Communications Management. I would like to invite you to take part in my research study, which concerns consumer opinions on cannabis packaging and sustainable options therein.

You are being asked to voluntarily complete this online survey. It involves questions about your opinions, use and interest on cannabis, its packaging and sustainability efforts. and should take about 5-10 minutes to complete. In order for all of your answers to be collected you must go to the end of the survey and click 'submit survey'. This will demonstrate your full consent to participation.

The survey is anonymous and as such will not be collecting information that will easily identify you, like your name or other unique identifiers. Only the researcher/s named in this study will have access to the data as collected. Any future publications will include collective information (i.e., aggregate data). Your individual responses (i.e. raw data) will not be shared with anyone outside of the research team.

Participation in research is completely voluntary and you can withdraw your consent at any point up to clicking the submit button at the end of the survey. However, due to the nature of google forms as soon as you answer a question, the response will be saved. Since the survey is anonymous, once you click the



submit button at the end of the survey the researchers will not be able to determine which survey answers belong to you so your information cannot be withdrawn after that point.

Please note, that by clicking submit at the end of the study you are providing your consent for participation. By consenting to participate you are not waiving any of your legal rights as a research participant.

1. I agree to participate in the research study via this online survey. I am participating voluntarily. I understand that my identity is entirely anonymous throughout the survey and that I can withdraw from the study at any time, without any penalty or consequences.

Mark only one oval.

Yes

No

2. How do you identify with your gender pronouns?

Mark only one oval.

She/Her

He/Him

They/Them

Prefer not to say

Other:

3. In what year were you born? (Please enter four digits i.e. 1987 )

4. Are you currently a resident in Canada? \*

Mark only one oval.

Yes

No

Prefer not to say

5. If you are not in Canada, please specify the country in which you are currently in.

6. In your personal opinion, how would you rate the cannabis industry as a whole?

Mark only one oval.

Very Bad

1

2

3

4

5

6

7

8

9

10

Very Good

7. Do you consume Cannabis? \*

Mark only one oval.

Yes

No (Skip to question 16)

On occasion

Prefer not to say (Skip to question 16)

8. Using the following scale, please rate your intentions when using Cannabis?

Mark only one oval.

Medical

1

2

3

4

5

Recreational

9. What is the frequency of your consumption?

Mark only one oval.

Daily

Few times a week

Once a week

Few times a month

Once a month

Less than once a month

Prefer not to say

10. What is your primary method of consumption?

Mark only one oval.

Dry Flower

Edibles

Vape

Extracts

Topicals

Prefer not to say

11. How much of your primary method do you consume each month? (One vape cartridge is 2g)

Mark only one oval.

Less than 1g a month

1-5g a month

6-10g a month

11-15g a month

16-20g a month

21-25g a month

25-30g a month

More than 30g a month

Prefer not to say

12. What is your secondary method of consumption?

Mark only one oval.

Dry Flower  
Edibles  
Vape  
Extracts  
Topicals  
Prefer not to say

13. How much of your secondary method do you consume each month? (One vape cartridge is 2g)

Mark only one oval.

Less than 1g a month

1-5g a month

6-10g a month

11-15g a month

16-20g a month

21-25g a month

25-30g a month

More than 30g a month

Prefer not to say

14. Through which method do you obtain the majority of your cannabis products? (This survey is anonymous)

Mark only one oval.

Online

In-store

Illegal means

Growing My Own

Prefer not to say

15. Please describe what you do with your empty cannabis packaging/products.

16. Have you heard of TerraCycle's Cannabis Recycling Program?

Mark only one oval.

Yes

No

17. What is the frequency of participating in this program?

Mark only one oval.

Never

Occasionally

Sometimes

Often

Always

18. Have you returned containers to this program before?

Mark only one oval.

Yes

No

Maybe

19. Do you partake in the beer store collection of alcohol bottles for reuse system?

Mark only one oval.

Yes

No

Maybe

20. What is the frequency of participating in this program?

Mark only one oval.

Never

Occasionally

Sometimes

Often

Always

21. Using the following scale, please rate your interest in packaging sustainability efforts

Mark only one oval.

Lowest Interest

1

2

3

4

5

6

7

8

9

10

Highest Interest

22. Please rate the value of favourable cannabis container aesthetics and branding

Mark only one oval.

Lowest value

1

2

3

4

5

Highest value

23. Please rate the value of cannabis container portability

Mark only one oval.

Lowest value

1

2

3

4

5

Highest value

24. Please rate the value of cannabis container sustainability  
 Mark only one oval.  
 Lowest value  
 1  
 2  
 3  
 4  
 5  
 Highest value

25. Please rate the value of cannabis container durability  
 Mark only one oval.  
 Lowest value  
 1  
 2  
 3  
 4  
 5  
 Highest value

26. Please rate the value of cannabis container discreetness  
 Mark only one oval.  
 Lowest value  
 1  
 2  
 3  
 4  
 5  
 Highest value

27. Are there any other particular things you find interesting in cannabis packaging?

28. Please choose the order of your preference of materials in cannabis packaging \*  
 Mark only one oval per row.  
 1st - Most favourable  
 2nd  
 3rd  
 4th - Least favourable  
 Glass  
 Stainless Steel  
 Plastic  
 Bioplastic

29. Please rate your interest in a system where one could deposit cannabis packaging to be processed for reuse  
 Mark only one oval.  
 Low Interest  
 1

2  
 3  
 4  
 5  
 High Interest

30. Please rate your interest in a system where one could deposit cannabis packaging to be processed for reuse - even if the packaging may be heavier or larger?  
 Mark only one oval.  
 Low Interest

1  
 2  
 3  
 4  
 5  
 High Interest

The following questions in this section of the survey are in reference to the following image:



31. How much additionally would you pay for the same product made of more sustainable materials?  
 Mark only one oval.  
 Less than \$1 (%cost range)  
 \$1-3 (%cost range)  
 \$3-5 (%cost range)  
 More than \$5 (%cost range)

32. How much additionally would you pay for a package that would be reused in a cyclic system?  
 Mark only one oval.  
 Less than \$1 (%cost range)  
 \$1-3 (%cost range)  
 \$3 - 5 (%cost range)  
 More than \$5 (%cost range)

33. How much extra would you be willing to deposit, to be returned as you return the empty cannabis package?  
 Mark only one oval.



- Less than \$1 (%cost range)
- \$1-3 (%cost range)
- \$3-5 (%cost range)
- More than \$5 (%cost range)

34. Any other changes you would like to see in the packaging of cannabis products? (Such as in areas of accessibility, sustainability, branding, feel and others)

35. What is your opinion of the current beer store recycling infrastructure?

36. How would you rate the issue of packaging waste in the Canadian cannabis industry?

Mark only one oval.

Smallest Issue

- 1
- 2
- 3
- 4
- 5

Highest Issue

37. Is it possible that COVID-19 may have affected your opinion during this survey? (No wrong answers here, just curiosity)

Mark only one oval.

Yes

No

Maybe

38. If you answered "Yes" or "Maybe" to the previous question, can you share your thoughts behind such?